Fuel Poverty in the European Union: A Multi-Methods Study

Harriet Rosalind Wand

PhD

University of York

Social Policy and Social Work

June 2015

Abstract

Fuel poverty is an issue that is growing in both recognition and prevalence across Europe, and has been identified as a policy priority by several European Union (EU) institutions, including the European Commission. However, little is known about the historical processes that have led to the adoption of current policy, nor what the nature of discourse has been with regard to defining and measuring fuel poverty. Furthermore, there remains a significant gap in knowledge concerning the incidence and intensity of fuel poverty issues at the household-level across the EU.

The main purpose of this thesis is to contribute to an improved understanding of fuel poverty as a policy problem in the EU. It first presents a qualitative analysis of 44 policy documents spanning 2003 to 2014, to determine the extent to which the EU acknowledges fuel poverty, and the existing policy mandates for defining and measuring fuel poverty. Subsequently, a household-level composite index is introduced, based on survey microdata from 2007 to 2011. The remainder of the thesis presents analyses of EU fuel poverty using the new measurement tool.

This thesis makes an original contribution to knowledge in two key ways. Firstly, it establishes the central role of institutions in shaping fuel poverty policy over time since the term first emerged in a policy document over a decade earlier. This analysis reveals that there is substantial desire among many EU institutions for quantitative assessments of fuel poverty, which has not been addressed thus far. The second contribution to knowledge is a demonstration of the pervasive and enduring nature of fuel poverty in Europe via a new pan-EU composite index. Based on the results, two key recommendations are made: firstly, an operational pan-EU definition of fuel poverty should be created; and secondly, data collection should be radically overhauled.

Contents

List of tables

List of figures

Acknowledgements

I am deeply indebted to my supervisor, Dr. Carolyn Snell, for always going above and beyond in advising and supporting me throughout my PhD, and ultimately encouraging me to be a better academic. I am grateful for the many opportunities provided to be involved with her own research projects, which have expanded my knowledge and skills. Thanks are also due to my thesis advisor, Dr. Stuart Lowe, for his continued advice and support throughout my studies.

I would like to express my gratitude to the many dedicated individuals comprising the fuel poverty research community, who at various points over the years have given advice and encouragement, and have provided me with invaluable opportunities to present and discuss my work. In particular, Helen Stockton, Stefan Bouzarovski, Ute Dubois, and Marie Moisan. Special thanks are due to Christine Liddell and the Housing and Human Wellbeing Research Group at the University of Ulster, with whom I spent six very enjoyable months honing my research skills. In addition, I would like to thank the trustees of Eaga Charitable Trust, and their manager Naomi Brown, for providing funding and guidance during my master's degree and subsequently during my PhD.

I gratefully acknowledge the funding provided by the Economic and Social Research Council, which made my PhD work possible. I would also like to thank Eurostat for allowing access to EU-SILC microdata, and note that the results and conclusions are mine and not those of Eurostat.

My time in York was made enjoyable in large part to good friends, many of whom were fellow PhD students in SPSW and RCSS. Special thanks to Jo, Abby, Katie, Sarah, Beth, Hannah and John, Kirsty and James, Katrina, Dave and Jenny.

Most of all, thanks to my husband Charlie, who has been an enduring source of inspiration, support, encouragement and love. I am also grateful to my parents-in-law Kathryn and John, for their continued support.

Lastly, the final stages of writing my thesis in Sweden would have been a solitary affair, if not for the companionship of my dog (Beatrix) and two cats (Murphy and Poppy)!

Author's declaration

The work presented in this thesis is my own and has not been submitted for examination at this or any other institution for another award.

The work presented builds on earlier work conducted by the author (née Thomson) for a Master of Research degree in Social Policy, however, all elements of analysis in this thesis are original. This master's degree was partially funded by Eaga Charitable Trust (CT), and was subsequently published as a co-authored journal article: Thomson, H., and Snell, C. (2013). Quantifying the prevalence of fuel poverty across the European Union. *Energy Policy*, 52: 563-572.

Funding for the PhD was provided by the Economic and Social Research Council. Additional funding was received during the PhD from Eaga CT to: conduct an evidence review of fuel poverty measurement in Europe; develop a pilot household survey; and to appraise existing data sources. Several parts of the thesis appear in similar form across the following Eaga-CT project outputs:

Chapter 5 was formed from and extended Thomson, H. (2013) *Fuel Poverty Measurement in Europe: A rapid review of existing knowledge and approaches*. University of York.

Chapter 6 expanded upon the appraisal of existing datasets in the final project report by Thomson, H., and Snell, C. (2014) *Fuel Poverty Measurement in Europe: a Pilot Study*. University of York.

All empirical analysis was conducted by the author alone, however, contributions of ideas from the project steering group and Co-Investigator should be acknowledged.

Parts of this thesis have been submitted for publication in co-authorship with the PhD supervisor:

Thomson, H., and Snell, C. 'Fuel poverty in the European Union: a concept in need of definition?' Invited submission to a *People, Place and Policy* special edition.

Thomson, H., and Snell, C. 'Measuring fuel poverty at the European scale: a critical analysis of data'. Being revised for resubmission, *Energy Research and Social Science*.

Chapter 1: Introduction

Fuel poverty is an issue that is growing in both recognition and prevalence across Europe, partly as a consequence of rising energy prices, the drive towards a single liberalised energy market, and the accession of numerous former socialist states to the European Union (EU) (Boardman, 2010a). Addressing fuel poverty has been identified as a key priority by several EU institutions, including the European Commission (2010a), European Parliament (2008a), and the European Economic and Social Committee (2011a; 2013). At the national level, fuel poverty has been a policy concern in the United Kingdom for over a decade (Department of Trade and Industry, 2001; Department of Energy and Climate Change, 2014), and in recent years policy frameworks have emerged in France and Ireland too.

However, current knowledge about fuel poverty is predominantly limited to the UK and Ireland (Petrova *et al*., 2013; Liddell *et al*., 2011). Of the limited comparative research that has been conducted to date, many of the studies have used data that predates the global economic recession, or have only conducted a cursory examination of the issues. Overall, there is a significant gap in knowledge concerning fuel poverty in the EU. This gap in knowledge has two key interrelated dimensions. Firstly, little is known about fuel poverty as a policy issue, particularly in terms of the historical processes that have led to the adoption of current policy, and what the nature of discourse has been across the institutions of the EU with regard to defining and measuring fuel poverty. Secondly, there remains a substantial gap in knowledge concerning the incidence and intensity of fuel poverty related issues at the household-level across the EU, which is impeding evidence-based policymaking. This thesis has been designed to address these two interrelated dimensions, as detailed in the subsequent section.

Research aim and questions

The main purpose of this thesis is to contribute to an improved understanding of fuel poverty in the EU by addressing the analytical gaps in policy and statistical understandings of fuel poverty. It aims to connect historical policy processes and policy discourses concerning fuel poverty measurement on the one hand, and the development of a new measurement tool that could be used for policy monitoring, on the other hand, recognising that the two are intertwined. An understanding of the scale and nature of fuel poverty in Europe is necessary in order to advance policymaking, however, a measurement tool should not be created in a policy vacuum. This thesis aims to establish the policy context to determine what mandates exist for advancing fuel poverty measurement, and move towards a practical use of available data for monitoring the incidence and intensity of fuel poverty across the Member States of the EU. In doing so, the thesis starts by addressing the following key research question, and sub-research questions, relating to the extent to which fuel poverty is recognised as a policy issue by the EU:

1. To what extent does the EU acknowledge fuel poverty and/or energy poverty?
    a. What are the origins of fuel and energy poverty discourses?
    b. What are the main characteristics of fuel and energy poverty discourses, and has this changed over time?
    c. Is fuel and energy poverty acknowledged and discussed by a range of EU institutions?
    d. Are the fuel and energy poverty discourses of the different EU institutions divergent?
    e. What suggestions have been made to define, measure and/or alleviate fuel and energy poverty?

The research questions outlined above help to determine the current policy context for addressing fuel poverty at the European-level, which in turns establishes what mandates exist for developing a pan-EU measure of fuel poverty. The second research question, and sub-questions, builds on question one, and concerns the prevalence of fuel poverty across Europe:

2. What levels of fuel poverty exist across the Member States of the EU?
    a. Does fuel poverty exist in all Member States of the EU?
    b. What is the intensity of fuel poverty issues across the EU Member States?
    c. Do the rates of fuel poverty in the EU change over time?
    d. What increases household propensity to be fuel poor?
    e. Does this differ between Member States?

Approach

This thesis uses a multi-methods and comparative approach to address the research questions detailed above. To answer research question one, qualitative content analysis is used to examine textual data from 44 European policy documents spanning 2003 to 2014. As detailed in Chapter 4, key concepts from new institutionalism, and in particular historical institutionalism, are used to shape the enquiry. Subsequently, the thesis employs secondary quantitative analysis to develop and analyse pan-EU household-level composite indices, as outlined in Chapter 7. This element of the research uses microdata from the EU Statistics on Income and Living Conditions microdata, from 2007 to 2011, to address research question two. The subsequent sections detail the overall remit of the thesis, and how fuel poverty is conceptualised in the research.

Thesis remit

This thesis examines the issue of fuel poverty within countries that collectively constitute the EU. This focal point has been chosen as the EU is one of the most important agents of change in contemporary Europe, which exerts considerable impact on policymaking across a range of policy domains, including energy and social policy. Awesti (2007) states there has been a shift in literature from theorising the EU as a process of integration, to viewing it as an existing system in its own right that requires theoretical analysis. Furthermore, many of the drivers and exacerbators of fuel poverty transcend national boundaries, or are strongly influenced by global pressures. For instance, energy price rises at the national level are likely to be caused, to varying degrees, by volatile global oil prices, EU-mandated climate change levies and obligations, and European-wide energy market liberalisation. Yet, as Bouzarovski and Petrova (2015) note, fuel poverty is rarely seen as a European issue. In using the term ‘EU’, this thesis refers to both the Member States of the EU, and the treaties and organisations comprising the EU.

Whilst it is not the intention of this research to focus on the UK and Ireland specifically, it is sometimes unavoidable in the review chapters as the literature is at nascent stage in many countries. Furthermore, it should be noted that this thesis does not investigate the issue of energy access in developing countries.

Conceptualisation of fuel poverty

In conceptualising fuel poverty, this research draws on Townsend's (1979) relative poverty approach, and the consensual approach to poverty measurement pioneered by Mack and Lansley (1985) and Gordon *et al*. (2000). This means that fuel poverty is viewed as a relative concept across the thesis, and as such fuel poverty is defined in reference to the society in which a household lives, and can therefore differ between Member States and over time. Based on the relative and consensual poverty research approaches, the following working definition of fuel poverty has been developed for this thesis:

Households, groups, and individuals can be said to be in fuel poverty when they lack the resources to obtain adequate levels of energy services which are customary, or at least widely encouraged or approved in the societies to which they belong.

This definition is in keeping with previous understandings of fuel and energy poverty by Bradshaw and Hutton (1983), Healy and Clinch (2002a), and Buzar (2007a), who were also influenced by Townsend's (1979) work. The phrase 'energy services' has been selected in order to make it explicit that fuel poverty concerns all energy uses in the home, including heating, lighting and the use of appliances. This definition is adaptable to the varying contexts that can be found across Europe, and can also be expanded to include specific measurement thresholds, such as spending more than twice the national median on energy costs.

Thesis structure

This thesis consists of ten chapters in total, as follows:

Chapter 2 presents a review of literature on the concept of fuel poverty, focussing on understanding the drivers and impacts of fuel poverty, and the ways in which fuel poverty can be defined and measured. The review finds that only three countries have an official definition of fuel poverty, whilst at the EU-level there is no recognised definition, and a significant level of terminological confusion exists. A range of potential determinants of fuel poverty are discussed, including energy efficiency, energy markets, tenure, and location. This chapter documents the significant negative consequences that can arise from living in fuel poverty, including poorer physical and mental health, and social exclusion. Lastly, this chapter examines the prevailing methods of measuring the incidence of fuel poverty, finding several methodological limitations to measuring pan-EU fuel poverty. In all, the evidence reviewed suggests there may be gaps in what is known about fuel poverty at the European level, particularly as the literature predominantly relates to the UK and Ireland.

Chapter 3 then examines the EU structure, the decision-making process, and the relationship the EU has to fuel poverty. This chapter discusses the role of various legislative and consultative institutions, and finds that the European Commission is a significantly powerful player as the only institution with the authority to propose new legislation. Only a limited number of previous empirical analyses of EU fuel poverty policy were found, from which several key gaps in knowledge were evident. These concern a lack of engagement with the early origins of fuel poverty concerns in the EU policy literature from 2001, and a lack of detailed discussion on the position taken by various EU institutions on topics pertaining to defining, measuring and alleviating fuel poverty.

Chapter 4 presents the methods and empirical findings of a qualitative analysis of EU policy documents from 2001 to 2014, and introduces fuel poverty as an EU policy issue. This aims to address the key gaps in knowledge identified in Chapter 3, concerning the emergence of fuel poverty concerns within EU policy, and the policy stances taken in relation to defining and measuring fuel poverty. Borrowing key concepts from the historical institutionalism literature, this chapter draws attention to the European Commission's *de facto* usage of the term vulnerable customer, which has displayed strong path dependency since it was first used in 2003. The implications of this divergent nomenclature are discussed. The chapter also finds evidence of several critical junctures in the 2001 to 2014 policy timeline, at which points key legislation could have been amended and/or introduced to enhance the alleviation of fuel poverty. However, due to opposition from the European Commission and the Council, there have been numerous missed opportunities. This is despite ongoing support from the European Parliament and other institutions for fuel poverty to be addressed at the European scale. Indeed, the European Parliament, European Economic and Social Committee, and Committee of the Regions have all given firm policy mandates for producing harmonised statistics on the incidence of fuel poverty across the EU, stating the importance of understanding the extent of the issue. This policy context reinforces the key aim of this thesis, which is to quantify the proportion of fuel poor households across the EU, in order to orientate policy action and enable the monitoring of progress.

Chapter 5 then turns to the question of measurement, and focusses on reviewing previous empirical studies of fuel poverty incidence across Europe in order to establish the gaps in knowledge. It is evident from the range of studies reviewed that the recognition and analysis of fuel poverty is growly rapidly across Europe, with single country studies of fuel poverty emanating from twelve different Member States. However, knowledge about fuel poverty is still lacking at the European-scale, and non-existent in many countries of the EU. Furthermore, the quality of existing research is highly variable across Europe, with many national-level analyses incorrectly partially transferring the UK's fuel poverty methodology. In addition, the age of many of the comparative studies and the data used means that they are at risk of becoming obsolete as society rapidly changes. A further concern is that none of the previous comparative studies have rigorously examined the relationship between indicators to determine the intensity of fuel poverty issues across the EU.

Chapter 6 is an analysis of currently available datasets that could be utilised to measure fuel poverty incidence across Europe. Using academic literature, grey literature, survey methodology, and basic secondary data analysis, this chapter identifies and assesses five existing surveys, and one supplementary survey. It is evident from this assessment that a paucity of suitable data at the EU-level is limiting the measures that can be applied and preventing rigorous assessment of fuel poverty across the EU. There is no dedicated survey of fuel poverty, and no standardised household microdata on energy expenditure, energy consumption, or energy efficiency. The chapter concludes that at present, using consensual indicators from the EU Statistics on Income and Living Conditions is the only viable data option for producing pan-EU estimates of fuel poverty.

Chapter 7 outlines the methods and data for constructing a pan-EU fuel poverty measure that is most suitable for comparing fuel poverty rates across the EU, whilst also retaining usability for analysis at the household-level to determine factors that exacerbate fuel poverty. The chapter discusses the benefits of developing a composite index, and states the key criterion that the index should be grounded in the existing academic and policy literature, whilst taking into consideration the limitations imposed by data quality and availability. Overall three varying indices of fuel poverty have been created. Two of these indices build on previous pan-EU analyses of fuel poverty using a consensual approach, whilst the third index draws on recent guidance issued by a working group of the European Commission concerning vulnerable consumers in the energy retail markets.

Chapter 8 presents the findings and country ranking tables produced using two of the pan-EU fuel poverty indices. The indices show that Southern and Eastern European countries are consistently worst affected by fuel poverty from 2007 to 2011. An additional key finding is that of the households that report experiencing consensual indicators of fuel poverty, a higher proportion report just one indicator, rather than two or three indicators. Lastly, the chapter examines the links between fuel poverty, as measured by the consensual index, and a range of sociodemographic and geographic factors, such as tenure, chronic illness, and living in a rural location.

Chapter 9 offers a discussion of the main research findings from the thesis, with consideration for the pre-existing state of the art in fuel poverty research, and reflects on the policy implications and key recommendations. The validity of the pan-EU indices is considered, with comparisons made with official statistics from the UK and European Commission, and other studies of fuel poverty. Overall, this chapter states that the indices are suitable as interim measures of EU fuel poverty, however, improvements to data collection are necessary.

Chapter 10 is the concluding chapter of the thesis. This chapter assesses the contributions to knowledge made by the study, in the context of its main strengths and limitations. The chapter summarise the key recommendations arising from the thesis, which are aimed at addressing the gaps in research, policy provision, and data availability. Two main recommendations are outlined. Firstly, it is recommended that a broad operational pan-EU definition of fuel poverty is created and adopted by the EU, in order to give prominence to the issue and clarify the terminological confusion. Secondly, it is suggested that data collection is radically overhauled, by way of consultation with Eurostat and relevant stakeholders. The thesis concludes with a number of suggested directions for future research on fuel poverty across Europe.

Contribution to knowledge

Overall, this thesis makes an original contribution to knowledge in two key ways. Firstly, by tracing and analysing the development of fuel poverty related concerns in EU policy, since the origins in official policy documents in 2001, this thesis establishes the central role of institutions in shaping fuel poverty policy over time. It specifically identifies the key role the European Commission has played in blocking policy advancement, despite significant and continued pressure from the European Parliament and other institutions. In doing so, this analysis also establishes a strong policy mandate for the thesis research by revealing the substantial desire that exists among many EU institutions for quantitative assessments of EU fuel poverty, which has not been addressed thus far. The second key contribution to knowledge is made via a new composite index that captures both the incidence and intensity of fuel poverty issues, and provides vital information on the pervasive and enduring nature of fuel poverty in Europe. The index demonstrates that fuel poverty exists across all countries of the EU, to varying extents, and in many instances there is significant overlap between the core drivers of fuel poverty. In all, this thesis adds to the weight of evidence concerning the prevalence of fuel poverty across Europe, and highlights the necessity of tackling fuel poverty via policy interventions at the EU and Member State-level.

Chapter 2: Understanding fuel poverty

Introduction

This chapter provides an introduction to the concept of fuel poverty. It starts by outlining how fuel poverty can be defined, with an overview of current national definitions of fuel poverty, before examining some of the circumstances in which fuel poverty is most likely to occur, and the factors that exacerbate fuel poverty. The chapter then moves on to discuss the key literatures concerning the consequences of living in fuel poverty. The penultimate section of the chapter outlines the main approaches available for measuring fuel poverty at a national and European-level, centring on the prevailing expenditure and consensual approaches. Lastly, the chapter summary brings together the key themes relating to defining, understanding and measuring fuel poverty, in the context of the thesis research questions and aims. The overall purpose of this chapter is to establish what fuel poverty is, why policymakers and researchers should care about alleviating the problem, and how the concept can be defined and measured. It should be noted that at times this review relies predominantly on British and Irish literature as the majority of academic work on fuel and energy poverty has been produced in, and relates to, the UK and Ireland (Petrova *et al*., 2013; Liddell *et al*., 2011). However, where possible a range of European literature has been cited.

Defining fuel poverty

The concept of fuel poverty is broadly accepted as occurring when a household is unable to afford basic levels of energy for heating, lighting and use of appliances (Boardman, 2010a; Liddell *et al*., 2011). However, detailed operational definitions of fuel poverty are contested, in part because the concept is multifaceted and defining it requires judgement. Indeed, as Boardman remarks: “who is fuel poor depends on the definition; but the definition depends on who you want to focus on and this involves political judgement” (2010a: 21). The issue of defining fuel poverty is further complicated by conflicting usage of terminology across Europe, as the next section will now consider.

Terminology

At the European scale, there is a conflicting use of terminology, with the term ‘energy poverty’ sometimes used instead of ‘fuel poverty’ (for example, Buzar, 2007a; Bouzarovski *et al*., 2012), and the terms are often used interchangeably within the same document (Thomson and Snell, 2013), even within official policy documents (see for example, European Commission, 2010a, 2010b). Generally speaking, energy poverty gives the impression of being the preferred term for the EU (Househam and Musatescu, 2012), appearing in several key European Directives (for instance Directives 2009/72/EC and 2009/73/EC). However, as will be explored in a content analysis of EU policy documents in Chapter 4, usage of ‘fuel poverty’ predates ‘energy poverty’ in the EU policy literature, and the terms continue to be used interchangeably, which adds to the terminological confusion.

As highlighted by Ürge-Vorsatz and Tirado Herrero (2012), usage of the term energy poverty can be problematic due to its origins in describing the lack of access to modern energy services in developing countries (as used by Bazilian *et al.*, 2010; Birol, 2007; and Sagar, 2005). Whilst energy access in developing countries is pertinent to European fuel poverty, and some parallels can be drawn with households in developed countries that live off the mains gas and electricity networks, the contexts are very different. Househam and Musatescu (2012) highlight the differences in contexts, and offer the following method of distinguishing between the terms:

> “Energy poverty is the term commonly used in the development community to refer to poverty that is exacerbated by a lack of access to modern energy sources and end-use technologies (particularly cooking fuels and electricity), and is most prevalent in less developed regions of the world. Fuel poverty is the term coined in the UK in the 1980s that refers to a problem of affordability rather than access, which is present in some of the world's most developed countries” (Househam and Musatescu, 2012: 2).

An earlier definition of energy poverty, which was used in relation to Eastern Europe, is “the inability to heat the home up to a socially- and materially-necessitated level” (Buzar, 2007a: 9). However, in its broadest use within European literature, energy poverty has a wider remit than the conventional definition of fuel poverty, with the European Economic and Social Committee defining energy poverty as occurring when “a household finds it difficult or impossible to ensure adequate heating in the dwelling at an affordable price…and having access to other energy-related services, such as lighting, transport or electricity for use of the Internet or other devices at a reasonable price” (2011: 54). Boardman (2010a), on the other hand, considers the two terms to mean the same thing, whilst the European Commission have indicated that both terms relate to the affordability of heating the home, but state the distinction lies with the fuel types covered by each term:

> “The term “energy poverty” and the term “fuel poverty” are often mistakenly used interchangeably. The energy sources covered by the term fuel poverty (electricity, natural gas, liquefied petroleum gas, oil, coal, district heating and other solid fuels) are broader than those considered in the energy poverty references in the internal energy market legislation (electricity and gas)”
>
> (European Commission, 2010a: 10).

It is argued by Bouzarovski *et al*. (2014) that rigid divides between fuel poverty and energy poverty are redundant and “become untenable when faced with the diversity of conditions and practices surrounding issues of energy equity across the world” (Bouzarovski *et al*., 2014: 4). For instance, the authors give the example of middle-income states in Central Asia and South America, where governments face twin problems of energy access and affordability (Bouzarovski *et al*., 2014). Instead, it is argued that a dynamic energy vulnerability framework should be adopted, which starts from the premise that all forms of fuel and energy poverty, in both developed and developing countries, are underpinned by a common condition: “the inability to attain a socially- and materially necessitated level of domestic energy services” (Bouzarovski *et al*., 2014: 0).

However, as fuel poverty is considered the most commonly accepted term throughout the industrialised world (Liddell *et al*., 2012), this thesis will primarily make reference to the term fuel poverty when describing the phenomenon whereby a household struggles to achieve adequate services in the home, reverting back to the usage of energy poverty only when referring to academic and policy literatures that use this term.

Existing policy definitions

At present, there is no accepted definition of fuel poverty, or energy poverty, at the EU-level, although there have been ongoing discussions on whether it would be appropriate to develop a pan-EU definition, as subsequent chapters explore. By comparison, at the Member State level three countries have an official definition of fuel poverty as summarised below in Table 2.1.

Table 2.1 Summary of existing fuel poverty definitions at the Member State level

Country	**Definition of a fuel poor person/household**
France	"If he/she encounters particular difficulties in his/her accommodation in terms of energy supply related to the satisfaction of elementary needs, this being due to the inadequacy of financial resources or housing conditions" (translation of Plan Bâtiment Grenelle, 2009: 16).
Republic of Ireland	"The inability to afford adequate warmth in a home, or the inability to achieve adequate warmth because of the energy inefficiency of the home" (Office for Social Inclusion, 2007: 67).
United Kingdom	Previous definition: "One that cannot afford to keep adequately warm at reasonable cost. The most widely accepted definition of a fuel poor household is one which needs to spend more than 10% of its income on all fuel use and to heat its home to an adequate standard of warmth." (Department of Trade and Industry, 2001: 6).
	New definition in England: "considers a household to be fuel poor if: • they have required fuel costs that are above average (the national median level) • were they to spend that amount, they would be left with a residual income below the official poverty line", (Department of Energy and Climate Change, 2014: 5).

A commonality of the existing national definitions listed above is that they all reflect the relationship between energy efficiency, low income, and energy costs. This is because these three factors are widely considered to be the main determinants of fuel poverty, as will now be explored in the next section.

Determinants of fuel poverty

As stated above, the main cause of fuel poverty is widely accepted by UK and Irish academics as a complex interaction between poor energy efficiency of buildings and technology, low household income, and high energy prices (Boardman, 2010a; Healy and Clinch, 2002a; Scott *et al*., 2008; Walker and Day, 2012). Additional contributory factors include above average energy needs (Bouzarovski *et al*., 2012), perhaps as a consequence of disability (Snell and Bevan, 2013), as well as an absence of savings and living in rented accommodation, both of which limit an occupant's opportunities to improve their dwelling (Boardman, 2010a).

However, there exists a gap in knowledge concerning the extent to which the main determinants drive fuel poverty across each Member State of the EU due to a lack of detailed research on fuel poverty in many countries, as Chapter 5 details. The severity of each determinant is likely to differ between Member States due to variations in factors such as welfare provision, energy efficiency standards, and energy market liberalisation. There are also likely to be drivers of fuel poverty that are specific to certain regions of the EU. For example, South Eastern and Central Europe will be disproportionately affected by the legacies of communism (Buzar, 2007a; 2007b), including "indirect energy price subsidies, reliance on polluting sources of energy, state interference and ownership of energy enterprises" (Bouzarovski *et al.*, 2012: 79). The aim of the following section, therefore, is to introduce and summarise the three main causes of fuel poverty, in addition to a range of known additional determinants, whilst recognising that this is not an exhaustive list, and the drivers will vary between countries.

Energy efficiency

Energy inefficient housing and equipment, which in many instances is synonymous with poor housing quality, is seen by many as the most important driver of fuel poverty (see Boardman, 1991; 2010a; 2010b; Healy and Clinch, 2002a). Furthermore, improving energy efficiency standards is considered the only permanent method of reducing fuel poverty (Boardman, 2010a; Walker *et al*., 2014). Indeed, a World Health Organization expert meeting held in 2006 concluded that alternative terms such as 'cold homes' or 'energy precariousness’ would be more appropriate than fuel poverty as they would “put the focus on inadequate housing as the fundamental problem” (World Health Organization, 2007: 10). Poor energy efficiency can be expressed in a number of ways, for instance, via poor building fabric, which means that internal heat is easily lost (EPEE, 2009a), or in the form of an inefficient heating system and/or fuel type, resulting in a poor conversion from expenditure on fuel to useable warmth (Walker *et al*., 2014). Energy inefficiency can also be exacerbated by high energy consuming appliances, such as refrigerators and ovens. In sum, all forms of inefficient housing and equipment result in householders having to spend more than is reasonable on fuel to achieve adequate home heating (Healy, 2004), and other energy services.

As outlined earlier in the chapter, there are many issues that are specific to Central and Eastern Europe as a result of the communist-era centrally-planned economy. In relation to energy efficiency, Boardman describes how the policy of including heat and other forms of power in rent resulted in “a lack of attention to the energy efficiency of the dwelling, no meters to monitor the amount of electricity or heat used, and an absence of awareness of its importance in the population” (Boardman, 2010a: 15). Similarly, Bouzarovski *et al.* (2012) state that inefficient housing stocks and heating systems in South-Eastern Europe are the result of the slow post-communist restructuring process (Bouzarovski *et al.*, 2012: 79).

A problematic aspect of energy inefficient housing is the distribution, with the poorest households most likely to occupy the worst housing. For example, across Europe, Deguen *et al.* (2012) found that “substandard housing is not evenly distributed across space and population; disadvantaged groups are disproportionately affected” (Deguen *et al*., 2012: 23). Whilst Stockton and Campbell (2011) found that in England the fuel poor occupied the worst housing across all tenures, in terms of energy inefficiency. This is problematic as fuel poor households are the least able to respond to this situation, for example by investing in energy efficiency measures, or by reducing fuel consumption (Boardman, 2012; Deguen *et al*., 2002; Stockton and Campbell, 2011). This means that external capital financing is required to improve the energy efficiency standards of the fuel poor (Boardman, 2010a; Stockton and Campbell, 2011), which the EU has recently recognised in the 2012 energy efficiency Directive.

Energy prices

The relationship between the cost of fuel and the ability to afford an adequate supply of energy in the home is perhaps an obvious one. If the price of energy continually increases, as it has done across most European countries (Healy, 2004; Bouzarovski *et al*., 2012), it will become more unaffordable, unless there is a corresponding increase in household income and/or improvement in the energy efficiency of the property. However, the association is more nuanced than this, with inequalities in the price paid for energy by different household groups (Walker and Day, 2012). These inequalities in energy prices can result from differences in tariff structures, payment methods, and choice of fuels.

In terms of energy tariffs, pricing can vary depending on factors such as individual consumption levels, with consumers sometimes charged more once consumption exceeds a certain threshold (Baker, 2006), and the time of energy use, whereby cheaper tariff rates are available during certain hours of the day, principally to reduce peak energy demands. Inequalities can also be introduced when cheaper tariffs are only made available to customers who have access to the Internet, and by charging different rates according to payment method (Hills, 2012). For instance, prepayment meter users typically pay the highest unit cost for energy in Great Britain (Hills, 2012), whilst direct debit plans usually have the lowest unit cost. However, many fuel poor households may be unable to pay by direct debit, or indeed may not want to use this payment method. For instance, research by Lusambili *et al*. (2011) found that older people were reluctant to use direct debit payments due to a lack of trust in how they worked and whether or not they would pay the correct amount.

The cost of energy is also strongly linked to the availability of energy carriers, which is likely to vary significantly depending on the national and regional context. For instance, 68 per cent of households in Northern Ireland use heating oil as their main heating source due to a lack of widespread mains gas infrastructure (The Consumer Council, 2013). This is the highest prevalence of heating oil usage across Western Europe, and means that many households in Northern Ireland have no alternative but to rely on expensive heating oil, which is contributing to extremely high levels of fuel poverty (Walker *et al*., 2012). The availability and choice of fuels across Europe is exacerbated by energy efficiency and the ability of households to invest in new heating measures. Indeed, Boardman notes: “not only is fuel a basic necessity, but the household is locked into the use of a particular fuel and requires capital investment before substitution is an option” (2010b: 255).

One of the key policy reforms that has negatively affected domestic gas and electricity prices across Europe in recent years has been the liberalisation of the energy markets. Pollitt (2012) characterises energy liberalisation as a process of introducing competition via “structural changes such as the removal of subsidies, vertical unbundling of integrated utilities to facilitate non-discriminatory access to monopoly networks and horizontal unbundling of incumbents to create viable competitors” (Pollitt, 2012: 128). Liberalisation of the gas and electricity markets across Europe has been one of the EU’s core policies over the last two decades (European Economic and Social Committee, 2011a), which Buchan (2010) labels an obsession. As will be detailed in Chapter 4, the process of opening up the gas and electricity markets across the EU, and transferring ownership from the state to the private sector, began in the late 1990s. The current legislation in place across the EU is the 2009 Directives concerning common rules for the internal market in natural gas and electricity.

The European Commission believes that liberalised energy markets will “achieve efficiency gains, competitive prices and higher standards of service” (Directive 2009/72/EC: 55). However, as the European Economic and Social Committee outlined in an opinion document on energy liberalisation, “liberalisation benefits consumers if it genuinely promotes competition, but in a number of Member States, public monopolies have been replaced by private oligopolies” (European Economic and Social Committee, 2011a: 55). In addition, Poggi and Florio have stated that households are potentially discriminated against, compared to businesses, during energy sector reforms, particularly when tariff adjustments occur (Poggi and Florio, 2010). In their study of social affordability of energy bills across ten European countries, Poggi and Florio found that steps towards liberalised energy markets, such as reducing public ownership in the gas sector, were “correlated with higher probability of experiencing deprivation” (2010: 261). Furthermore, energy liberalisation is partly reliant on consumers taking an active role, by way of switching suppliers to achieve the best energy prices. However, research has found that some consumers are reluctant to switch electricity and gas suppliers for fear of losing support (Consumer Futures, 2013), concerns about having to pay two suppliers during the switch over process (Barnes *et al*., 2014), or for fear of being liable for unexpectedly high charges or fees for switching before their current contract ends (Faulk, 2009; George *et al*., 2011). In addition, some consumers are simply not interested in actively engaging with their energy bills or changing supplier. This may be due to a bad previous experience with switching, a lack of trust with energy suppliers (Barnes *et al*., 2014), or satisfaction with the status quo.

In some countries, social tariffs and financial support schemes have been introduced to assist vulnerable consumers with paying for energy (see Baker, 2006 for an early review). For example, Bouzarovski *et al.* (2012) note that vulnerable households in Bulgaria are provided with direct financial support towards their energy bills through the Winter Supplement Programme. Similarly, in Belgium there are social tariffs for gas and electricity and a social heating fund for oil (Noeninckx, 2011). However, such schemes only offer short term relief for fuel poor households, and do not address the underlying structural issue of energy inefficiency.

Household income

Household income is a key determinant of fuel poverty for two primary reasons. Firstly, it dictates household ability to pay for fuel bills, which subsequently shapes energy consumption patterns. A low household income, in combination with continually rising energy prices, is likely to cause fuel poor households to resort to coping strategies such as reducing expenditure on other essentials, such as food, or getting into debt (Gibbons and Singler, 2008; Brunner *et al*., 2012). Having a low household income can also be compounded by sudden financial shocks, such as receiving a large energy bill. There is a risk that households that are unable to pay for their energy may have their energy supply disconnected, either voluntarily (often referred to as self-disconnection) or by an energy company (see O'Sullivan *et al*., 2011). Although, disconnection rates will vary by country depending on disconnection policies, for instance, Thomson (2011) reports varying levels of disconnection protection across Europe in the gas and electricity markets.

Secondly, household income and availability of savings determines whether a household is able to invest in energy efficiency improvements. As discussed previously, low income households are the most likely to occupy housing with poor energy efficiency levels, but without external support via grants and loans, many poorer households will be unable to make energy efficiency improvements. However, it is important to distinguish fuel poverty from broader issues of income poverty. As Boardman argues, it is "the crucial role of housing stocks - the house, heating system and other energy using equipment" (Boardman, 1991: 221) and "the role of capital investments that distinguishes the fuel poor from the poor" (Boardman, 2010b: 256). Similarly, in an official review of fuel poverty for the UK government, Professor Hills (2012) confirmed that fuel poverty is a distinct issue from general income poverty, although there is a small degree of overlap.

Additional determinants

Beyond the three key determinants outlined above, namely household income, energy efficiency, and energy price, there are likely to be a range of other contributory factors. These factors include, but are not limited to: inequalities in knowledge and understanding; living in a rural area; energy needs; housing tenure and dwelling type.

In terms of inequalities in knowledge and understanding, the available literature demonstrates that disadvantaged groups of people are more likely to lack knowledge concerning effective coping strategies, methods of alleviation and available support, than more affluent and better educated groups of people, compounding the situation of being fuel poor. For example, in relation to exposure to carbon monoxide from gas or solid fuel heating systems, Morris and Braubach (2012) state that particular socio-demographic groups may lack knowledge about the risks associated with heating systems and through actions such as limiting ventilation to reduce fuel expenditure, may increase their risks (Morris and Braubach, 2012: 18). In Austria, Brunner *et al.* (2012: 57) argue that with respect to changing energy supplier, some low-income households lack the physical and mental resilience to carry out the process, in addition to being unable to source information about other suppliers, perhaps due to a lack of internet access. Similarly, Anderson *et al.* (2010) found that switching energy supplier was a minority activity amongst low income households in their study, in part because some households did not know how to go about the process or did not have the means to do so. Writing in 1991, Boardman discussed issues of knowledge and understanding, arguing that heating systems were being used inefficiently by some demographic groups due to ignorance about fuel prices and running costs (Boardman, 1991: 51).

Similar information and knowledge barriers have been noted in relation to accessing energy efficiency schemes. For instance, Gibbons and Singler found that the "installation of energy efficiency measures was often prevented due to a lack of knowledge of the benefits of the measures, the means of applying and eligibility criteria, and of the work involved" (Gibbons and Singler, 2008: 7). Reflecting on the communication of relevant information in England, Harrington *et al.* argue: "good-quality, unbiased information does not necessarily reach those in fuel poverty. Information about grants, and about the merits of home improvements, was transmitted haphazardly" (Harrington *et al.*, 2005: 267). This haphazard transmission of information is an issue for concern because if fuel poor households are not in possession of good quality knowledge about energy efficiency and fuel poverty generally this may lead to imprudent decisions and financial exploitation. For example, Harrington *et al.* (2005) also found that some respondents in their study were choosing to install double glazing and take on debt to finance the installation, rather than install cheaper and more cost effective measures such as roof insulation. The authors speculate this decision may be due to two factors: firstly, double glazing has higher visibility than insulation, and secondly, there is more commercial pressure from advertising and door-to-door selling (Harrington *et al.*, 2005: 265).

Moving beyond intangible issues of access to knowledge and barriers to the uptake of fuel poverty alleviation schemes, there are many tangible factors that increase the likelihood of fuel poverty occurring. For instance, Shucksmith *et al.* (2009) found that across poorer EU Member States, rural areas are at a significant disadvantage compared with urban areas in relation to housing condition indicators, which includes dampness and rot. In the UK, analysis has found worsened levels of fuel poverty in rural locations (Hills, 2012; Baker *et al.*, 2008), with the study by Baker *et al.* finding that the prevalence of solid walled properties, which are difficult to retrofit with energy efficiency measures, and properties not connected to the mains gas network is much higher in rural areas (Baker *et al*., 2008: 4). However, beyond this literature base there is limited evidence concerning the relationship between fuel poverty and rurality, and more research is needed to confirm the association, particularly in countries beyond the UK.

With regard to household structures, single parent families and single pensioner households have been found to be at an increased risk of experiencing fuel poverty across EU14 (Whyley and Callender, 1997; Healy and Clinch, 2002a), the UK (Barnes *et al*., 2008), Ireland (Healy and Clinch, 2002b) and Austria (Benke and Varga, 2012). It is argued that these household types are likely to be at an increased risk due to the higher internal temperatures needed in households containing young children and elderly people, in addition to broader patterns of poverty within these groupings (Healy and Clinch, 2002a). The issue of recognising above average energy needs is an important aspect of determining fuel poverty (Bouzarovski *et al*., 2012), and relates to the number of hours of daily heating that is required, as well as additional heating, cooling and other energy service needs that may result from chronic illnesses and disability (Snell and Bevan, 2014).

In terms of housing tenure, much of the literature considers tenants of rented accommodation to be most at risk of fuel poverty (for example, Boardman, 2012; 2010a; Brunner *et al.,* 2012; Stockton and Campbell, 2011). This is because living in rented accommodation limits the opportunities to improve the property (Boardman, 2010a), and landlords are unlikely to see the need for energy efficiency improvements (Brunner *et al.*, 2012), thus households that rent are likely to be at a considerable disadvantage compared with households that own their property. Barnes *et al.* (2008) report that British children living in private rented accommodation were most likely to persistently experience living in accommodation that was inadequately heated and in poor state of repair compared with other tenure types. Similarly, Stockton and Campbell report that in England the most energy inefficient homes occupied by the fuel poor are found in the private rented sector (Stockton and Campbell, 2011: 5). A strongly related issue is the dwelling type, both in terms of actual property type such as high rise apartment building or cottage, and in terms of the construction period, which determines physical characteristics such as the presence or absence of wall cavities and the standard of energy efficiency achieved (Hills, 2012).

Impacts of fuel poverty

Having outlined a range of potential determinants of fuel poverty, the following section now moves on to consider the main coping strategies associated with fuel poverty, and a range of subsequent impacts. In terms of coping strategies, the literature indicates that households struggling with fuel poverty may adopt one or more of the following coping strategies: "reducing their use of fuel, including by rationing fuel, or self disconnection… taking financial measures, for example by reducing household expenditure…[and/or] getting into debt" (Gibbons and Singler, 2008: 5). In Austria, Brunner *et al.* (2012) found that interviewees resorted to reducing the level of illumination in the property by either not using lights, or only using a limited selection, for example by only having lights on in one room.

A common dilemma that is often articulated in the media is the concept of 'heat or eat', whereby households are forced to choose between essential items and services, namely food and heating. There is limited literature on this concept, in part due to the difficulties inherent in measurement, however, a study from the United States of America that tracked food and fuel expenditure found that during cold weather poor families reduce their food expenditure by approximately the same amount as they increase fuel expenditure (Bhattacharya *et al.*, 2003). By comparison, richer families increase both their fuel and food expenditure during cold weather (Bhattacharya *et al.*, 2003). The same research stated that children and adults from poor households reduced their calorific intake by ten per cent during winter months, whereas there was no reduction in calorific intake by children and adults from richer households (Bhattacharya *et al.*, 2003). More recently, Lambie-Mumford *et al*. (2015) have begun to explore the phenomenon of heat or eat in rural England, finding that the terminology is highly variable, and the concept is difficult to assess.

Moving beyond coping strategies, there is a broad existing literature base that indicates living in fuel poverty results in significant deteriorations to physical health and mental wellbeing (Liddell and Guiney, 2014; Liddell and Morris, 2010), and indeed at worst can cause premature deaths, as the subsequent sections will now consider.

Physical and mental health and wellbeing

The health and wellbeing consequences of belonging to a fuel poor household are wide ranging, from an increased likelihood of suffering from illnesses such as "influenza, heart disease, and strokes" (Department of Trade and Industry, 2001: 7), heightened anxiety and depression (Liddell and Morris, 2010), through to an increased risk of suffering from asthma due to the growth of fungi and dust mites that cold homes promote (Department of Trade and Industry, 2001: 8). Liddell and Guiney (2014) have recently put forward a cumulative stress framework that hypothesises the cycle of risk initiated by living in fuel poverty. Their model incorporates the multiple pathways to impaired mental wellbeing, physical health deterioration, and increases in health-risk behaviours, and is based on cumulative stress theory, which asserts that vulnerability increases quadratically when people experience an accumulation of stressors from multiple sources (Liddell and Guiney, 2014: 11). It has been documented that people living in cold homes have an increased likelihood of using health services. For instance, Evans *et al.* found "those who had difficulty keeping their home warm enough 'most of the time' were nearly twice as likely to visit the surgery four or more times, and twice as likely to use outpatient departments as those who never experienced this problem" (Evans *et al.*, 2000: 678). Similarly, a study of the impact of fuel poverty on children found that "for infants, living in fuel poor homes is associated with a 30% greater risk of admission to hospital or primary care facilities" (Liddell, 2008: 2).

The link between exposure to dampness and to mould (often symptoms of fuel poverty) and asthma has been confirmed by several studies. A British study found that installing central heating in the homes of asthmatic children resulted in a significant reduction of respiratory symptoms, less night time coughing and less days off school due to asthma (Somerville *et al.*, 2000). Similarly, a randomised controlled trial of heating interventions in New Zealand resulted in a significant reduction of winter school absences, on average 21 per cent, and produced improvements in room temperatures and pollutants (Free *et al.*, 2010). In terms of the estimated number of asthma-related deaths resulting from exposure to dampness and mould, a review of environmental health inequalities across Europe, stated:

> "it has been estimated that 0.07 asthma-related deaths and 50 asthma-related DALYs [disability-adjusted life years] per 100 000 children per year are associated with exposure to dampness in

> dwellings, and that 0.06 asthma-related deaths and 40 asthma-related DALYs per 100 000 children per year are associated with exposure to mould". (Deguen *et al.*, 2012: 42).

Whilst there is limited research that considers the relationship between fuel poverty and disabled people (Snell and Bevan, 2014), the existing evidence suggests that the impacts of under-heating and living in a cold home may be significantly worse for people with chronic illnesses or disability, compared to people without underlying medical conditions (see for example El Ansari and El-Silimy, 2008; Howden-Chapman *et al*., 2012; Day and Hitchings, 2011; Liddell and Morris, 2010). This may be because healthy and active people are able to generate more body heat and stay warmer for longer (Snell and Bevan, 2014). In addition, some health conditions necessitate increased heating, such as Chronic Obstructive Pulmonary Disease, which requires a heating regime of 21 degrees centigrade to avoid severe health implications (Ormandy and Ezratty, 2012).

Living in fuel poverty can have a negative effect on mental health and wellbeing, particularly in terms of persistent worry about debt and affordability (Liddell and Guiney, 2014), trying to balance household finances to pay for energy bills, and living in poor housing conditions. As EPEE state "unaffordable fuel bills are inevitably the cause of worry and distress for families and individuals. Debt and the fear of disconnection are sources of anxiety for households" (EPEE, 2009b: 45). Harrington *et al.* (2005) also found that people experienced distress as a result of their inability to achieve current normative living standards. Social exclusion, whereby an individual is "geographically resident in a society and…does not participate in the normal activities of citizens in that society" (Burchardt *et al.*, 1999: 230), has also been associated with those living in fuel poverty. As detailed in the following quotation, "poor housing conditions militate against social interaction since people are reluctant to invite friends or neighbours into an unwelcoming and inhospitable living environment" (EPEE, 2009b: 45). An inhospitable living environment could be the result of low indoor temperatures, as well as damp and mould problems. A reduction in social interaction, due to poor housing and fuel poverty, can diminish a person's mental health by prompting feelings of isolation and loneliness, particularly in households where the occupants spend a significant proportion of the day in their property, perhaps due to unemployment or a disability.

Excess winter and summer mortality

As Liddell and Morris (2010) note, until recently the primary health risk associated with excess cold was to life itself. This risk is often categorised as excess winter deaths or mortality. The accepted definition of excess winter mortality (EWM) is "the surplus number of deaths occurring during the winter season (December to March inclusive) compared with the average of the non-winter seasons" (Healy, 2003: 785). Premature deaths resulting from excessive heat has also received recognition, although to a lesser extent, and excess summer mortality has previously been measured longitudinally by analysing the volume of daily mortality over several years (Robine *et al.*, 2008). Population vulnerability to both high and low outdoor temperatures has been noted by numerous authors across Europe and beyond (for example Ekamper *et al.*, 2009; Keatinge *et al.*, 1989; Robine *et al.*, 2008; Shah and Peacock, 1999; Healy, 2003; Lawlor *et al.*, 2002; and Hales *et al.*, 2012) and is said to be strongly related to "a wide variety of social, economic, and behavioural factors" (Ekamper *et al.*, 2009: 385).

There are a variety of ways in which heat and cold stress, emanating internally from a dwelling and/or externally, can cause death. Cold stress can cause arterial thrombosis due to blood becoming more concentrated during exposure to cold and liable to clot (Ekamper *et al.*, 2009: 389), as well as a suppression of immune responses to infections (*ibid.*). Excessive heat can cause death in two ways: firstly, coronary and cerebral thrombosis can occur due to a loss of salt and water during sweating and a subsequent increase in red blood cells (*ibid.*), and secondly, the process of providing additional blood flow to the skin to expel heat can cause strain on failing hearts (*ibid.*).

Within the literature, several authors have attempted to quantify the extent of excess summer and winter mortality and to provide an optimal temperature at which the least number of surplus deaths occur. Keatinge *et al.* calculated that each degree Celsius (°C) colder the winter of 1964 was compared with summer amounted to an increase in respiratory mortality of 18.7% (Keating *et al.*, 1989: 74). However, it is likely this gradient has changed as society has adapted and evolved, indeed, in the Netherlands, Ekamper *et al.* observed an increase in the optimal temperature from below 15°C to around 17°C during the period 1855-2006 (Ekamper *et al.*, 2009: 416).

Robine *et al.* (2008) discovered that more than 70,000 additional deaths occurred across Europe during the summer heat wave in 2003, whilst in a cross-comparative study of EWM in fourteen European countries, Healy reported that Portugal, Spain and Ireland suffered from the highest rates of EWM, with levels of twenty eight per cent in Portugal, and twenty one per cent in Spain and Ireland respectively (Healy, 2003: 784). Healy states there is a lack of research concerning seasonal variations in mortality in southern Europe, and attributes this to the perception that countries with mild winter climates are not affected by EWM (*ibid*.).

There is considerable debate concerning the association between seasonal mortality and the following determinants: household income, social class, deprivation and fuel poverty. In terms of income and class, Healy (2003) found a strong relationship between EWM and socioeconomic indicators of wellbeing, which includes poverty, income inequality and fuel poverty, and suggested that levels of EWM could be reduced through socioeconomic progress (Healy, 2003: 788). Likewise, in the Netherlands Ekamper *et al.* (2009: 417) found that the lowest social class was the most vulnerable to temperature fluctuations in their study, due to poor housing, clothing, working conditions and footwear (*ibid.*). In New Zealand, "those in the lowest tertile of income were at increased risk of winter death compared to those in the highest tertile" (Hales *et al.*, 2012: 379).

Conversely, Shah and Peacock (1999) state that whilst there is a clear relationship between mortality and deprivation, their study "provides no evidence of an effect of deprivation on excess winter mortality or temperature dependent variations in mortality" (Shah and Peacock, 1999: 499). Lawlor *et al.* (2002) concede that it seems plausible that deprived areas would experience greater levels of EWM due to the propensity of deprived populations to live in poor quality housing, however, they also conclude that EWM is not associated with deprivation (Lawlor *et al.*, 2002). By way of explanation, Lawlor *et al.* state that people in deprived areas may adapt by wearing extra clothing or restricting heating, or it is possible that "the overall increase in ill health and total mortality associated with deprivation may mask any seasonal variation" (Lawlor *et al.*, 2002: 374).

However, despite the disparity outlined above, the literature concerning indoor cold stress, energy efficiency and EWM concludes that a relationship does exist. Keatinge *et al.*

(1989) hypothesised that the rapid increase in central heating in England and Wales (from thirteen per cent to sixty nine per cent over a twenty year period) was likely to be a substantial cause of the decline in respiratory EWM (Keatinge *et al.*, 1989: 75). Healy (2003) found that thermal efficiency and housing standards were a factor that contributed to the high levels of EWM in Southern and Western Europe. Indeed, Healy outlined what he termed the 'paradox of excess winter mortality', which "consists of the fact that higher mortality rates are generally found in less severe, milder winter climates where, all else equal, there should be less potential for cold strain and cold related mortality" (Healy, 2003: 786). Healy further stated that domestic thermal efficiency tends to be poor in countries with comparatively warm all year climates, which means households find it hard to keep their dwelling warm when cold weather does arrive (*ibid.*).

As Porritt *et al.* (2012: 1) state, extreme weather events, which include heat waves, are predicted to increase in frequency and severity; therefore the existing housing stock will need adaptation. Porritt *et al.* identify that it is possible to install housing interventions that "both eliminate overheating and reduce space heating energy use" (*ibid*.). However, some interventions such as solar reflective paints will reduce overheating, but at the expense of increased space heating energy use (*op.cit*., 11) and so the interactions need to considered carefully.

Measuring fuel poverty

The following section provides an overview of two key prevailing fuel poverty measurement approaches, namely expenditure and consensual, summarising the advantages and difficulties associated with each method. However, the aim of this discussion is not to outline existing quantitative studies of fuel poverty, as this will be addressed in detail in Chapter 5, thus only limited references will be made to previous analyses. Within this section, a distinction is made between measuring the national and regional incidence of fuel poverty for monitoring and benchmarking purposes, and attempting to identify fuel poor households at the local scale for policy delivery. Whilst this thesis focuses entirely on the former, by measuring the prevalence of fuel poverty at the national and European-scale, the latter point merits brief discussion. Accurately and efficiently locating fuel poor households can be a major obstacle to the delivery of fuel poverty alleviation policies (Dubois, 2012), particularly as "most monitoring proposals do not translate successfully into appropriate criteria at the level of the individual household" (Boardman, 2012: 144). Several research teams from the UK have developed systems of area-based targeting, which use a combination of small area statistics and census data to locate households that are likely to be fuel poor (see Walker *et al.*, 2012; Fahmy *et al.,* 2011; Morrison and Shortt, 2008; and Baker *et al.,* 2003).

Expenditure approach

The first, and most commonly used, method of fuel poverty measurement is the expenditure approach, which explores the ratio of household income to fuel expenditure. Broadly speaking, under an expenditure definition, a household is considered to be fuel poor if they spend more than X per cent of their income on fuel (Healy, 2004). Within this approach, there are two main considerations: firstly, whether to use an absolute or relative expenditure threshold, and secondly, whether to use actual or required fuel expenditure data. Following on from these decisions, there are a number of other elements that require thought, namely issues around measuring household income, and calculating household energy requirements. Given the variety of ways in which expenditure based measures can be applied there are limitations associated with each approach, as will be discussed below.

Absolute versus relative expenditure thresholds

As with the measurement of income poverty, there are ongoing debates over the use of relative and absolute fuel poverty thresholds (Hills, 2012). There are a variety of assumptions that underlie expenditure thresholds, each with particular strengths and weaknesses. Under an absolute measure of fuel poverty, a household is considered to be fuel poor if they spend more than a fixed X per cent of their income on fuel (Healy, 2004), for instance, in the UK the threshold was previously 10 per cent, and fuel poverty rates increased in line with rising fuel prices. Given their construction, absolute thresholds make the eradication of fuel poverty a possibility (Boardman, 2012).

By comparison, fuel costs under a relative threshold are typically calculated on a median cost to income ratio (Moore 2012: 21). The median is the preferred statistical value as it is better suited to the asymmetrically distributed nature of fuel expenditure, whereas the use of the mean can be misleading as it gives weight to 'atypically' high values (Moore, 2012; Fahmy, 2011). In other words, the median is more robust when dealing with skewed data as it is not influenced by outliers. Liddell *et al.* (2012) state that medians are internationally favoured in part because they smooth out extreme values. They further argue that conceptualising fuel poverty in median terms has been useful for comparing prevalence across countries "since it absorbs real variations in the amounts which residents of very diverse countries customarily pay for heat, power and light" (Liddell *et al.*, 2012: 27). A twice-median expenditure threshold is the prevailing measure used to indicate unaffordability and fuel poverty (Liddell *et al*., 2011). However, a criticism of relative measures is that unlike incomes, fuel prices do not remain static, thus relative measures may be subject to substantial fluctuations (Moore 2012: 21). This provides a more complex account of fuel poverty and the difficulty of a 'moving target' (Boardman, 2012), but potentially one that represents relative hardship more accurately (Boardman 2010a: 231). As indicated in Table 2.1, England recently moved from an absolute to relative mode of measurement, with the new definition of fuel poverty referring to both the national median required energy bill and the 60% of median income poverty line (Department of Energy and Climate Change, 2014).

Energy needs and spending

For an expenditure based measure of fuel poverty some quantification of energy costs is required. Two main approaches exist, required theoretical spend and actual spend. In the UK, modelled required energy consumption is used, which takes into account the energy *required* for space heating, water heating, lights and appliances, and cooking (Department of Energy and Climate Change, 2010). The model takes into consideration required internal temperatures based on World Health Organisation standards (1987), occupancy rates (hours spent in the home and under occupancy), energy efficiency, and types of fuel available to the household (Department of Energy and Climate Change, 2010). The approach used in the United Kingdom relies on detailed information to be collected about all aspects of the dwelling (Department of Energy and Climate Change, 2010).

Required fuel expenditure is considered to be more meaningful than actual spend, particularly as it is unaffected by the priorities and decisions households actually make (Hirsch *et al.*, 2011), but the housing data required to do so is almost unique to the UK (Moore, 2012) and subsequently no other European country conducts in-depth modelling. As such, the majority of non-UK based studies of fuel poverty utilise actual expenditure data, as will be elaborated in Chapter 5.

Actual fuel expenditure is easier to calculate, but is widely regarded as a poor indication of fuel poverty (Moore, 2012; Liddell *et al.*, 2012), especially as low income households often spend significantly less on fuel than would be required to maintain a warm home (Moore, 2012; Department of Energy and Climate Change, 2011). Indeed, a comprehensive study of household fuel expenditure in the UK by Hirsch *et al*. (2011: 4) found that on average, households consume only around two thirds of their theoretical 'need', with people on low incomes most likely to be under-consumers of fuel. Similarly, Liddell *et al.* (2011) compared fuel poverty rates in England, Wales, Scotland and Northern Ireland based on actual expenditure and required expenditure, finding that an actual expenditure measure would significantly deflate national fuel poverty rates, which they suggest indicates that under-heating is common practice throughout the UK (Liddell *et al*., 2011: 68). Furthermore, the use of actual fuel expenditure may be problematic in states where meter readings may be as infrequent as every two years (Darby, 2012).

Household Income

In both required and actual fuel expenditure models, an accurate assessment of household income is needed. The definition of household income is contentious in three key ways: firstly, whether to use a before housing costs or after housing costs measure; secondly, what welfare payments or benefits should be included within this calculation; and lastly, whether income should be equivalised to reflect household size (see Boardman, 2010a; Hills, 2012; Thomson *et al.,* 2013).

Limitations and criticisms

The expenditure approach is the most widely used method for measuring fuel poverty, in part due to the objective and quantifiable nature of the approach. However, there are numerous criticisms that can be levied on the approach. Firstly, the underlying methodology for the UK's modelled fuel poverty statistics is complex and not easily transferred, as evidenced later in Chapter 5 by the misapplication of the ten per cent threshold. By using a ten per cent actual expenditure threshold that is not grounded in the specific context of the country under study, researchers risk producing invalid results. Indeed, the confusing nature of the expenditure approach has been highlighted by Healy and Clinch who state "it can be misleading, as several formulae now exist for calculating fuel poverty, some with housing costs included in net household income…while other calculations analyse gross household income as opposed to net" (Healy and Clinch, 2002b: 5).

Harrington *et al.* (2005) condemn the methodology for calculating required fuel expenditure, stating: "a formula-based fixed model of acceptable heating, perhaps driven by the 'tyranny of numbers', may give a misleading picture of household need" (2005: 266). This point corresponds with that made by Bouzarovski *et al.*, who assert that the delimitation of the causes of fuel poverty to 'low income, inadequate building quality and high energy prices' ignores the importance of energy needs and socio-demographic circumstances at the household scale (Bouzarovski *et al.*, 2012: 78). Healy and Clinch further criticise the method for its inability to "capture the deprivation and social-exclusion elements of fuel poverty" (Healy and Clinch, 2002a: 9).

The most pertinent critique of the expenditure approach, however, is that it is not easily applied at the European-scale. As stated previously, the UK is almost unique in its production of a series of large national housing condition surveys. Without the replication of this model in other Member States, a required fuel expenditure approach cannot be applied on a European basis, necessitating the use of less favourable actual fuel expenditure data. However, standardised pan-EU actual expenditure data is not yet available.

Consensual approach

Given the criticisms and difficulties associated with the expenditure approach, particularly in a European context, some researchers (most notably Healy and Clinch, 2002a; Healy, 2004; Petrova *et al.*, 2013; Thomson and Snell, 2013) have promoted the use of self-reported indicators of living standards to quantify fuel poverty across the EU. Typically, this has involved asking households whether they can afford to heat their home, pay their utility bills on time, and if they live in a damp and rot free home.

Origins of the consensual fuel poverty method

This method is grounded in Townsend's (1979) seminal work on relative poverty, and the consensual poverty approach later pioneered by Mack and Lansley (1985), and Gordon *et al.* (2000). As outlined in Chapter 1, in one of the earliest published articles on fuel poverty, Bradshaw and Hutton (1983: 250) stated that fuel poverty, like general poverty, is a relative concept, and thus it is instructive to adapt Townsend's classic definition (words in italics changed or added by the authors):

> "Individuals, families and groups in the population can be said to be in *fuel* poverty when they lack the resources to obtain *the reasonably warm and well lit homes* which are customary, or at least widely encouraged or approved in the societies to which they belong" (Bradshaw and Hutton, 1983: 250).

Building on Townsend's work, the consensual poverty approach is based on the inability "to afford items that the majority of the general public considered to be basic necessities of life" (Gordon *et al* 2000: 7). Healy and Clinch's work (2002a) was the first body of work to apply a consensual measure of fuel poverty in a large cross-comparative study. They utilised a range of subjective and objective indicators, including the absence of central heating, and ability to keep warm, based on the assumption that these would be socially perceived necessities.

Advantages

The consensual approach to measuring fuel poverty has numerous strengths. Firstly, it can be less complex to collect consensual data than expenditure data, particularly required expenditure data, thus it may be suitable as an interim measure of fuel poverty in countries that lack a comprehensive house condition survey. In a study of thermal comfort and housing quality in Ukraine, Petrova *et al*. (2013) demonstrate the benefits of using self-reported consensual indicators to assess energy poverty. A key result from the analysis was the importance of energy efficiency in driving energy poverty, which they argue lends credence to the use of subjective measures (Petrova *et al*., 2013: 1254).

Secondly, at the European-level there are no standardised microdata concerning household fuel expenditure or house conditions (Thomson and Snell, 2013; Healy and Clinch, 2002a), and so by employing consensual indicators researchers have been able to circumvent data issues and provide interim quantifications of fuel poverty levels in the EU. A third strength, and arguably the most important, is that a consensual approach to fuel poverty has the potential to "capture the wider elements of fuel poverty, such as social exclusion and material deprivation" (Healy and Clinch, 2002a: 10), and provides an insight into the individual's lived experience of fuel poverty and their perceived burden. Some researchers argue an additional benefit is that the consensual approach is a bottom-up process, with assessments of adequate warmth and thermal comfort made by the respondents themselves (Petrova *et al*., 2013). When combined with participatory research to determine citizen perspectives, this has the potential to be a powerful tool.

Limitations and criticisms

However, there are a number of inherent limitations associated with the consensual approach. Most notably, the subjective indicators used in the consensual approach have been criticised for their error of exclusion, whereby households may not identify themselves as fuel poor even though they may be characterised as fuel poor under other measures (Dubois, 2012). For instance, Boardman (2011) states that the fuel poor may deny the reality of their situation, and so will say they are warm enough even if they are cold. Cultural differences will likely influence the responses given, with variations in individual conceptualisations of 'adequate' warmth (Bouzarovski, 2013). Furthermore, the degree to which subjective measures overlap with expenditure measures is a concern. For example, using English House Condition Survey data from 2005, Palmer *et al.* (2008) found that very little overlap exists between fuel poverty using a subjective measure and fuel poverty using the UK's ten per cent required expenditure threshold. Indeed, just 6% of households in fuel poverty by the standard expenditure definition said that their living rooms were not warm in winter because of the cost it took to do so (Palmer *et al.*, 2008: 16). Additionally, Palmer *et al.* (2008) found that a third of households that declared they were unable to keep their living rooms warm in winter had average or above-average incomes. However, the overlap between expenditure fuel poverty measures and alternative consensual indicators, such as arrears on utility bills, have not been explored, nor does research exist outside of the UK.

McKay is also critical of consensual deprivation indicators, stating they “assume that there is a broad consensus on what goods/services families should be able to afford, and that an inability to afford those items can measure deprivation” (2004: 201). Consequently, if the underlying assumptions are incorrect, a person may appear poor due to their consumption preferences rather than lacking resources (McKay, 2004). Indeed, with regard to air conditioning, in a study of staying cool in four American cities that experience heat waves, Sampson *et al.* (2013) found that some participants actively opted not to use air conditioning by preference. This highlights the importance of gathering public opinion on what items are necessary, and reveals a weakness of previous pan-European consensual fuel poverty work – the indicators have not been tested with the general public prior to analysis, thus consensus is assumed to exist across 28 diverse countries.

Lastly, some authors (Ürge-Vorsatz and Tirado Herrero, 2012; Healy, 2004) argue that the focus on adequate warmth that predominates in consensual fuel poverty research is unhelpful for countries that may struggle with achieving adequately cool indoor temperatures during summer months, and suggest that fuel poverty should be a broader concept that encompasses cooling related difficulties.

Summary

This chapter has provided an introduction to the concept of fuel poverty, focusing on the main determinants and impacts of living in fuel poverty, and the methods of defining and measuring the phenomenon. The chapter started by highlighting the contested nature of fuel poverty, and it was found that there is no pan-EU understanding of fuel poverty, and only three of the 28 Member States have an official definition of fuel poverty. Overall, a significant level of terminological confusion at the European level was noted, within both academic and policy literature. To begin to address this confusion, and to contribute to an improved understanding of fuel poverty in the EU, a content analysis of EU policy documents is presented in Chapter 4, which aims to answer the following key research question: To what extent does the EU acknowledge fuel poverty and/or energy poverty?

A range of potential determinants of fuel poverty were identified. This started with a discussion of the three main causes, poor energy efficiency, low household income, and high energy prices, before moving on to state a number of additional contributory factors. This additional factors included tenure, additional energy needs, and location. Some drivers were found to be specific to particular regions of Europe, with unique issues found in Central and Eastern Europe resulting from the centrally-planned communist era. However, from the evidence reviewed, it is evident that there are gaps in what is known about fuel poverty at the European-level, particularly as the majority of research relates to the UK and Ireland. This analytical gap has prompted a focus on the factors that increase household propensity to be fuel poor, and is addressed in Chapter 8 by way of multinomial logistic regression models.

At the individual level, this chapter has documented the significant negative consequences that can arise from fuel poverty, including poorer physical and mental health, increased risk of death during periods of high and low temperatures, and social exclusion. Several clear themes have emerged from the literature: firstly, alleviation of fuel poverty cannot be achieved by the household alone as there are often significant financial and information barriers – external intervention is necessary to overcome these barriers. Secondly, energy inefficiency, in terms of building fabric, heating system and appliances, is the principal driver of fuel poverty, with energy efficiency retrofits identified as a long term solution for alleviating fuel poverty.

The latter part of this chapter has focussed on the ways in which fuel poverty can be measured. It has highlighted the methodological issues that measuring fuel poverty on a national and European scale presents, finding that the UK is almost unique in its production of a series of detailed national housing condition surveys, which allow theoretical required fuel costs to be accurately determined. Given the absence of the UK's model in other Member States, the available options are to use actual fuel expenditure data or a consensual approach, both of which have inherent limitations. On a pan-European scale, this chapter finds that standardised energy expenditure data is not yet available, which has prompted researchers to utilise the consensual approach. Indeed, a key outcome of this thesis will be the development of a pan-European measure of fuel poverty that is grounded in the consensual approach. Chapter 5 builds on the literature reviewed in this chapter, and considers existing empirical research that has been conducted to quantify fuel poverty rates at both the pan-European and national scale.

Moving forward, the next chapter provides an overview of the EU, in terms of its history, institutional structure, decision-making processes, and the ways in which the EU has already taken steps to ameliorate aspects of fuel poverty. This provides the context for Chapter 4, which outlines the methods and subsequent results of a qualitative analysis of EU policy documents spanning 2003 to 2014.

Chapter 3: The European Union and its relationship to fuel poverty

Introduction

The EU is the most important agent of change in contemporary government and policymaking in Europe (Wallace *et al*., 2010: 4); decisions made at the EU scale have considerable impact on policymaking activities in individual countries, for both Member States and their non-EU neighbours alike. In examining the existence of fuel poverty in Europe, it is essential to understand the policy context in which the phenomenon is situated, and to establish the policy mandate for research. Before outlining the methods and theoretical framework applied to charting and analysing the evolution of EU fuel poverty policy, this chapter provides a historical context of the EU, summarises how policies are made, and discusses the relationship between the EU and fuel poverty policy. It starts by plotting the origins and development of the EU, from the 1951 Treaty of Paris and European Coal and Steel Community, through to the contemporary 2007 Treaty of Lisbon, before moving on to outlining the institutional structure at the supranational level, and identifying the main characteristics of decision-making in the EU. The chapter ends by examining the relationship between the EU and fuel poverty, which outlines the ways in which many of the determinants of fuel poverty transcend national boundaries, discusses relevant EU legislation, and introduces the limited existing empirical analyses of EU fuel poverty policy.

Origins of the EU

The EU is a supranational organisation that has evolved from three originally separate communities, the European Coal and Steel Community (ECSC), established in 1951 with six European signatories, the European Economic Community (EEC), established in 1957, and the European Atomic Energy Community (Euratom), also established in 1957. The term 'organisation' is used to describe the EU as it has many of the features of an international organisation, for instance, membership is voluntary, decision making is consultative, and the balance of sovereignty lies with the Member States (McCormick, 2008: 13), although some argue that the EU is moving closer to the concept of a 'state', particularly as the balance of responsibility and power in some policy areas is shifting away from the Member States to the European level (McCormick, 2008: 13).

As outlined in Table 3.1, the EU has undergone significant changes since the 1950s by way of treaty amendments and entirely new treaties, which has made possible the expansion of the EU from just six members in 1951, to 28 in 2014, with a further six countries recognised as candidates, demonstrating the enduring popularity of the EU 'club'.

Table 3.1 The main treaties of the EU, including revisions and enlargements. Adapted from Wallace *et al*. (2010: 6-7) and Europa (2014)

Treaty	Year	Outcome
Treaty of Paris	1951	Created the ECSC. Signed by Belgium, Germany, France, Italy, Luxembourg, and The Netherlands.
Treaties of Rome	1957	Created the EEC, and the Euratom. Also established the European Economic and Social Committee.
Merger Treaty	1965	Created a single Commission and a single Council to serve the ECSC, EEC and Euratom, effectively streamlining and combining the three Communities into a single entity.
Act of Accession	1972	Admits Denmark, Ireland, and the UK from 1973.
Act of Accession	1980	Admits Greece from 1981.
Act of Accession	1985	Admits Portugal and Spain from 1986.
Single European Act	1986	More qualified majority voting (QMV) in Council to make it harder for a single country to veto proposed legislation; creation of cooperation and assent procedures which give some legislative power and influence to the European Parliament.
Treaty on European Union (Maastricht)	1992	Establishes the EU and its three-pillar structure; more QMV in Council; formalizes European Council; some co-decision powers for the European Parliament; creates Committee of the Regions.
Act of Accession	1994	Admits Austria, Finland and Sweden from 1995. Negative vote on accession in Norway.
Treaty of Amsterdam	1997	'Simplifies' the EU and EEC treaties by amending renumbering and consolidating them; more legislative powers to European Parliament, and stronger requirement for its 'assent', for example on enlargement and Commission appointments.
Treaty of Nice	2001	Intended to streamline the EU institutions for further enlargement, introduces methods for changing the composition of the Commission and redefining the voting system in Council.
Act of Accession	2003	Admits Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia, from May 2004.
Constitutional Treaty	2004	Combines existing treaties into one text. Extends the powers of the EU. Not ratified after negative referendums in France and The Netherlands.
Act of Accession	2005	Admits Bulgaria and Romania, from January 2007.
Treaty of Lisbon	2007	Modified version of the 2004 Constitutional Treaty; gives more power to the European Parliament; changes the voting procedures in Council; creates a permanent president of the European Council.
Act of Accession	2011	Admits Croatia, from July 2013.

The 28 Member States of the EU are geographically, politically and socially diverse. The map in Figure 3.1 below indicates the location of the EU Member States.

Figure 3.1 Map of the EU (Freeworldmaps.net, n.d.)

During the development of the EU, there have been important changes made to the governance of the EU, with the 1965 Merger Treaty establishing a single Commission, and a single Council to govern the newly merged communities. The Single European Act in 1986 and the subsequent 1992 Treaty on European Union were both important milestones for the European Parliament, which in both instances was granted some legislative and co-decision power and influence. Other noteworthy changes have been made to the voting procedures used in the European Council, with the 1986 Act and 1992 Treaty expanding the application of Qualified Majority Voting (QMV) in certain policy areas in place of unanimity. QMV is a complicated method of voting, whereby each minister is given several votes that approximately correspond to the population of his or her Member State, to a total of 345 votes across the Council. For a vote to be successful it must achieve a triple majority of at least 255 votes, from a majority of states (McCormick, 2008: 81-2).

In 2004 a Constitutional Treaty was put out for national ratification via parliamentary votes or national referendums in each country. However, this failed to be ratified after negative referendums in France and The Netherlands, said to be the result of unpopular national governments in these two countries, concerns about the economic effects of further integration, and worries about increased immigration from Eastern Europe (McCormick, 2008: 65). The most recent agreement is the 2007 Treaty of Lisbon, which is a modified version of the unsuccessful 2004 Constitutional Treaty, and extends the powers of certain EU institutions.

In addition to changes to the governance and composition of the EU, in the last 60 years there have also been significant developments in societal standards and expectations, motivations for countries to join the EU, and in the challenges that European policy needs to address. For instance, Europe 2020, which is the EU's growth strategy and can be seen as a reflection of modern European challenges, established five key headline goals for EU countries to achieve by 2020:

1. Employment: 75% of the 20-64 year-olds to be employed
2. Research &Development (R&D): 3% of the EU's GDP to be invested in R&D
3. Climate change and energy sustainability: greenhouse gas emissions 20% (or even 30%, if the conditions are right) lower than 1990; 20% of energy from renewables; 20% increase in energy efficiency
4. Education: Reducing the rates of early school leaving below 10%; at least 40% of 30-34–year-olds completing third level education
5. Fighting poverty and social exclusion: At least 20 million fewer people in or at risk of poverty and social exclusion

European Commission (2010c: 32).

These are in stark contrast to the 1950s priorities, which were shaped by the aftermath of World War II. McCormick (2008: 45) states that the original priorities of the ECSC were: "postwar economic construction, the desire to prevent European nationalism leading once again to conflict, and the need for security in the face of the threats posed by the cold war". Six years on, and goals of the EEC were relatively more ambitious, including setting a common external tariff for all goods entering the Community, establishing a common agricultural policy, and developing a single market that allowed free movement of people, goods, money, and services (McCormick, 2008: 45).

The process of decision-making in the EU, and the role of institutions

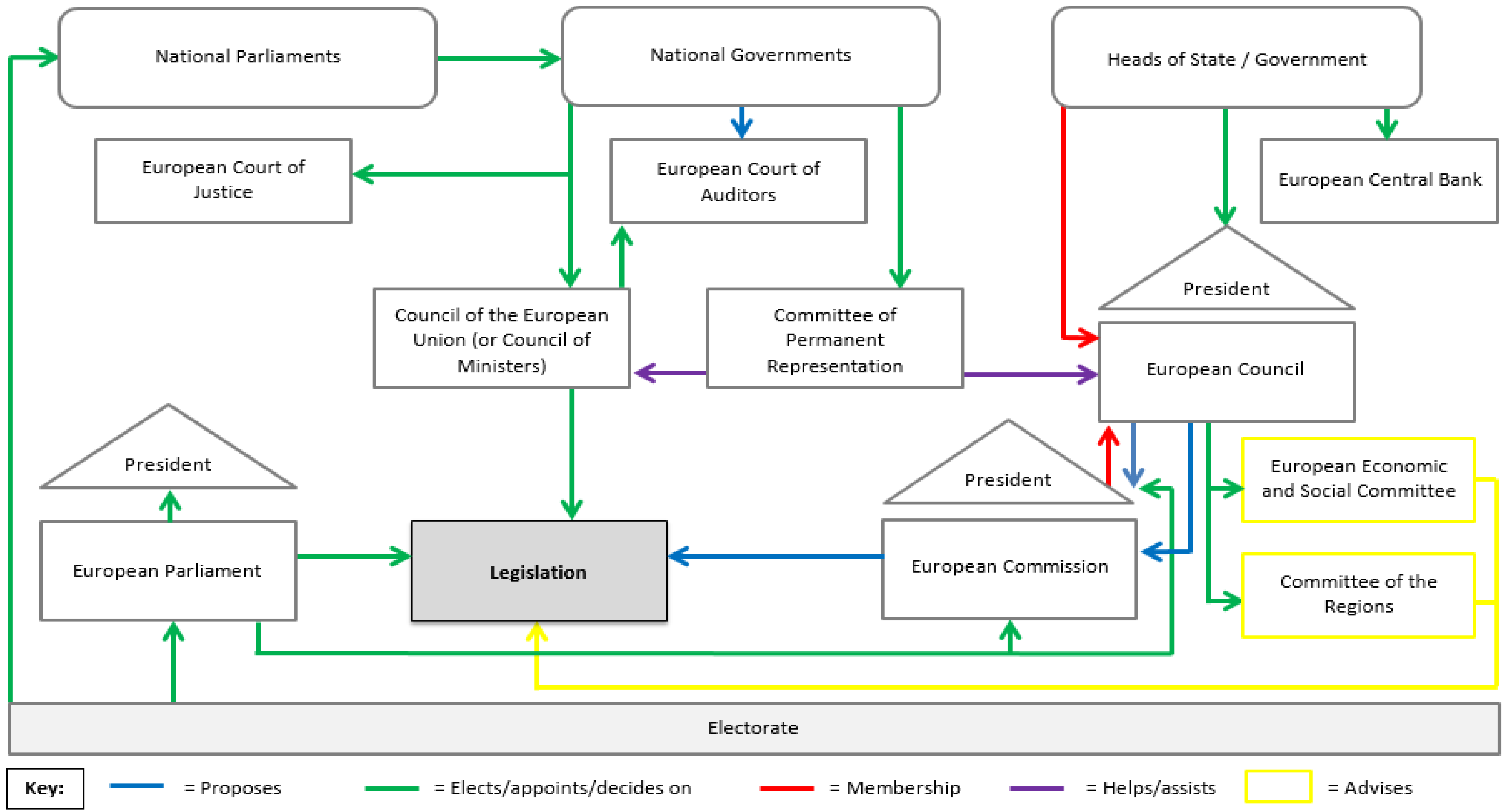
Institutional context

There are a variety of contending definitions of the term 'institution' (Peterson and Shackleton, 2002), as will be discussed in the subsequent chapter, but for the purposes of this research an 'institution' is conceived of as an organisation within the EU where power and influence are exercised, which is defined and shaped by the institutional rules of the EU. Institutions play a key role in structuring and stabilising policymaking across the EU, in which there exists "a legally enshrined institutional path through which policy making progresses. Policy making does not occur on an ad hoc basis but is constrained by the established institutional route" (Awesti, 2007: 7). The institutional route for policymaking in the EU is well defined by the various treaties comprising the EU. In total ten key EU institutions and organisation were identified during the research, as depicted below in Figure 3.2. This chart has been created in order to situate the judicial, legislative and advisory institutions comprising the EU within the policymaking process, and to highlight the division of power between the main institutions of the EU. It is colour coded according to the various roles that each institution performs:

- Blue corresponds with 'proposing', in terms of proposing new legalisation, and proposing potential candidates.
- Green corresponds with 'electing/appointing/deciding upon', whereby that institution has a say over electing and/or appointing certain officials, as well as decision making over certain aspects of policy and legislation.

- Red indicates ‘membership’; for instance, heads of state or government in EU Member States are automatically members of the European Council.
- Purple denotes that an institution ’helps or assists’ other institutions. For example, the Committee of Permanent Representation exists to prepare the agenda for the Council of the European Union, in addition to overseeing and coordinating the work of numerous committees and working parties (Lewis, 2002).
- The final colour, yellow, refers to institutions whose role is to advise on policy, as performed by the European Economic and Social Committee, and the Committee of the Regions.

Figure 3.2 Organisational chart of the EU



The organisational chart demonstrates well the complex nature of the flow of power across the institutions in the EU. Indeed, the European Commission is the only institution that has the power to propose new legislation, which is an interesting feature as the 28 European Commissioners are not chosen or voted for by the national electorate. However, the European Parliament, comprised of nationally elected politicians, and the Council of Ministers, both have a role in deciding on legislation. The two consultative institutions, the European Economic and Social Committee (EESC) and the Committee of the Regions (CoR), play a minor role in comparison, although their opinion does have to be sought on certain topics.

Key institutions featured in this research

Given the scope of this research, which broadly focuses on energy and social policy, not all of the institutions found in Figure 3.2 feature in this research, indeed discussions over forthcoming chapters, especially in Chapter 4, focus on outputs from just five institutions: the European Commission, European Council, European Parliament, the EESC, and the CoR.

European Commission

The European Commission is the executive-bureaucratic arm of the EU, and its core roles are threefold: to develop proposals for new laws and policies, which are then decided upon by the Council of Ministers and the European Parliament (McCormick, 2008); subsequently, to oversee implementation of laws and policies by the Member States; and to promote the general interests of European integration (McCormick, 2008). As noted above, the Commission is comprised of 28 Commissioners, referred to collectively as the College of Commissioners. These members, one from each Member State, are not directly chosen or voted for by the national electorate, instead they are appointed by elected national government leaders. Despite their method of selection, each Commissioner must swear an oath of office saying that they will renounce any defence of national interests, as they are not national representatives (McCormick, 2008). The term of office for Commissioners is fixed to five years. Peterson (2002) suggests that the formal powers of the Commission are neither extensive, nor spelled out clearly. Its main source of power is the monopoly on the right to initiate legislation; with few exceptions, nothing can become EU legislation unless the College of Commissioners chooses to propose it (Peterson, 2002: 88).

European Council

McCormick (2008) describes the European Council as more of a process or a forum than a formal institution. Comprised of national heads of government, foreign ministers, and the president and vice-president of the Commission, one of the main roles of the European Council is to guide the overall direction of European integration at periodic summit meetings (McCormick, 2008), meeting at least twice a year (Wallace, 2010).

European Parliament

The European Parliament is directly elected by voters in the Member States, making it the only directly elected international legislature in the world (McCormick, 2008; Shackleton, 2002). From Figure 3.2, we can see that the Parliament is junior to the Commission, in that it cannot introduce laws, and it shares the powers of amendment and decision with the Council of Ministers, leading Shackleton (2002) to declare that the European Parliament has been a relatively weak institution in comparison with the Council and Commission. Although as noted previously, over the history of the EU it has been granted increasingly more powers in successive treaties.

EESC and the CoR

Founded as part of the 1957 Treaty of Rome, the EESC is a well-established consultative body that was designed to provide a channel for social and economic concerns to be fed into European-level decision making (Jeffery, 2002). The EESC consists of employers, workers and other sectional interest groups (McCormick, 2008). The CoR was launched several decades after the EESC in 1994 as part of the Treaty on European Union, and is comprised of local and regional representatives from sub-national authorities such as regions, municipalities and cities. The CoR has to be consulted by the Council and Commission on certain questions (Laursen, 2012).

Neither the EESC or CoR are formal institutions by EU standards, and the EESC has been described in rather harsh terms as “an ineffectual body with weak powers, and an unwieldy, disparate membership" that has failed to make an enduring impact (Jeffery, 2002: 326). Jeffery further argues that the CoR has followed a similar trajectory, resulting in a growing preference for social and regional interests to pursue their concerns through more effective channels within the EU (Jeffery, 2002: 326). One of Jeffery's key contentions is the purpose of the EESC and CoR: "…it has never been clear what kind of added value they should try to deliver. Are they primarily panels of experts there to help make better decisions? Or are they bodies that are genuinely representative of important interests in society, which would otherwise be neglected..?" (Jeffery, 2002: 327).

Decision-making

The Treaty on the Functioning of the EU, which was amended by the 2007 Treaty of Lisbon, refers to only two types of legislative procedure: ordinary legislative procedure; and special legislative procedures. The ordinary legislative procedure covers the majority of policymaking areas, including energy, thus only this method will be referred to. Elements of the EU decision-making process have already been introduced above, namely that legislation starts with a proposal from the Commission, which is then jointly decided upon by the European Parliament and the Council.

Article 294 of the Treaty on the Functioning of the EU sets out in detail the co-decision procedure for the European Parliament and the Council to follow, which has been summarised below in Table 3.2. The table shows that there are several points at which a proposed act is deemed to have been adopted, or not adopted, as indicated by the underlined text, for example, the proposal could be adopted straight away at first reading, or it could take several readings and a conciliatory meeting before it is adopted.

Table 3.2 Summarised from Article 294 of the Treaty on the Functioning of the EU

Stage	**Process**
Proposal	European Commission submits a proposal to the European Parliament and the Council.
First reading	The European Parliament adopts its position on the proposal and communicates this to the Council. If the Council approves this position, the act shall be adopted. If the Council rejects this position, it shall adopt its own position and communicate this to the European Parliament.
Second reading (if required)	If the European Parliament approves the Council's position, or does not take a decision within 3 months, the act shall be adopted according to the Council's position. If the European Parliament (by a majority) rejects the Council's position, the act is deemed not to have been adopted. If the European Parliament (by a majority) suggests amendments, the text is forwarded to the Council and to the Commission, which shall deliver an opinion. If within 3 months of receiving the European Parliament's amendments the Council (by QMV): - Approves all amendments, the act shall be adopted. - Does not approve all the amendments, then a Conciliation Committee will be convened. Note, the Council has to act unanimously on the amendments that the Commission has delivered a negative opinion on.
Conciliation Committee (if required)	The Committee is comprised of an equal number of representatives from the Council and the European Parliament. The Commission is also in attendance, with a view to take 'all necessary initiatives' to reconcile the positions of the European Parliament and the Council. The task is to reach joint agreement, by way of QMV from the Council, and a majority vote from the European Parliament. If within six weeks of it being convened the Committee does not approve the joint text, the act is deemed not to have been adopted.
Third reading (if required)	If the Conciliation Committee approves a joint text, the European Parliament (by majority) and the Council (by QMV) have six weeks from approval to adopt the amended act. If they fail to do so, the act is deemed not to have been adopted.

Whilst co-decision power remains with the Council and the European Parliament, it is interesting to note that at second reading the Council has to act unanimously, rather than by QMV, on amendments which the Commission has delivered a negative opinion on. The impact of this is to make it more difficult for some amendments from the European Parliament to be passed if the Commission does not agree with them.

However, decision-making at the EU-level is only part of the process in getting policy implemented. Indeed, as Zahariadis (2013) notes: "…many important issues are acrimoniously debated at the EU level. However, while decisions are fiercely fought at the collective level, implementation remains mostly in national hands" (Zahariadis, 2013: 813). This is a pertinent point in terms of fuel poverty policy, as the majority of Member States have not taken action to address fuel poverty, as highlighted in the previous chapter.

The relationship between the EU and fuel poverty policy

There are two key reasons for examining and addressing fuel poverty at the EU-level. Firstly, many of the drivers and exacerbators of fuel poverty outlined in the previous chapter transcend national boundaries. For instance, energy price rises at the national level are likely to be caused, to varying degrees, by volatile global oil prices, EU-mandated climate change levies and obligations, and European-wide energy market liberalisation. Increases in extreme weather patterns, which affect heating and cooling demand, can be partially attributed to international climate change. Similarly, national wealth, employment opportunities and poverty levels are all shaped by globalisation and the increasing integration of many European economies, principally via the Eurozone. The second key reason for an EU-wide approach is that the EU already has a prominent role in policymaking relating to reducing poverty and social exclusion, and promoting energy security, energy efficiency, climate change mitigation, and sustainable development. This means there are likely to be significant opportunities for policy synergy, for instance, improving the energy efficiency of a property has the potential to reduce fuel poverty whilst also contributing to climate change goals. Additional arguments for a pan-EU approach include the possibility of increasing the political visibility of the issue, and opportunities for bypassing political resistance, particularly as thus far only a minority of Member States have recognised the concept of fuel poverty and set reduction targets.

To date, there has been no specific legislative programme to address fuel poverty, however, there have been several European Council Directives that contain measures that have the potential to alleviate some aspects of fuel poverty. Table 3.3 below presents a summary of the relevant Directives, arranged in chronological order.

Table 3.3 Summary of EU Directives with relevance to fuel poverty

Directive Name	Relevant fuel poverty elements
Directive 2002/91/EC on the energy performance of buildings	Sets minimum requirements of energy performance in new buildings and major renovations, and introduces Energy Performance Certificates.
Directive 2003/54/EC concerning common rules for the internal market in electricity Directive 2003/55/EC concerning common rules for the internal market in natural gas	Requires Member States to "ensure that there are adequate safeguards to protect vulnerable customers, including measures to help them avoid disconnection". Also requires transparency of contract, dispute settlement mechanisms and the ability of consumers to switch supplier.
Directive 2005/29/EC concerning unfair business-to-consumer commercial practices in the internal market	Outlaws unfair commercial practices including within the energy sector, such as misleading and aggressive practice. Vulnerable consumers are protected at a higher level, such as children and disabled people.
Directive 2005/32/EC establishing a framework for the setting of ecodesign requirements for energy-using products	Increases energy savings from energy using products (EUPs) such as boilers, fridges, and televisions, and requires labelling displaying the product's energy efficiency.
Directive 2009/72/EC concerning common rules for the internal market in electricity Directive 2009/73/EC concerning common rules for the internal market in natural gas	Recognises energy poverty is a growing problem and requires affected Member States to develop national action plans or frameworks. Requires Member States to define a concept of vulnerable customers which *may* refer to energy poverty. Customers must have the right to choose their supplier and to change supplier within 3 weeks. All customers must have access to accurate consumption data. Mandates Member States to create an independent energy body to manage complaints. Requires all household customers to have access to an electricity supply.
Directive 2010/31/EU on the energy	Establishes minimum requirements for the energy

performance of buildings (recast)	performance of buildings, and mandates Member States to develop a methodology for calculating energy performance. Notes the potential of energy efficiency to reduce energy poverty.
Directive 2012/27/EU on energy efficiency	Establishes a common framework of measures to promote energy efficiency in order to meet the EU's 20% target for improved energy efficiency by 2020. It highlights the benefits of energy efficiency in reducing energy poverty, and encourages Member States to target schemes at energy poor households.

As will be outlined in the subsequent chapter, there is substantial appetite across the European Parliament, EESC and CoR for the EU to go much further in addressing fuel poverty. Suggestions to date have included harmonised statistics, legally mandating Member States to reduce fuel poverty levels, and the creation a broad pan-EU definition.

Empirical analysis of EU policy

There is a dearth of literature that appraises EU fuel and energy poverty policy in significant detail. One of the first considerations of EU policy was by Thomson (2011), who in a master's dissertation summarised the range of European Council Directives that were directly and indirectly relevant to fuel poverty at the national-level. This was accompanied by an examination of the range of national definitions of 'fuel poverty', 'energy poverty', and 'vulnerable consumers', and the extent to which fuel poverty related terms were present in National Energy Efficiency Action Plans. Besides this work, only Stefan Bouzarovski and colleagues have examined EU policy in detail. In a published review of EU policy, Bouzarovski *et al.* (2012) examined recent policy developments at the EU-scale and the subsequent impact this has had in Bulgaria, based on workshops and interviews with over 30 key stakeholders, and a limited review of policy documents from 2009 and 2010. Bouzarovski and Petrova (2015) later updated this work, with a comprehensive focus on agenda-setting processes and policy developments, predominantly from the point of the 2009 internal market Directives, through to the establishment of the European Commission's Vulnerable Consumer Working Group (VCWG) and its related activities in 2013. This latter work applied the theory of policy mobilities (McCann and Ward, 2012), from the geographical political economy literature, which examines how policy knowledge is mobilised and the role of policy transfer agents.

Whilst the existing literature has given some insight into the piecemeal policy frameworks at the EU-scale, and the associated agenda-setting processes, very little is known about the origins of fuel poverty concerns in EU policy. The work by Thomson (2011) was relatively broad, and did not examine other forms of policy documents besides Directives, nor did it explore the reasons for policy emergence. By comparison, Bouzarovski *et al*. (2012) and Bouzarovski and Petrova (2015) both present a more analytical and detailed assessment of policy, offering significant input on the role of policy actors in shaping policy agendas. However, their work is restricted by the core focus on documents and events from 2009 onward, which fails to engage with the first discussions on fuel poverty and energy poverty at the EU scale in 2001 and 2002. Tracing the early emergence of fuel poverty related concerns in EU policymaking is important for identifying policy legacies and the structuring impact of institutions over time. An additional limitation of the existing fuel poverty literature is the lack of extended discussion on the position taken by various EU institutions on topics pertaining to defining, measuring and alleviating fuel poverty.

Summary

This chapter has provided an overview of the origins and expansion of the EU, from three originally separate communities with just six members in 1951, to a single community with 28 members in 2014 and a significantly extended policy reach. The chapter has provided an essential examination of the institutional structure of the EU, with a focus on the legislative procedures, finding that the European Commission is a significantly powerful player. The penultimate section of the chapter looked at how fuel poverty fits within the overall context of the EU and its existing legislation, and presented arguments for considering fuel poverty policy at the EU-level. The focus of the final section was on the limited existing academic literature that has examined EU fuel poverty policy, from which several key gaps in knowledge were evident. Firstly, the existing literature has not engaged with the early discussions on fuel and energy poverty at the EU scale, focussing instead on policy events since 2009 when energy poverty was formally recognised with the internal gas and electricity market Directives. Tracing the early emergence of fuel poverty related concerns in EU policymaking is important for identifying policy legacies and the structuring impact of institutions over time. Secondly, the existing fuel poverty literature has lacked an extended discussion on the position taken by various EU institutions on topics relating to defining, measuring and alleviating fuel poverty. This is an essential context for any pan-EU fuel poverty research, and especially for this thesis, which aims to contribute to an improved understanding of fuel poverty in the EU.

The subsequent chapter presents the methodology and results of a qualitative analysis of EU policy documents from 2001 to 2014, which aims to address these key gaps in knowledge concerning the emergence of fuel poverty concerns within the EU, and subsequent recommendations for defining, measuring and alleviating fuel poverty. The main question that Chapter 4 intends to address is: to what extent does the EU acknowledge fuel poverty and/or energy poverty? This is supported by five sub-questions, relating to the origins of EU discourse on fuel and energy poverty, differences between institutions, and policy suggestions.

Chapter 4: Analysing the development of EU fuel poverty policy

Introduction

In the previous chapter, the policymaking processes of the EU were outlined, followed by a critical discussion of the EU's relationship to fuel poverty policy. Chapter 3 revealed that the EU exerts significant influence over a range of policy areas pertinent to fuel poverty, including gas and electricity internal markets, consumer protection, and energy efficiency standards for appliances and housing stocks. The EU has also taken steps, albeit limited, to recognise the growing prevalence of fuel poverty across Europe. However, whilst there has been some discussion concerning EU policy governing fuel and energy poverty, notably by Thomson (2011), Bouzarovski *et al*. (2012) and Bouzarovski and Petrova (2015), little is known about the initial processes that have led to the adoption of current EU policy. Furthermore, there is an absence of detailed discussion on the discourse across the core legislative and consultative EU institutions regarding fuel poverty measurement and whether this is necessary. As such, there is an identified need for empirical research to analyse the early development of fuel poverty policy at the European level, and to examine the standpoint of EU institutions regarding pertinent topics such as statistical indicators, definitions, and alleviation. Examining EU policy through an institutional lens can help to understand why despite emerging in the EU policy literature over a decade ago, fuel poverty has yet to be addressed in a comprehensive manner, and for understanding the ways in which institutions have shaped policy resistance.

This chapter introduces and critically reviews the qualitative policy analysis approach that has been adopted to address the primary gap in knowledge identified concerning the development of European fuel poverty policy. The chapter starts by providing information on: the development of the empirical research questions; the application of theories from new institutionalism; the rationale for analysing EU policy documents; the data collection and selection process; method of analysis; and the criteria for assessing the research. Following on from this, the chapter presents the results of the qualitative analysis of policy documents. This analysis seeks to trace and examine the development of fuel poverty related concerns in EU policy, since the origins in official policy documents in

2001. In doing so, the chapter also summarises the main discourses of the legislative and consultative institutions constituting the EU, on topics relating to fuel poverty definitions, measurement, and alleviation. The analysis outlined in the chapter is important for establishing the policy mandate for the thesis and subsequent efforts to develop a pan-EU measurement tool for quantifying fuel poverty rates.

Methods

Empirical research questions

As outlined in the preceding chapter, the work by Thomson (2011) on summarising EU policy frameworks was relatively broad, and did not examine other forms of policy documents besides Directives, nor did it explore the reasons for policy emergence. By comparison, Bouzarovski *et al*. (2012) and Bouzarovski and Petrova (2015) both present a more analytical and detailed assessment of policy, offering significant input on the role of policy actors in shaping policy agendas. However, their work is restricted somewhat by the core focus on documents and events from 2009 onward, which fails to engage with the first discussions on fuel poverty and energy poverty at the EU scale in 2001 and 2002. From a historical institutionalist standpoint, tracing the early emergence of fuel poverty related concerns in EU policymaking is a necessary process for identifying policy legacies and the structuring impact of institutions. An additional limitation of the existing fuel poverty literature is the lack of extended discussion on the position taken by various EU institutions on topics pertaining to defining, measuring and alleviating fuel poverty.

To address the identified gap in knowledge, this stage of the thesis seeks to outline and analyse the European discourse concerning fuel poverty and energy poverty, since their first mentions in policy documents. The overall question which this element of research intends to address is:

To what extent does the European Union acknowledge fuel poverty and/or energy poverty?

The proposed research is complementary to Bouzarovski and Petrova (2015), who examined the specific role of policy ideas and policy actors, as this work aims at acknowledging the impact of policy legacies and formal political institutions. Indeed Béland (2005) contends "policy ideas and political institutions constitute analytically distinct levels of reality that intersect and impact on one another" (Béland, 2005: 14). However, it also offers additional detail on proposals relating to defining and measuring fuel poverty. In order to answer the main research question for this element of analysis, a series of interrelated sub-questions have been developed, as outlined in Table 4.1.

Table 4.1 Qualitative policy analysis sub-research questions

Question	Theme
a. What are the origins of the fuel and energy poverty discourses?	The origins and development of EU discourse on fuel poverty and energy poverty
b. What are the main characteristics of the discourses, and has this changed over time?	
c. Is fuel and energy poverty acknowledged and discussed by a range of EU institutions?	Differences between EU institutions
d. Are the fuel and energy poverty discourses of the different EU institutions divergent?	
e. What suggestions have been made to define, measure and/or alleviate fuel and energy poverty?	Policy suggestions

The questions are grouped by three key themes: the origins and development of EU discourse on fuel poverty and energy poverty; differences between EU institutions; and policy suggestions. The first two questions are essential for tracing the emergence of fuel and energy poverty related concerns in EU policy, and for subsequently identifying policy legacies over time in order to understand the EU's current policy position. The analysis will be longitudinal in nature, tracing the usage of 'fuel poverty' and 'energy poverty' since their first mentions in policy documents. At present, this form of analysis is absent from the European literature, particularly given the earlier criticisms of the work by Thomson (2011), Bouzarovski *et al.* (2012) and Bouzarovski and Petrova (2015). This process of historical tracing will help to unpick issues such as why the phenomenon of fuel poverty has yet to be defined or even described at the European level. In addition, there has been some terminological confusion about the usage of fuel poverty and energy poverty, as discussed in Chapter 2, therefore, an additional outcome of this analysis will be a clarification of terminology.

The second set of questions, numbers three and four, seek to understand if all the main legislative and consultative institutions of the EU acknowledge fuel and energy poverty, and whether there are any differences or overlaps between the discourses of each institution. As seen in the previous chapter, the EU is a complex structure, with many institutions involved with decision making, and there are likely to be differences in opinions across the institutions, particularly between advisory committees, such as the EESC and CoR, and core legislative institutions, such as the European Commission. The last question, number five, addresses the topic of policy suggestions. It seeks to compare the policy suggestions arising from different institutions, concerning the definition, measurement and alleviation of fuel poverty. This will be compared to policy which has been adopted as legislation, to assess the alignment of policy rhetoric and action. The last sub-research question will also help to establish the policy mandates for creating a pan-EU measure of fuel poverty.

As was discussed in Chapter 2, this thesis will primarily make reference to the term fuel poverty when describing the phenomenon whereby a household struggles to afford adequate energy services in the home, however, it has been apparent during the analysis that both fuel poverty and energy poverty are used, often interchangeably and inconsistently, and so to remain close to the original data, both terms will be used throughout this chapter.

Theoretical framework

In order to structure the analysis of EU fuel poverty policy, and to subsequently understand the evolution of policy, a theoretical framework, or blend of frameworks, was sought. As Zahariadis (2013) explains, frameworks help to make sense of the policy process by enabling researchers to "structure diagnostic and prescriptive modes of inquiry, helping to systematically organize distinct ways of thinking about public policy" (2013: 808). The theories associated with particular frameworks are used to "identify particular elements of importance within each framework that are relevant to a class of questions and specify processes and consequences" (Zahariadis, 2013: 808).

After considering a number of approaches, this research has chosen to borrow concepts and ideas from new institutionalism, and in particular, historical institutionalism, for the reason that within these concepts there are several useful meta-theories that can be applied fruitfully to the research. For example, as will be detailed later in the chapter, veto points, path dependency, and critical junctures are all useful concepts. However, it should be noted that due to the broad scoping nature of the analysis, this research does not necessarily apply historical institutionalism in its entirety, which is often applied to finer-grained analysis, but rather as stated above, it borrows key concepts and ideas.

New institutionalism and historical institutionalism

New institutionalism is a theoretical approach that began to emerge in the 1980s, which emphasises the importance of institutions as the key to understanding social and political life (Hudson and Lowe, 2006). It is considered 'new' in that whilst earlier social science work emphasised the importance of institutions, this approach was dominated by detailed configurative studies of administrative, political and legal structures, which failed to engage with the informal distributions of power, attitudes and political behaviour (Thelen and Steinmo, 1998: 3; Bulmer, 1998). By comparison, new institutionalists attempt to "emphasise both agency and structure, pointing in particular to the role of institutions in structuring interaction between political actors" (Hudson and Lowe, 2006: 148).

The definition of an institution is contested within the literature (Thelen and Steinmo, 1998). Peters (2005: 18) argues that two key defining characteristics of an institution are that it is in some way a structural feature of the society and/or polity, and that it constrains the behaviour of its members. As such, the structure may be formal (a legislature, public agency, or a legal framework), or informal (such a set of shared norms, or organised network) (Peters, 2005: 18). Institutions are said to provide the 'rules of the game' for political actors, and to "condition the policy process by distributing opportunities for political action and, in so doing, they mobilise bias" (Hudson and Lowe, 2006: 162). For instance, in the context of the EU, Tsebelis (1999) states that institutional structure determines the sequence of moves that define the game, with formal institutions specifying that "legislation starts with the introduction of a draft of a directive or a regulation by the Commission to the Parliament, and ends by the approval by the Council (Tsebelis, 1999: 2).

Yet, as Thelen and Steinmo note, the emphasis on institutions in new institutionalism does not replace attention to other variables, namely "the players, their interests and strategies, and the distribution of power among them. On the contrary, it puts these factors into context, showing how they relate to one another" (Thelen and Steinmo, 1998: 12). However, new institutionalism does not offer a single coherent theoretical perspective (Hall and Taylor, 1996), rather it should be regarded as an umbrella term, consisting of differing sub-strands (Hall and Taylor, 1996; Peters, 2005; Thelen and Steinmo, 1998; Bulmer, 1998). These are namely rational choice institutionalism, sociological institutionalism, and historical institutionalism (Hall and Taylor, 1996), which overall agree on the importance of institutions, but differ in their "views over the processes and mechanisms through which institutions impact upon political outcomes" (Awesti, 2007: 9). Of the three variants of new institutionalism, this thesis borrows predominantly from historical institutionalism due to its emphasis on temporal processes in shaping policy outcomes. Historical institutionalists argue that in order to understand the impact of institutions on policy outcomes it is necessary to understand the role they have played in shaping policy over the long duration (Hudson and Lowe, 2006: 150). The historical institutionalism literature is diverse (Thelen and Steinmo, 1998), but generally the approach favours the development of hypotheses in an inductive manner during the course of interpreting empirical material (Thelen and Steinmo, 1998: 12).

Key concepts - veto points, critical junctures and path dependency

Within the methodological toolkits of new and historical institutionalism, there are various concepts that can be applied to understand the evolution of policy. Of particular relevance to this research are the concepts of veto points, critical junctures and path dependency, which will be briefly summarised below.

Path dependency, and the related concept of critical junctures, are both derived from historical institutionalist literature (Hall and Taylor, 1996), which states that "small decisions about institutions and policy tools taken at once time can have a major influence over what is possible and realistic in the future" (Greer, 2008: 220). Path dependency is used to explain why inefficient or suboptimal outcomes persist (Greer, 2008), with a central argument by Pierson that once a particular path is established, self-reinforcing or positive feedback processes make reversals very difficult (Pierson, 2004: 10). By comparison, critical junctures, which are also known by the metaphor 'policy windows' (Hudson and Lowe, 2006), represent a change in policy direction that occur when “substantial institutional change takes place thereby creating a ‘branching point’ from which historical development moves onto a new path” (Hall and Taylor, 1996: 942). Greer states that a critical juncture can be characterised by: “a high degree of contingency, multiple possible trajectories, and a high likelihood that the results will prove self-perpetuating” (Greer, 2008: 219).

The concept of veto points is slightly younger, with Hallerberg (2011) crediting Immergut (1990) as being among the first to explicitly consider veto points and veto players. In her 1990 paper, Immergut posits that political decisions, such as new legislation, require agreement at several points along a chain of decisions (Immergut, 1990: 396). It is argued that “by envisioning political systems as sets of interconnected arenas and examining the rules of representation within each, one can predict where such ‘veto points’ are likely to arise” (Immergut, 1990: 396). Thus it follows that in general, the more veto points that exist within a system, the more difficult it will be to gain policy approval, which in some respects is a desirable feature as it filters out unacceptable policy change (Hudson and Lowe, 2006). However, it also means that in order for interest groups to influence legislative outcomes, they will need access to the political representatives situated at the ‘weak links’ or veto points in the chain (Immergut, 1990: 396). In all, these concepts are useful for considering how and why fuel poverty policy at the EU level has remained fragmented and unambitious, despite concern about fuel poverty emerging in the EU policy literature over a decade earlier.

Rationale for analysing EU policy documents

The chosen research strategy is one of analysing textual data from a comprehensive selection of policy documents, including Directives and working papers. Policy documents offer a rich source of textual data that can be analysed to understand policy developments, and this approach was used by Bouzarovski *et al.* (2012), and later Bouzarovski and Petrova (2015). However, a key limitation of their work is that they only reviewed a limited selection of EU policy documents, predominantly from 2008 onward.

The advantages of analysing policy documents are that they are unobtrusive and non-reactive as the documents have not been created specifically for the research (Bryman, 2008), and they can provide rich and detailed data (Silverman, 2006). As Silverman states, official records, such as the legal proceedings of parliaments, “constitute a potential goldmine…First, they are relevant to important issues – revealing how public and private agencies account for, and legitimate, their activities. Second, they are accessible” (Silverman, 2006: 176). However, there are a number of limitations to the use of textual data, including the lack of influence on their production, which means the textual data may not address all of the intended research questions, and difficulties associated with identifying authors, which may affect the legitimacy of the documents. Additionally, Coffey and Atkinson (2004: 58) caution that one must be clear about what documents can and cannot be used for, stating: “documents are ‘social facts’, in that they are produced, shared and used in socially organized ways. They are not, however, transparent representations of organizational routines, [or] decision-making processes” (Coffey and Atkinson, 2004: 58). Therefore, whilst EU policy documents provide a useful insight into the formal emergence of fuel poverty and energy poverty as concepts, they are not necessarily reflective of the informal policymaking process, and may provide an incomplete or distorted account of events, nor do they reflect the implementation of policy at the Member State level.

Alternatively, the sub-questions outlined earlier could be addressed by means of key informant interviews, whereby people with specialised knowledge about the topic of interest are interviewed. However, this approach has already been executed comprehensively by Bouzarovski *et al.* (2012), who held workshops and semi-structured interviews with decision-makers, experts and activists in Sofia and Brussels in order to explore the adoption of policies within the organisational context of the EU, and within national state institutions in Bulgaria. To advance upon the work by Bouzarovski *et al.* could be costly and time- consuming, particularly in terms of sourcing interviewees, conducting interviews, and subsequently transcribing interviews (Bryman, 2008).

Data collection and selection

The collection and selection of data was a two stage process. In the first stage textual units, which are documents produced by EU institutions, were obtained through a full text search of documents archived on *EUR-Lex* (n.d.), a website maintained by the EU’s

Publications Office that makes EU legal documents available to the public. The first search of *EUR-Lex* was conducted during March 2013 using the keywords "energy poverty" and "fuel poverty", generating 93 unique textual units overall. Using the term "energy poverty" generated 90 document hits, whilst the term "fuel poverty" generated 35 document hits, with some overlap between the two searches as some documents make references to both terms. However, as this is a live policy topic that is continuing to gain political visibility, the risk associated with conducting just one search is that it excludes subsequent developments in policy. To resolve this issue, an additional phase of *EUR-Lex* searches was undertaken in October 2014, enabling several new important policy statements to be included in the analysis. This secondary phase search found 174 documents using the term "energy poverty", and 64 documents for "fuel poverty", between 2001 and 2014. As before, there was significant overlap between the searches, with some documents using both terms interchangeably. Overall, there were 185 unique document hits. The textual units originate from various EU institutions, including three advisory committees, the European Commission, European Council and the European Parliament.

The second stage involved selecting units for analysis. Given the time constraints of the research, particularly as the qualitative analysis of policy documents forms just one part of a broader multi-methods research plan, it was unfeasible to analyse all 185 textual units in detail. Therefore, a smaller sample of documents needed to be selected, however, it was also essential that the final sample include documents from a range of institutions and years, particularly given the assertion by Phillips and Hardy that: "texts are not meaningful individually; it is only through their interconnection with other texts…and the nature of their production, dissemination, and consumption that they are made meaningful" (Phillips and Hardy, 2002: 4). To address this, three criteria were defined for the inclusion of documents into the analysis:

1. Documents were included if they discussed energy poverty or fuel poverty in the context of developed European countries. As discussed previously, although parallels can be drawn between energy access issues in developing countries and European fuel poverty, this thesis will focus only on the latter;

2. Documents were included if they made substantive reference[1] to fuel poverty and/or energy poverty;
3. Documents were included if they had a clear link to the EU Directives on common rules for the internal market in natural gas, common rules for the internal market in electricity, energy performance of buildings, or energy efficiency.

   This selection criterion reduced the total number of documents for analysis in the first phase to 31. Subsequently, a further 13 documents were included in the analysis after the secondary phase searches, increasing the total number of textual units to 44. The final selection is outlined in Table 4.2 and includes documents from the European Commission, European Parliament, CoR and the EESC, as well as European Directives and questions from Members of the European Parliament (MEP) to the Commission. It should be noted that whilst the majority of documents identified in phase one were excluded from detailed analysis, some of these documents are still referred to during the analysis for context. Similarly, despite not mentioning fuel or energy poverty, the 1996, 1998 and 2003 Directives concerning the internal markets in gas and electricity have been reviewed; as the precursors to the current legislation governing European fuel poverty, they are important for establishing the policy context.

[1] This criteria involved a subjective assessment of documents with limited mentions of the key terms. In general, documents with just one mention of fuel poverty or energy poverty were removed, unless they were important in the context of criterion 3. The European Commission's communication on an energy policy for Europe is an example of such an exception. Further details on the number and % coverage of terms can be found in Appendix 1.

Table 4.2 Policy document counts

Institution/document type	Total	Included
European Commission	54	10
European Parliament	42	6
European Council	1	0
Directives	4	4
Committee of the Regions	17	4
European Coal and Steel Community Consultative Committee	1	0
European Economic and Social Committee	37	6
MEP questions to the Commission	27	13
Vulnerable Consumer Working Group	1	1
Africa Caribbean Pacific – EU Joint Parliamentary Assembly	1	0
Total	**185**	**44**

The publication dates of the selected documents span 2003 through to 2014; a full list of document titles and publication years can be found in Appendix 1. The textual units selected for analysis cover a range of binding and non-binding document types, including Directives, opinions, and written questions to the European Commission. The distribution of policy document types is outlined in full below in Table 4.3.

Table 4.3 Types of policy documents selected for analysis

Policy document type	Total
Communication	6
Directive	4
Directive proposal	1
Opinion	10
Resolution	3
Position	3
Working document	3
Question to EC	13
Guidance document	1
Overall total	**44**

The function of some of these document types is outlined in Article 288 of the Treaty on the Functioning of the European Union (2008), which states that EU institutions are able to adopt regulations, Directives, decisions, recommendations and opinions. The function of these documents is summarised in Table 4.4.

Table 4.4 Outline of EU document types and their function. Adapted from Article 288 of the Consolidated Version of the Treaty on the Functioning of the European Union (2008)

Document type	Function
Regulation	General application. It shall be binding in its entirety and directly applicable in all Member States.
Directive	Binding, as to the result to be achieved, upon each Member State to which it is addressed, but shall leave to the national authorities the choice of form and methods.
Decision	Binding in its entirety. A decision which specifies those to whom it is addressed shall be binding only on them.
Recommendation	Have no binding force.
Opinion	Have no binding force.

Of the document types shortlisted for analysis, only Directives have binding force. As Article 288 of the Consolidated Version of the Treaty on the Functioning of the European Union (2008) states, Directives are binding as to the result to be achieved, upon each Member State to which it is addressed, but shall leave to the national authorities the choice of form and methods. The remaining document types are non-binding, and as such are less influential than Directives. Nevertheless, their importance should not be overlooked, indeed McCormick (2008) asserts that opinion documents can be used to test reactions to new EU policy, as well as "persuade or to provide interpretation on the application of regulations, Directives and decisions" (McCormick, 2008: 73).

Analysis of documentary data

The policy documents were processed and coded using NVivo 10, a Computer Assisted Qualitative Data Analysis (CAQDAS) software package. The decision to use CAQDAS software was driven by the versatility and multifunctionality of the software, indeed, Miles and Huberman (1994) list numerous uses for CAQDAS software, including: "coding: attaching key words or tags to segments of text to permit later retrieval; data "linking": connecting relevant data segments with each other; and memoing: writing reflective commentaries…as a basis for deeper analysis" (Miles and Huberman, 1994: 44).

Qualitative Content analysis

Qualitative content analysis is only one of numerous research methods that can be used to analyse textual data. Alternative methods include grounded theory, phenomenology, discourse analysis, rhetorical analysis and conversation analysis (Hsieh and Shannon, 2005; Krippendorff, 2004). In Table 4.5 these methods are compared on the basis of their purpose, required data, analysis techniques and outcomes.

Table 4.5. Overview of qualitative analysis strategies

	Content analysis	Conversation analysis	Discourse analysis	Grounded theory	Phenomenology	Rhetorical analysis
Purpose	To make replicable and valid inferences from texts to the contexts of their use (Krippendorff, 2004: 18)	To uncover the underlying structures of talk in interaction (Bryman, 2008)	To analyse talk and other forms of discourse, emphasising the ways in which versions of reality are accomplished through language (Bryman, 2008: 693)	To develop an explanatory theory of basic social processes (Starks and Trinidad, 2007: 1373)	To capture the meaning and common features, or essences, of an experience or event through close examination of individual experiences (Starks and Trinidad, 2007: 1374)	Examines how arguments are constructed either in speech or written texts and the role that various linguistic devices play (Bryman, 2008: 506)
Data type	Written, verbal or visual	Transcription of a recording of verbal interactions in natural settings	Observation, interviews, or textual data (Starks and Trinidad, 2007)	Observation, interviews, or textual data (Starks and Trinidad, 2007)	Observation, interviews, or textual data (Starks and Trinidad, 2007)	Oral or written texts and documents

	Content analysis	Conversation analysis	Discourse analysis	Grounded theory	Phenomenology	Rhetorical analysis
Analysis	An interpretive method that assigns categories to the data. An inductive, deductive or hybrid approach can be used (Hsieh and Shannon, 2005)	Fine-grained analysis of talk as it occurs in interaction in naturally occurring situations (Bryman, 2008: 494)	An interpretive and inductive process, whereby categories are derived from the data (Starks and Trinidad, 2007)	An interpretive and inductive process, whereby categories are derived from the data (Starks and Trinidad, 2007)	An interpretive and inductive process, whereby categories are derived from the data (Starks and Trinidad, 2007)	An interpretive and flexible method that is guided by the five canons of rhetoric: invention; arrangement; style; memory; and delivery (Leach, 2003).
Outcomes	Generation of concepts or categories that describe the phenomenon (Elo and Kyngäs, 2008)	Identification of the features that are used to organise verbal interactions, such as pauses and emphases (Bryman, 2008).	Description of language-in-use and identification of how identities and relationships and are shaped, negotiated and produced (Starks and Trinidad, 2007: 1373)	The generation of theory from the data	A thematic description of the pre-given 'essences' and structures of lived experience (Starks and Trinidad, 2007: 1373)	Identification of techniques that are designed to convince and persuade (Bryman, 2008: 661)

Examining the qualitative research approaches presented in Table 4.5, there are three approaches that can be immediately disregarded as they are not suited to the purpose of this research: conversation analysis, because it concerns the features of verbal interactions; rhetoric analysis as it examines how arguments are constructed; and phenomenology as it is concerned with the 'essences' of lived experiences. None of these approaches focus on context or content *per se*.

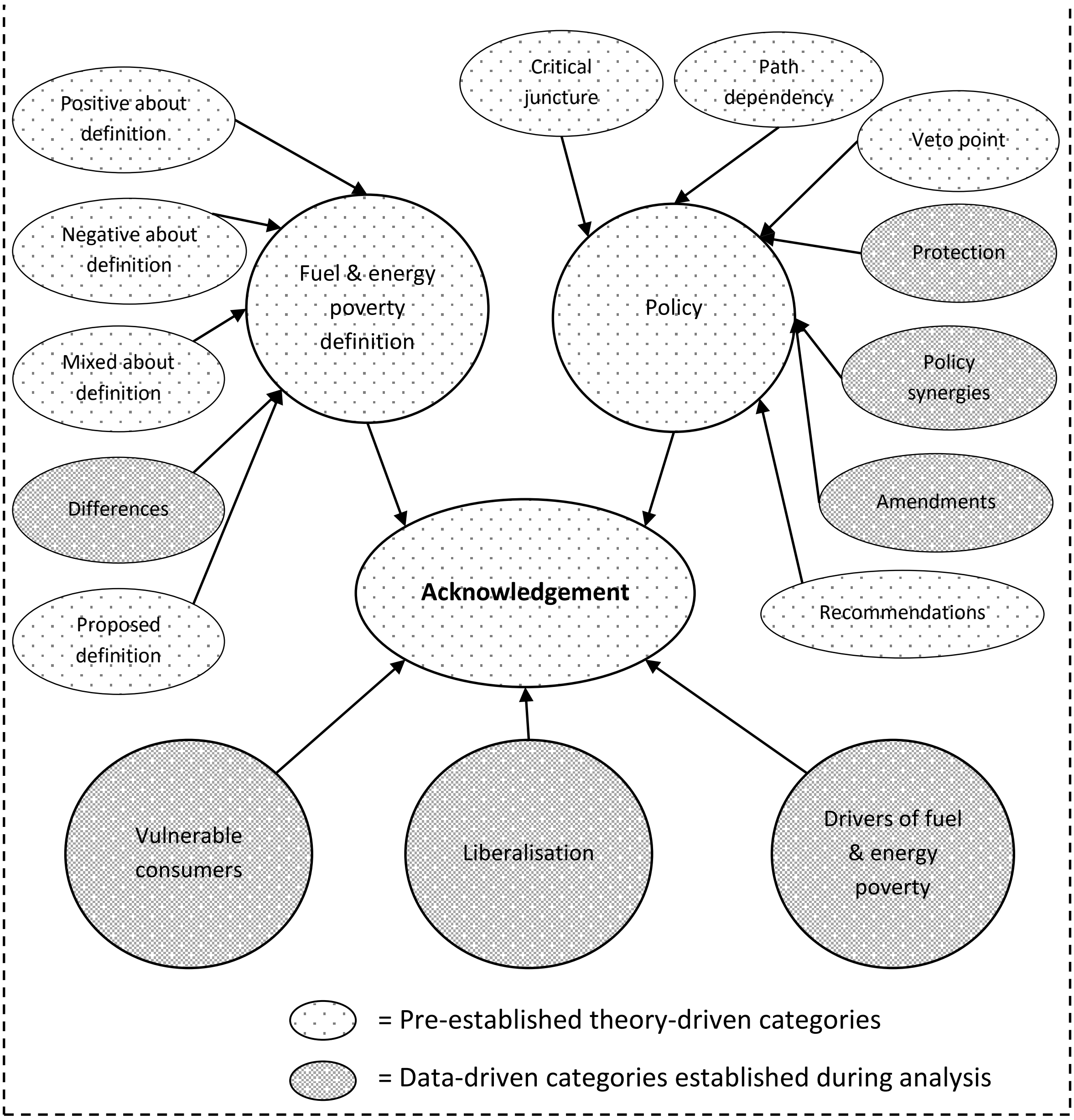
By contrast, discourse analysis and grounded theory are both valid methods for analysing the documentary data collected; however, the main disadvantage of these two approaches is that they require an inductive approach which is unsuited to the research as *a priori* knowledge of EU policy governing fuel and energy poverty does exist. By comparison, content analyses can be conducted in an inductive, deductive or hybrid manner. A further advantage of content analysis is that "most content analyses start with data that are not intended to be analyzed to answer specific research questions" (Krippendorff, 2004: 30), which makes the method of analysis particularly suitable for analysing EU policy documents which were not created to answer the specific research questions of this thesis.

It is for the above reasons that a content analysis approach has been employed to analyse the data. At the basic level, content analysis can be understood as "a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use" (Krippendorff, 2004: 18). Content analysis is usually portrayed in binary terms as being primarily a qualitative versus quantitative research method (Hsieh and Shannon, 2005; Elo and Kyngäs, 2008). Broadly speaking, a quantitative content analysis codes text into specific categories and uses statistics to describe the categories (Hsieh and Shannon, 2005), whilst a qualitative content analysis "goes beyond merely counting words to examining language intensely for the purpose of classifying large amounts of text into an efficient number of categories that represent similar meanings" (Hsieh and Shannon, 2005: 1278).

Qualitative approaches to content analysis have their origins in literary theory, the social sciences and critical scholarship, and are often labelled as interpretive (Krippendorff, 2004: 17). Krippendorff lists the characteristics that qualitative content analyses share: a close reading of relatively small amounts of textual matter; the rearticulation of given texts into new (analytical, deconstructive, emancipatory, or critical) narratives; and an acknowledgement by analysts that they are working within hermeneutic circles in which their own socially or culturally conditioned understandings constitutively participate (Krippendorff, 2004: 17).

Overall, the research follows the principles of inductive research, whereby theory is the outcome of research and generalizable inferences are made from observations (Bryman, 2008: 11). However, a hybrid process of inductive and deductive content analysis was used for coding categories, whereby theory-driven categories relating to specific research questions were established in advance of coding, and integrated with data-driven categories that emerged during coding. For instance, as displayed in the coding categories model in Figure 4.1, a category for fuel and energy poverty definitions was established in advance of coding, in addition to four sub-categories, however, during coding, the data necessitated the creation of a category for the differences between the concept of energy poverty and fuel poverty. Similarly, ‘liberalisation’ and ‘vulnerable consumers’ were two strong themes that emerged during coding, and so categories were created to accommodate these themes.

Figure 4.1 Visual model of the coding categories



This method of analysis was chosen as it addresses predetermined research questions, whilst also allowing new themes and theories to emerge. This approach would be classified as a 'directed content analysis' by Hsieh and Shannon (2005), who distinguished three approaches to qualitative content analysis: conventional, directed, or summative. The authors state that the goal of a directed content analysis is "to validate or extend conceptually a theoretical framework or theory" (Hsieh and Shannon, 2005: 1281), using existing research to guide the development of initial coding categories, whilst also enabling text to be categorised with new codes if the predetermined codes cannot be used (Hsieh and Shannon, 2005).

This approach has been selected as it acknowledges that *a priori* knowledge of EU policy concerning fuel poverty and energy poverty exists, particularly as a result of the work undertaken by Thomson (2011), Bouzarovski *et al*. (2012), and Thomson and Snell (2013). As Hsieh and Shannon confirm, "as research in an area grows, a directed approach makes explicit the reality that researchers are unlikely to be working from the naive perspective that is often viewed as the hallmark of naturalistic designs" (Hsieh and Shannon, 2005: 1283). However, Hsieh and Shannon also acknowledge that a directed approach presents some methodological challenges, especially as "researchers approach the data with an informed but, nonetheless, strong bias. Hence, researchers might be more likely to find evidence that is supportive rather than nonsupportive of a theory" (Hsieh and Shannon, 2005: 1283).

Criteria for evaluation

The criterion for evaluating qualitative research is contested, and forms part of a much larger debate about "the nature of the knowledge produced by qualitative research, whether its quality can legitimately be judged, and, if so, how" (Mays and Pope, 2000: 50). As such, there has been a multiplicity of approaches articulated by various academics. For instance, Bryman (2008) states that reliability, replication, and validity are three of the most prominent criteria for the evaluation of social research (Bryman, 2008: 31), and Elo and Kyngäs (2008) concur with this position, suggesting that the issues, particularly validity, are universal to any qualitative research design. However, these criteria originated to evaluate positivist, quantitative, research, leading to a philosophical schism in the 1980s, with academics such as Lincoln and Guba (Guba, 1981; Lincoln and Guba, 1985) arguing for alternative criteria to be used for assessing trustworthiness. Some qualitative researchers argue that validity and reliability cannot and should not be used to evaluate qualitative research as it is fundamentally distinct from quantitative research (Mays and Pope, 2000: 50). Instead, Guba (1981) and later Lincoln and Guba (1985), proposed that for interpretive research, such as content analysis, the following criteria should be used: credibility, transferability, dependability and confirmability. These terms are matched with the 'scientific' terms in Table 4.6 below.

Table 4.6 Comparison of scientific and naturalistic terms for evaluating research. Adapted from Guba (1981: 80)

Scientific term	Naturalistic term
Internal validity	Credibility
External validity, generalizability	Transferability
Reliability	Dependability
Objectivity	Confirmability

However, there is no decisive consensus on what evaluation criteria to use for qualitative research, and reliability, replication and validity continue to be used as criteria for qualitative research. Indeed, Richards (2008) argues that whilst the rejection of positivism was necessary for defending qualitative research from the use of irrelevant evaluation standards, a refusal to use concepts such as validity can "put at risk the acceptance of your qualitative research" (Richards, 2008: 192). Therefore, the following section will assess the research using both standards, starting with validity, credibility and transferability.

In his monograph concerning content analysis methodology, Krippendorff (2004) states that a content analysis has validity if "the inferences drawn from the available texts withstand the test of independently available evidence, of new observations, of competing theories or interpretations, or of being able to inform successful actions" (Krippendorff, 2004: 313). However, Smith claims that in the process of qualitative researchers rejecting traditional, quantitatively driven, notions of validity, they have created "an almost bewildering array of definitions and variations on definitions for this concept" (Smith, 2004: 958). For instance, Bryman identifies four main types of validity: measurement (or construct) validity, which is concerned with whether a concept is accurately measured; internal validity, which relates mainly to the issue of causality; ecological validity, which is concerned with whether social scientific findings are applicable to people's everyday lives in natural settings; and finally, external validity, which concerns the generalisation of findings beyond the research context (Bryman, 2008: 32-33).

Guba argues that internal validity cannot be measured in naturalistic research as it relies on a test of isomorphism, that is, whether the data of an inquiry matches the phenomena those data represent (Guba, 1981: 80). Instead Guba propose that credibility would be a more appropriate term, and could be confirmed using "member checks", whereby data is tested with the audiences or groups from which data were drawn (Guba, 1981: 80). A potential limitation of this research therefore, is that the findings have not been explicitly tested with members from the various EU institutions due to the complexity of this process and limited resources. However, as a diverse selection of official policy documents have been used, it could be argued that the research does present a valid interpretation of the policy process.

In terms of external validity, a rigorous selection process has been employed to ensure that all policy documents produced by EU institutions that mention fuel poverty and/or energy poverty are considered for analysis. The selection criterion outlined earlier in this chapter subsequently ensured that all relevant documents were included in the analysis, and as the list in Appendix 1 shows, documents from a range of institutions and across a number of years have been analysed. Therefore, issues of external validity have been minimised, allowing the results to be generalizable over time and across EU institutions. With regard to transferability, which Guba posits as the naturalistic term for external validity and generalisability, it is acknowledged that the findings of this research cannot be removed from the contexts in which they are found, thus the transfer of results to other settings will be dependent upon the level of similarity between the contexts (Guba, 1981: 81).

Reliability, that is “whether the results of a study are repeatable” (Bryman, 2008: 31), is a contentious topic in qualitative research (Richards, 2008), with some researchers arguing that the concept of reliability is not valid due to the underlying philosophical assumptions inherent in qualitative research, and should instead be replaced by the idea of dependability (Smith, 2004: 958). As Richards comments, “Qualitative methods are all about interpretation and individual agency” (Richards, 2008: 98), and it is this subjectivity that is at odds with the concept of reliability. It is also argued that change can occur over time, not only due to error, but also due to evolving insights and sensitivities (Guba, 1981). Guba proposed that dependability is a concept that embraces both the stability inherent in the quantitative notion of reliability, as well as the “trackability required by explainable changes in instrumentation” (Guba, 1981: 81).

Nevertheless, whilst reliability is usually more of a concern in quantitative research (Bryman, 2008), there are ways in which unreliability can occur in qualitative research, for example, due to error of interpretation, and as a result of inconsistent data coding by using a category in different ways. The implication of inconsistent coding is an inability to rely on that category to yield all of the relevant data (Richards, 2008: 99). Potter and Levine-Donnerstein (1999) state that fatigue is the primary threat to reliability as coding requires consistently high levels of concentration (Potter and Levine-Donnerstein, 1999: 271) The issue of reliability in the research process has been addressed in several ways. Firstly, CAQDAS software has been used to increase the consistency of coding, secondly, coding categories were re-examined after coding had been completed to ensure that consistent application of the categories had occurred.

The last criterion, and closely related to reliability, is the idea of replicability, whereby "researchers choose to replicate the findings of others…If a researcher does not spell out his or her procedures in great detail, replication is impossible" (Bryman, 2008: 32). Elo and Kyngäs suggest that researchers using content analysis must aim to describe the analysis process in as much detail as possible (Elo and Kyngäs, 2008). To this end, details regarding the selection of policy documents, use of CAQDAS software, and the process of coding and analysis have been outlined in detail in this chapter and Appendix 1, so that the research process is transparent and replicable.

Ethical considerations

There were limited ethical considerations to be made when designing this element of the research as existing EU policy documents were used. As noted earlier, analysis of documents is unobtrusive and non-reactive as the documents have not been created specifically for the research (Bryman, 2008). The main requirement was adhering to what Tracy (2010) terms procedural ethics, which encompass "the importance of accuracy and avoiding fabrication, fraud, omission and contrivance" (Tracy, 2010: 847). It was also important to be cognisant of what the documents can and cannot be used for, as Coffey and Atkinson (2004) caution, particularly in terms of being aware that the documents are not fully reflective of the policymaking process, especially in terms of informal lobbying of political representatives located at veto points in the policy chain.

Analysis of the development of EU fuel poverty policy

The results of the qualitative analysis of EU policy are arranged across four sections. The first background section provides a contextual summary of EU fuel and energy poverty policy developments, including the establishment of the internal market in gas and electricity, and examines the frequency of fuel and energy poverty mentions in policy documents over time. Subsequently, the results are grouped by key periods in time, namely 2001 – 2006, 2007 – 2010, and 2011 – 2014. Subsequent to this result section, the chapter concludes with a discussion of the developments in EU fuel poverty policy over time.

Background

In Figure 4.2 on the subsequent page, a timeline of key EU fuel and energy poverty events is presented. The timeline begins in 1996, with the publication of the first EU electricity Directive (96/92/EC), which sets out rules for the creation of an internal market and market opening. The timeline shows that the term 'fuel poverty' was first mentioned in an EU policy document in 2001, followed shortly by mention of the term 'energy poverty' in 2002. However, explicit recognition of household customers in energy markets, and in particular vulnerable customers, does not take place until 2003, when revised gas and electricity internal market Directives are published. It then takes a further six years before energy poverty is given legal recognition in the successive 2009 internal market Directives. Thereafter the timeline displays a significant increase in the recognition of energy poverty issues. From this timeline, several key phases begin to emerge, such as the origins of discussions on fuel and energy poverty from 2001 to 2006, a period of legal recognition for energy poverty from 2007, which evolves into a phase of enhanced focus on energy poverty and vulnerable customers from around 2011 onward.

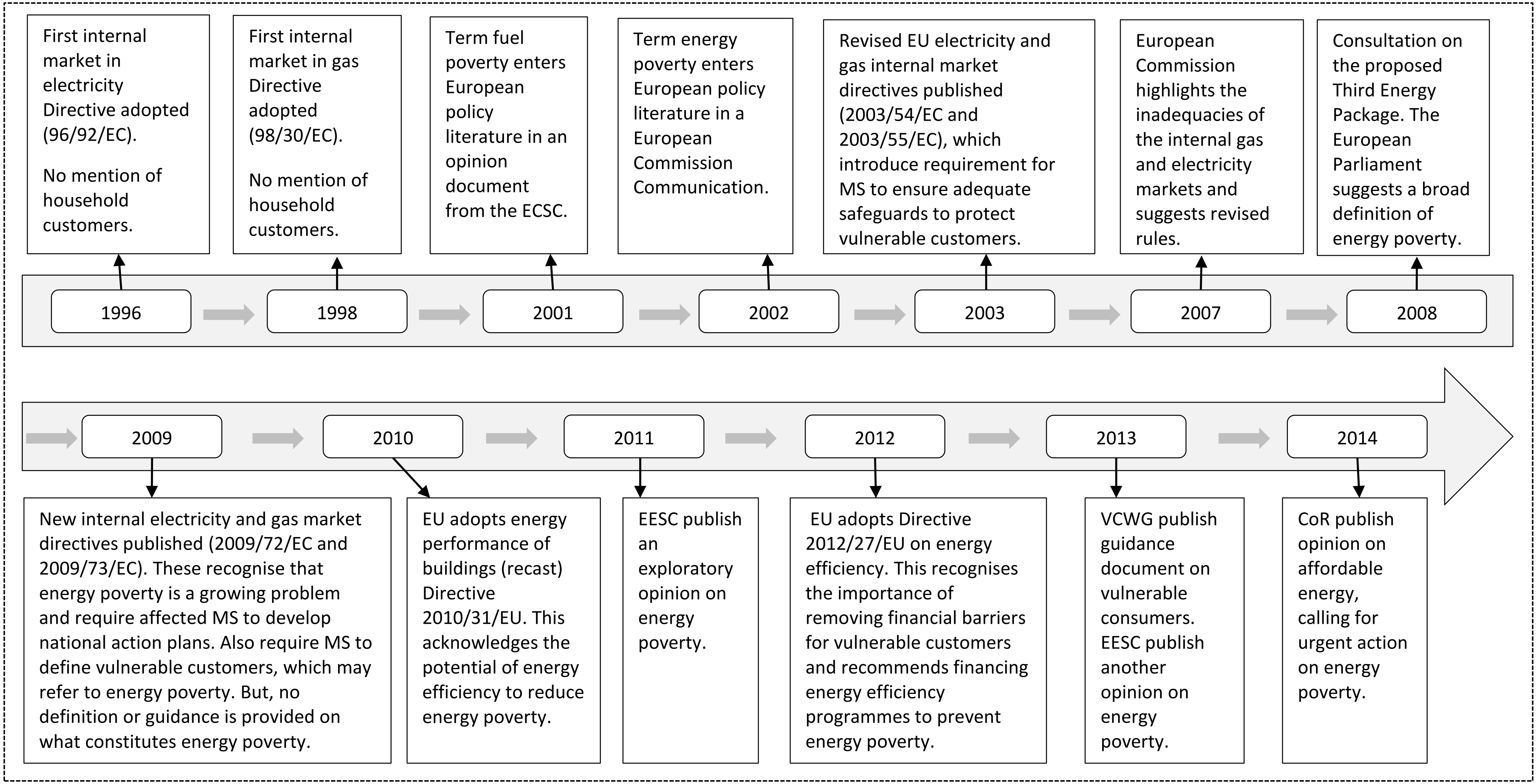
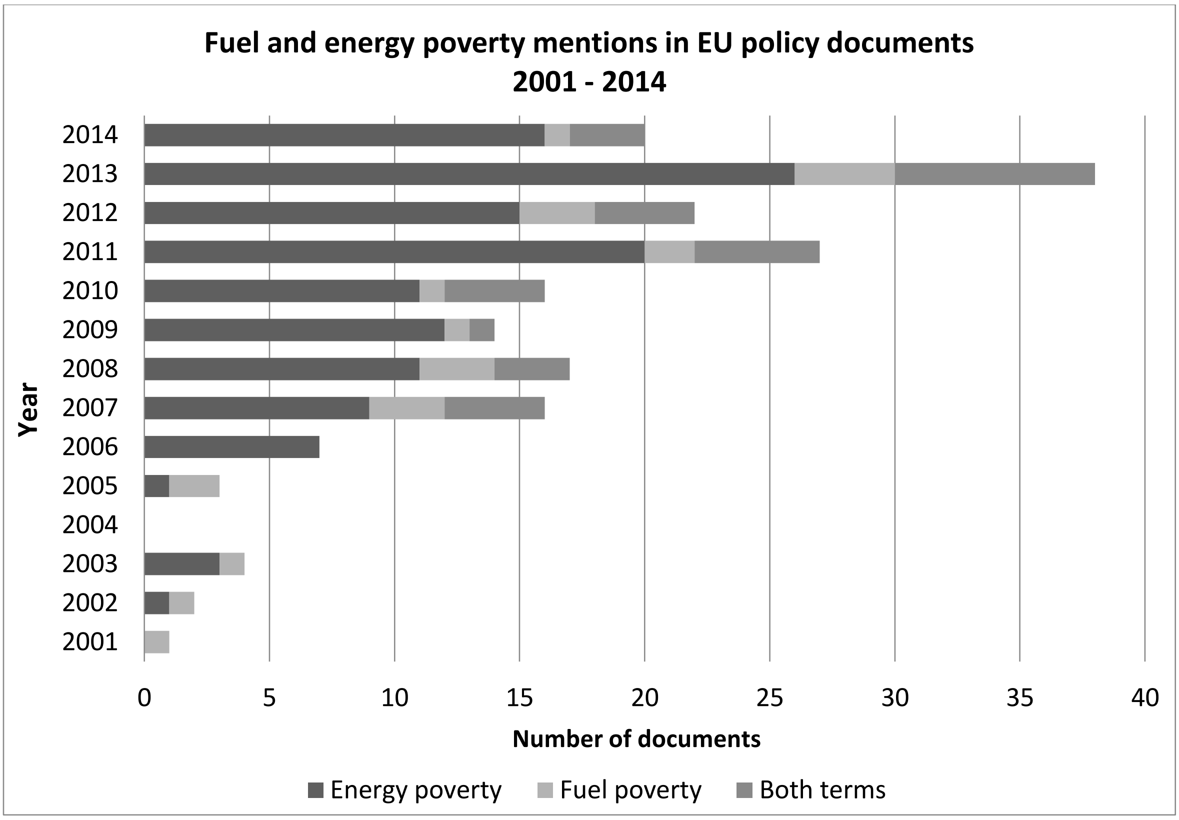


Figure 4.2 EU fuel and energy poverty policy timeline

The key phases discussed above can be discerned in Figure 4.3 below, which shows the number of fuel and energy poverty mentions in all EU policy documents from 2001 to 2014. As can be seen, there is an early emergence of fuel and energy poverty concerns in 2001 and 2002 respectively, followed by a significant increase in mentions in 2007, and a secondary increase from 2011 onward.

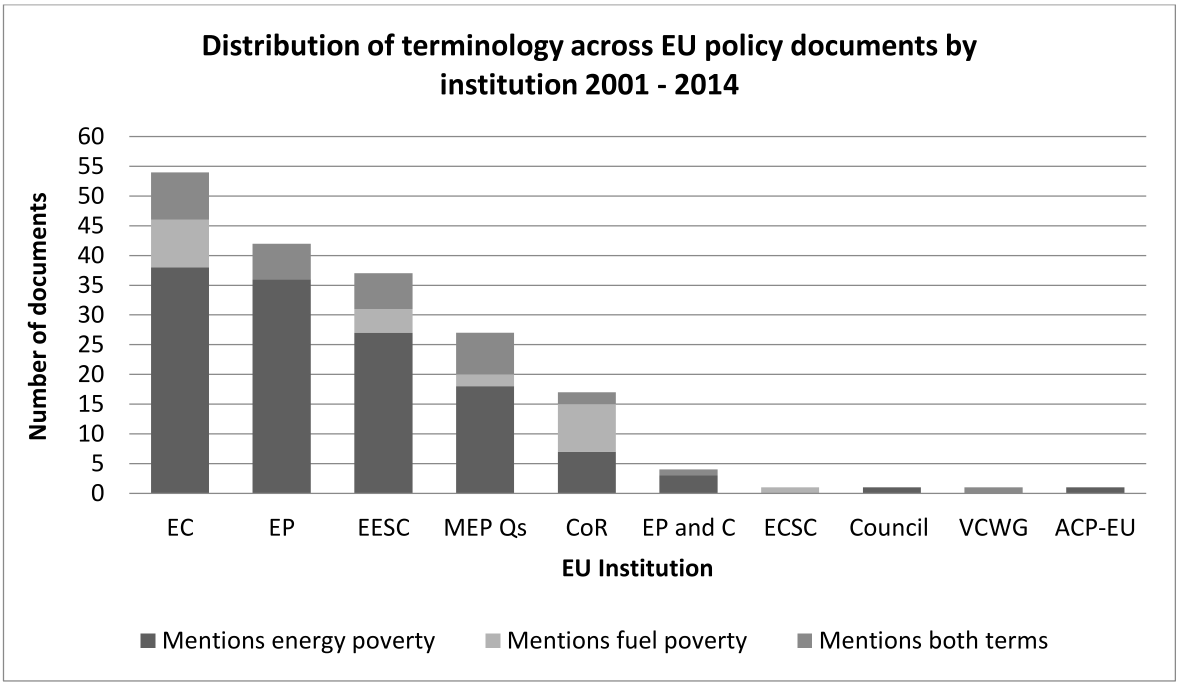
The figure also suggests that there has been a high degree of inconsistency over time with regard to terminology. Overall, the term energy poverty has been used far more frequently than fuel poverty in policy documents, with significant fluctuations in the number of policy documents exclusively using the term fuel poverty. However, a large proportion of policy documents use both terms interchangeably.

Figure 4.3 Fuel and energy poverty mentions in EU policy documents 2001 - 2014



The inconsistency in the use of terms is also evident in Figure 4.4 below, which shows the overall distribution of terminology across the various consultative and legislative institutions of the EU. Many of the institutions, including the Commission, have exclusively used the term fuel poverty at least once across this time frame. The CoR and Commission have employed the term most frequently, followed by MEPs in their written questions to the European Commission. The European Commission has used the term energy poverty most often, followed by the European Parliament and the EESC. Overall, the main contributors to policy discussions are the Commission, Parliament and EESC.

Figure 4.4 Distribution of terminology across all policy documents. See footnote[2] for abbreviations.



2001 - 2006 Origins of EU level discussions on fuel and energy poverty

The term fuel poverty was first used in European policy literature in 2001 by the Consultative Committee of the European Coal and Steel Community (ECSC), which was an international organisation that was established in the 1951 Treaty of Paris and expired in 2002. Similar in function to the CoR and EESC, the Consultative Committee was comprised of members from the coal and steel sectors, and in an opinion document on climate change and emissions trading, the committee noted:

> "In adopting appropriate measures to encourage improved energy efficiency by the domestic sector, the EU and its Member States should avoid any measures that risk exacerbating fuel poverty" (European Coal and Steel Community Consultative Committee, 2001: 2).

[2] The following abbreviations apply: CoR = the Committee of the Regions; ECSC = the European Coal and Steel Community Consultative Committee; EC = the European Commission; Council = the European Council; EESC = the European Economic and Social Committee; EP = the European Parliament; EP and C = joint documents from the European Parliament and Council; MEP Qs = written questions from MEPs to the European Commission.

Beyond this sentence the ECSC did not elaborate on what they meant by ‘fuel poverty’, although it is probable that the ECSC was influenced by the United Kingdom’s 2001 government strategy on fuel poverty (Department of Trade and Industry, 2001), given the timing of events. Subsequently, a further four documents were published between 2001 and 2006 that briefly discussed fuel poverty, including an opinion document from the CoR, which emphasised the need for the energy efficiency of publicly owned buildings to be improved since the occupants may be more likely to be affected by fuel poverty (Committee of the Regions, 2002). Fuel poverty was also discussed in a written question to the Commission in 2003 from Claude Moraes, a British MEP, who asked:

> “‘Fuel poverty’ is the inability of citizens to afford adequate heating and light because of energy pricing policies and low incomes. Does the Commission have a view, or has it undertaken any research on the issue of ‘fuel poverty’ in EU countries? Is the Commission aware that multinational companies like Electricité de France have different pricing policies, and different policies on disconnection following non-payment of electricity bills in the cities of London and Paris, for example?” (Question from Claude Moraes to the Commission, 28 May 2003).

The response from the Commission in July 2003 is the earliest instance of the Commission officially engaging with the concept of fuel poverty. The answer clearly states that fuel poverty falls within the remit of energy policy, by way of public service requirements at the Member State level:

> “For the Commission the question of fuel poverty enters into the bigger debate of public service aspects under energy policy. The Commission in its proposals amending the Electricity and Gas Directives has substantially strenghtened [sic] the public service aspects of the existing Directives to ensure that vulnerable customers will be sufficiently protected in a market that will be completely open to competition…In both the Electricity and Gas Directives a provision is contained obliging Member States to…ensure in particular that there are adequate safeguards to protect vulnerable customers” (Answer from Mrs de Palacio on behalf of the Commission, 2 July 2003).

The written response from the Commission also strongly implies a *de facto* usage of the term ‘vulnerable customer’ in place of fuel poverty, although the overlap between the concepts is not discussed, nor is guidance offered on what constitutes a vulnerable customer. The term vulnerable customer was first introduced into EU energy policy in Directives 2003/54/EC and 2003/55/EC of the European Parliament and of the Council concerning common rules for the internal market in electricity and gas, which precede the present-day 2009/72/EC and 2009/73/EC Directives. The 2003 Directives made no mention of fuel poverty or energy poverty, but rather stated:

> "Member States should take the necessary measures to protect vulnerable customers in the context of the internal electricity market. Such measures can differ according to the particular circumstances in the Member States in question and may include specific measures relating to the payment of electricity bills, or more general measures taken in the social security system" (Directive 2003/54/EC: 39).

As discussed earlier, the first electricity and gas Directives in 1996 and 1998 did not mention domestic household customers, thus the 2003 Directives are an important milestone as they incorporated minimum standards of protection for domestic customers into legally binding energy policies. A range of minimum standards are outlined in the 2003 Directives, including requirements to ensure transparency of contract, dispute settlement mechanisms and the ability of consumers to switch supplier.

The origins of discussions on energy poverty in EU policy documents are somewhat different. Whereas fuel poverty entered the European policy literature by means of opinion documents from consultative committees, the concept of energy poverty was first used by the European Commission in a 2002 communication concerning energy cooperation with developing countries, which noted:

> "Apart from the absolute priority of guaranteeing access to adequate energy services for the "energy poor", demand-side cooperation is undoubtedly the most promising avenue of approach, since improving energy efficiency is a crucial area that has to a large extent not been exploited so far in the developing countries" (European Commission, 2002)

However, this was in relation to a lack of access to modern energy services in developing countries, rather than energy affordability issues in developed European countries. In all, energy poverty is mentioned across 12 documents between 2001 and 2006, but only two of these documents refer to European countries, both of which originate from the European Parliament in 2006. Firstly, in relation to establishing an Energy Community Treaty with non-EU members in Southeast Europe, Parliament requested clarification by the Council and the Commission on the inclusion of programmes relating to energy efficiency and energy infrastructure to reduce widespread energy poverty. Secondly, concerning a Green Paper for Sustainable, Competitive and Secure Energy, the European

Parliament argued that energy poverty should feature more clearly in the Commission's proposals.

2007 – 2010 Legal recognition of energy poverty

From 2007 onward, fuel and energy poverty related concerns were frequently discussed in EU policy documents, particularly during the preparatory stages of Directives 2009/72/EC and 2009/73/EC. This second phase is characterised by new legal recognition of energy poverty in the 2009 internal gas and electricity market Directives, and in a later 2010 Directive concerning the energy performance of buildings.

Moves to update the 2003 internal gas and electricity market Directives were initiated by the European Commission. In a communication on the prospects for the internal gas and electricity markets, the European Commission (2007a) highlighted the inadequacies of the internal markets thus far, particularly in terms of the lack of meaningful competition in many Member States, and suggested revised rules. Within the communication, both vulnerable consumers and the issue of fuel poverty were noted:

> "Experience to date has demonstrated that wholesale energy prices exhibit considerable volatility. This raises the question of whether and how end-user customers, including vulnerable customers, should be exposed to such fluctuations" (European Commission, 2007a: 19).

> "The changes taking place in the European energy market must fully protect the citizens' rights to be supplied with enough electricity to meet their basic needs at reasonable, easily and clearly comparable and transparent prices. Special measures may also be taken to ensure the protection of the most vulnerable citizens, particularly in terms of fuel poverty" (European Commission, 2007a: 20).

With reference to the requirements introduced in the 2003 internal energy market Directives, the Commission highlighted a lack of inaction at the Member State level in defining and protecting vulnerable customers:

> "Existing data suggests that Member States have made rather limited use of targeted PSOs to address vulnerable customers. Indeed only half the Member States have even attempted to define this group and only five have any form of social tariffs" (European Commission, 2007a: 21).

In a subsequent staff working paper on the internal markets, the Commission acknowledged that energy poverty is a concern in some Member States, and briefly discusses measures to enhance protection for energy poor and vulnerable customers. The document notes that two options were considered: additional new legislative measures or "soft law" in the form of an energy consumer charter (2007b). The Commission appears to favour the latter, stating:

> "…an Energy Charter would provide a suitable level of protection at EU level, in particular against energy poverty" (European Commission, 2007b).

The European Commission published two further communications in 2007, which both acknowledged energy poverty. For instance, in a communication on an energy policy for Europe, it is argued that:

> "Energy is essential for every European. Existing European legislation already requires the respect for Public Service Obligations. But the EU needs to go further in tackling energy poverty" (European Commission, 2007c: 10)

Later in 2007, the Commission published a communication discussing a European Charter on the Rights of Energy Consumers (2007d), which recognised that market mechanisms alone cannot fully ensure consumers' best interest, and thus public service obligations and consumer rights are necessary (2007d: 2). Within this communication, which uses both fuel poverty and energy poverty interchangeably, the Commission reaffirms that the EU needs to go further in tackling energy poverty, and notes that rising energy prices and infrequent metering and billing are exacerbating the situation. The Commission also repeated its earlier criticism of the Member States:

> "The Commission is of the opinion that Member States have not sufficiently addressed the problem of vulnerable consumers" (European Commission, 2007d: 5).

In terms of a European Charter on the Rights of Energy Consumers, the European Commission envisages that it would: assist in establishing schemes to help vulnerable customers deal with energy price rises; improve the minimum level of information provided to citizens; reduce paperwork when consumers switch supplier; and protect consumers from unfair selling practices (European Commission, 2007d: 5). However, the Commission stated in this communication that the charter would not be a legal document, thus other than restating existing rights, the charter would not extend protection for fuel poor and vulnerable households, although it would potentially increase visibility of the core problems and available legal recourse. In an opinion document requested by the Commission, the EESC bluntly criticise this decision to use non-binding legislation, offering an extended argument that:

> "The EESC concurs with the European Parliament resolution and believes that binding legal measures are needed to protect the rights of citizens, and that soft law measures do not fully achieve their aims. In the case of passenger rights, the Commission considered it necessary to enact a regulation, 261/2004 EC of 11 February 2004. It is not therefore clear why the rights of energy customers should be relegated to a non-binding document. A Charter is being published because the rights that currently exist are not properly respected. Apart from a few praiseworthy exceptions, transposition into national law has been deficient. The Commission has the power and the responsibility to intervene, but prefers a non-binding instrument, even though it knows full well that the market alone is not in a position to provide appropriate and adequate solutions" (EESC, 2008b: 31).

Given the precedent established in the aviation regulation, it is an odd decision by the Commission to opt for soft law, and is one that has perhaps been influenced by external stakeholders. The EESC also refer to a European Parliament resolution, which stated that the use of soft laws may result in invalid actions by the Commission:

> "The European Parliament Resolution of 4 September 2007 on the institutional and legal implications of the use of 'soft law' instruments states, in recital X: 'where the Community has legislative competence, but there seems to be a lack of political will to introduce legislation, the use of soft law is liable to circumvent the properly competent legislative bodies, may flout the principles of democracy and the rule of law under Article 6 of the EU Treaty, and also those of subsidiarity and proportionality under Article 5 of the EC Treaty, and may result in the Commission's acting ultra vires'" (EESC, 2008b: 30).

The EESC also argue that in the context of the unsatisfactory implementation of the 2003 internal market Directives, it may be more appropriate for the Commission to introduce a few new, clear rules to strengthen consumer protection (EESC, 2008b: 30). Indeed, the EESC argue this is clearly within the Commission's competence:

> "The subsidiarity principle set out in Treaty Article 5, so often mistakenly quoted to oppose Community initiatives, should in this instance apply in support of decisions that benefit consumers, in the absence of effective national legislation" (EESC, 2008b: 30).

In the same opinion document, the EESC also argue for a common definition of a vulnerable customer, later stating that this would prevent discriminating against anyone and avoid distorting competition:

> "Fuel poverty means exclusion from a dignified life. It would be helpful to harmonise the definition of vulnerable consumers and the measures adopted to support them, avoiding the interruption of supply through a minimum service guarantee but also through the free provision of energy" (EESC, 2008b: 28)

Throughout 2008 the majority of documents were issued in relation to the consultations on the proposed internal energy market Directives, with numerous opinions produced by the European Parliament, CoR and EESC, in addition to communications from the Commission. The CoR (2008) stressed that discussions on the liberalisation of energy should centre on the consumer. They further stated that the proposed European Charter on the Rights of Energy Consumers should have legal force. Regarding energy poverty, the CoR recommended:

> "…that in future protection of vulnerable consumers be stepped up so as to combat the phenomenon of energy poverty" (CoR, 2008: 58).

Similarly, the EESC called for the Commission to highlight the importance of vulnerable consumer protection, whilst respecting that measures relating to vulnerable customers are a national matter. The EESC also argued that a common definition of energy poverty should be established, although they do not expand on the recommendation:

> "Although the protection of vulnerable consumers will remain a strictly national matter, it is crucial that the Commission recognise the importance of such measures at international level...The concept of energy poverty should be established at EU level (minimum applied rate) and the public service and general interest obligations laid down in the current directives should be pursued" (EESC, 2008a: 24).

As outlined in the previous chapter, the European Parliament is able to suggest amendments to Directives, and with regard to the draft Directives on common rules for the internal market in natural gas and electricity, the European Parliament (2008a, 2008b) proposed various amendments. On the topic of energy poverty, the European Parliament suggested the following new paragraphs, which introduce a broad description of energy poverty and energy affordability:

> “40. “energy poverty” means the situation where the members of a household cannot afford to heat their home to an acceptable standard, based on the levels recommended by the World Health Organisation;
>
> 41. “affordable price” means a price defined by Member States at national level in consultation with national regulatory authorities, social partners and relevant stakeholders while taking account of the definition of energy poverty provided for in point 40” (European Parliament, 2008a: 150).

These descriptions are broad enough to allow Member States to interpret them to their own national contexts, whilst also helping to clarify what is meant by ‘energy poverty’. Subsequently, the European Parliament added a replacement paragraph that mandates Member States to create their own national definitions of vulnerable customers and to recognise the phenomenon of energy poverty:

> “(b) paragraph 3 shall be replaced by the following:
>
> ‘3. Member States shall take appropriate measures to protect final customers and shall, in particular, ensure that there are adequate safeguards to protect vulnerable customers, including prohibiting the disconnection of pensioners and disabled people in winter. In this context, Member States shall recognise energy poverty and shall provide definitions of vulnerable customers. Member States shall ensure that rights and obligations linked to vulnerable customers are applied and, in particular, shall take measures to protect final customers in remote areas. They shall ensure high levels of consumer protection, particularly with respect to transparency regarding contractual terms and conditions, general information and dispute settlement mechanisms. Member States shall ensure that the eligible customer is in fact able easily to switch to a new supplier. As regards at least household customers, these measures shall include those set out in Annex A.’” (European Parliament, 2008a: 150).

The final relevant amendment adds a new paragraph to the Directives that requires Member States to address energy poverty via national action plans, and create a national definition of energy poverty:

> “(c) the following paragraphs shall be inserted after paragraph 3:
>
> ‘3a. Member States shall take appropriate measures to address energy poverty in national action plans in order to ensure that the number of people suffering energy poverty decreases in real terms and shall communicate such measures to the Commission. Each Member State shall be responsible for providing, in accordance with the principle of subsidiarity, a definition of energy poverty at national level, in consultation with national regulatory authorities and stakeholders with reference to Article 2(40). Such measures may include benefits in social security systems, support

to energy efficiency improvements and energy production at the lowest possible prices, and shall not impede the opening of the market set out in Article 23. The Commission shall provide guidance to monitor the impact of such measures on energy poverty, and on the functioning of the market" (European Parliament, 2008a: 151).

The European Parliament proposals outlined above would have made defining and addressing energy poverty an explicit necessity. However, in the subsequent approval phase via the Council, the European Parliament's amendments were not incorporated. In a response document, the European Commission states, amongst other things, that it does not support an EU definition of energy poverty:

> "Energy poverty is not a concept that has been used in all Member States and measures to address poverty require all aspects of energy and social policy to be taken into account. The Commission believes that using energy policy as the sole tool would distort the operation of the market for energy. Member States have the freedom to define vulnerable consumers with reference to those experiencing energy poverty. The Commission could therefore support an obligation on Member States to define energy poverty within the confines of a definition of vulnerable consumers at national level, but does not support a definition of energy poverty at EC level." (European Commission, 2008a: 6).

The final published Directives (2009/72/EC and 2009/73/EC) expand on the requirements of the 2003 Directives by acknowledging that energy poverty exists in Europe and mandating Member States to develop national action plans:

> "Energy poverty is a growing problem in the Community. Member States which are affected and which have not yet done so should therefore develop national action plans or other appropriate frameworks to tackle energy poverty, aiming at decreasing the number of people suffering such situation" (Directive 2009/72/EC: 7)

However, the Directive fails to offer a basic description of energy poverty, nor any guidance on determining whether a Member State is 'affected'. This loose wording offers Member States the opportunity to ignore addressing energy poverty by simply stating they are not affected. In terms of vulnerable customers, the Directives state that Member States should define the concept:

> "Member States shall take appropriate measures to protect final customers, and shall, in particular, ensure that there are adequate safeguards to protect vulnerable customers. In this context, each Member State shall define the concept of vulnerable customers which may refer to

> energy poverty and, inter alia, to the prohibition of disconnection of electricity to such customers in critical times" (Directive 2009/72/EC: 11).

However, guidance on what constitutes a vulnerable customer has not been offered, which complicates the issue of who is vulnerable, and subsequently has the potential to weaken Member State will to enforce policy on this topic. Given the Commission's earlier criticism of the Member States for failing to apply the 2003 internal energy market Directives, the lack of description and guidance in combination with loose wording is remiss.

In a staff working document produced a year later in 2010, the European Commission reaffirmed why it would not support a common definition of energy poverty or vulnerable customers, stating:

> "Given the diverse situations of energy consumers in different parts of the EU, the Commission does not consider it appropriate at this stage to propose a European definition of energy poverty or of vulnerable customers" (European Commission, 2010a: 12).

The Commission goes on to state that the issue of energy poverty has received 'considerable' attention. The Commission argues that there is no consensus on the concept of energy poverty, and indeed, that fuel poverty and energy poverty are separate issues:

> "There is no consensus on what actually constitutes energy poverty. The lack of a uniform definition should not be a problem per se as it allows for solutions that are adapted to national and local conditions.
>
> The term "energy poverty" and the term "fuel poverty" are often mistakenly used interchangeably. The energy sources covered by the term fuel poverty (electricity, natural gas, liquefied petroleum gas, oil, coal, district heating and other solid fuels) are broader than those considered in the energy poverty references in the internal energy market legislation (electricity and gas). It could therefore be argued that considering energy poverty in isolation would exclude those consumers using fuels other than electricity and gas to heat their homes" (European Commission, 2010a: 10).

This statement by the European Commission exemplifies the lack of understanding and absence of clarity that exists in European policymaking concerning fuel and energy poverty. The Commission's conceptualisation of fuel and energy poverty is at odds with previous statements made by EU institutions, and with the earlier academic research outlined in Chapters 2 and 3. However, it does highlight a critical issue in current European fuel poverty legislation, namely that only households supplied with gas and electricity are protected by law, albeit piecemeal. By comparison, there are currently no legal frameworks pertaining to fuel poverty for heating oil and solid fuel markets.

Despite its opposition to an EU-level definition of energy poverty, the European Commission has not refrained from proposing ways of measuring energy poverty. Indeed it is suggested that energy poverty could be quantified by:

> "Try[ing] to count the households that spend more than a pre-defined threshold share of their overall consumption expenditure on energy products. An alternative method could focus on those households that have (or have had in recent times) payment difficulties or are in arrears with energy bill payments" (European Commission, 2010a: 10).

On the basis of self-reported difficulties, the Commission concedes that the problem of energy poverty exists in all Member States, to varying degrees. The working document also provides a number of estimates of fuel poverty on the basis of Household Budget Survey and EU-SILC data, as will be examined in further detail in Chapters 5 and 6.

In addition to the documents outlined thus far, MEPs have also been active individually in questioning the European Commission about fuel and energy poverty, and vulnerable customers. For example, questions were asked by: Anni Podimata, a Greek MEP, in 2008; Proinsias De Rossa, an Irish MEP, in 2010; and by Alan Kelly, an Irish MEP, also in 2010. The main themes of these questions have been how the Commission views fuel and energy poverty, and what it will be doing to tackle the problem.

One of the final activities in this second phase was the publication of Directive 2010/31/EU on the energy performance of buildings. This Directive mentions energy poverty once, noting the potential of energy efficiency to contribute to reducing energy poverty. However, no definition or basic description of energy poverty is offered, despite the fact the European Parliament proposed an amendment to include a definition. The proposed definition expands on the European Parliament's amendments to the draft internal gas and electricity market Directives, and appears to have transferred policy from UK's fuel poverty methodology:

> "'energy poverty' means the situation where a household has to spend more than 10 % of its revenue on energy bills in order to heat its home to an acceptable standard based on the levels recommended by the World Health Organisation" (European Parliament, 2009: 271).

2011 – 2014 Enhanced focus on energy poverty and vulnerable consumers

The final phase in the development of EU policy is characterised by an increased focus on fuel and energy poverty concerns, and vulnerable consumers. During this latter period, consultative institutions play a larger role in drawing attention to the issues of fuel and energy poverty, as evidenced by the publication of two opinion documents from the EESC specifically on the topic of energy poverty, and one opinion document from the CoR concerning affordable energy.

The first of the two EESC opinion documents was published in 2011, and at the request of the Belgian government focused on energy poverty in the context of liberalisation. Whilst opinion documents have no binding force, they nevertheless play an important role in persuasion and offering new interpretations. Indeed, this document was the first EU policy document to explicitly discuss energy poverty, rather than considering it tangentially within the context of broader energy policies. In the 2011 policy document, the EESC argued that:

> "Combating energy poverty is a new social priority that needs to be tackled at all tiers of government and the EU should provide common guidelines to ensure that all Member States adopt the same approach to eradicating this phenomenon" (European Economic and Social Committee, 2011a: 1).

The EESC's desire for a pan-EU general definition of energy poverty is restated, which they argue would help to quantify and tackle energy poverty more effectively:

> "The EESC suggests that the EU adopt a common general definition of energy poverty that can then be adapted by each Member State. One option would be to define energy poverty as the difficulty or inability to ensure adequate heating in the dwelling and to have access to other essential energy services at a reasonable price" (European Economic and Social Committee, 2011a: 1).

Of note is that the EESC understand ‘other essential energy services’ to include lighting, electricity and transport. The inclusion of transport broadens the concept significantly and represents a deviation from the prevailing academic research. On a related note, however, the EESC identify the multiplicity of definitions within EU policy documents and across Member States as an issue. Additional suggestions from the EESC include harmonised EU statistics to allow an assessment of energy poverty in Europe, although they acknowledge that energy poverty is not easily quantified, and the establishment of a European Energy Poverty Monitoring Centre (European Economic and Social Committee, 2011a: 1).

The EESC opinion document offers a comprehensive examination of the issues relating to European energy poverty, and makes links to both the causes and consequences of living in fuel poverty. Within the opinion, the EESC argue that energy poverty should be addressed at the EU-level:

> “The European Union legislates on energy policy, has powers in this field and consequently has an impact, whether direct or indirect, on energy poverty in the Member States. The EU must, therefore, act and deliver policies within its sphere of competence” (European Economic and Social Committee, 2011a: 56).

However, they are also critical of the Member States for their failure to act thus far:

> “Although the legal documents presented by the EU are good ones, the reaction of the Member States has to date been inadequate. By way of example, despite the fact that they were made mandatory in the common market directives on gas and electricity (first Directive 2003/54/EC and then Directive 2009/72/EC), only 10 of the 27 Member States provide social tariffs for vulnerable customers and in only 8 Member States is the term ‘vulnerable customer’ in common use” (European Economic and Social Committee, 2011a: 55).

Shortly after the release of the EESC opinion, a new energy efficiency Directive was published (2012/27/EU). Following the precedent established in the 2009 gas and electricity internal market Directives and the 2010 energy performance of buildings Directive, this new Directive also officially recognises the existence of energy poverty and vulnerable customers. Overall, energy poverty and vulnerable customers receive limited mentions in the Directive, however, the legislation makes strong recommendations for Member States to link energy efficiency financing to targeted programmes to prevent energy poverty, especially in rental accommodation:

> "…be linked to programmes undertaking action to promote energy efficiency in all dwellings to prevent energy poverty and stimulate landlords letting dwellings to render their property as energy-efficient as possible" (Directive 2012/27/EU: 8).

The Directive also states on several occasions that Member States could incorporate social aims within national energy efficiency obligation schemes:

> "The common framework should allow Member States to include requirements in their national [obligation] scheme that pursue a social aim, in particular in order to ensure that vulnerable customers have access to the benefits of higher energy efficiency" (Directive 2012/27/EU: 4).

> "Within the energy efficiency obligation scheme, Member States may: (a) include requirements with a social aim in the saving obligations they impose, including by requiring a share of energy efficiency measures to be implemented as a priority in households affected by energy poverty" (Directive 2012/27/EU: 16).

Given the central role of inefficient housing and capital investment barriers in perpetuating fuel and energy poverty, these recommendations are very important for steering Member States towards making longer term structural adjustments, rather than relying on short term protection via cash-transfers and social energy tariffs. The Commission later reiterated the importance of energy efficiency in alleviating vulnerability and energy poverty in a 2012 communication on making the internal energy market work. In this communication, the Commission stated it would assist Member States in defining consumer vulnerability:

> "Member States should provide targeted assistance to vulnerable consumers in order to address their economic vulnerability and to help them make informed choices in the increasingly complex retail markets. The Commission will support Member States in defining what is meant by and what causes energy consumers' vulnerability by providing guidance and facilitating the exchange of best practice. Member States should emphasise the importance of energy efficiency improvements in addressing consumer vulnerability and energy poverty" (European Commission, 2012a: 11).

However, in a response opinion document, the CoR question whether the Commission's intentions are sufficient, stating the CoR:

> "doubts whether the proposed EC measures are satisfactory to empower consumers and to combat energy poverty and demands special focus to be given to the protection of consumers" (Committee of the Regions, 2013: 1).

The above quotes from the Commission communication and Directive demonstrate how the terms energy poverty and vulnerable customer are used interchangeably within official EU legislation, which would imply they have a similar meaning. Descriptions of energy poverty and vulnerable customer are not provided in the Directive or communication, however, even though for the purposes of the Directive definitions are provided for 45 other key terms. This omission serves to compound the policy ambiguity relating to energy poverty.

Over the three year period there is a noticeable increase in the number of individual MEPs asking questions to the Commission relating to fuel and energy poverty, compared to the previous phases. Several key themes emerge from the content of these questions, including the risk of extreme fuel poverty in Greece as a consequence of the economic crisis:

> "…The acute economic crisis gripping Greece and the resultant plummeting incomes are rapidly pushing a large section of the population into 'fuel poverty' and this is having painful consequences on the lives and health of its citizens…" (Question from Konstantinos Poupakis to the Commission, 20th November 2012).

> "Increased tax on heating oil during the current crisis, in conjunction with inoperative natural gas supply networks and the absence of comprehensive and effective building insulation programmes, is placing an increased burden on the public and forcing many households to resort to traditional hearth fires and cheap and inefficient heating devices…" (Question from Nikos Chrysogelos to the Commission 8th January 2013).

MEP questions have also highlighted the pervasive European-wide nature of fuel poverty and have requested the Commission to outline what measures it is taking to address the issue:

> "The high cost of energy has led to energy poverty in many EU Member States. It was huge social problems linked to energy prices that brought about the fall of the government in Bulgaria. Most families in southern and central European countries are spending half their household budget on meeting their energy needs. Unless specific measures are taken to tackle the problem, we are likely to see a series of similar uprisings against energy poverty in many EU Member States…" (Question from Niki Tzavela to the Commission 22nd March 2013).

> "The issue of fuel poverty is something which affects many families throughout the EU…1. What is the Commission doing to address the imbalance of fuel poverty? 2. Are there any schemes

> available for those families who have difficulty heating their homes?” (Question from Diane Dodds to the Commission 29th April 2013).
>
> “…1. Will the Commission incorporate an analysis of fuel poverty in the EU, including vulnerability factors, into the report it is preparing for the European Council (delivery: end of 2013) and will the Commission propose an EU strategy and a road map to prevent and eradicate fuel poverty? 2. Is the Commission working on European fuel poverty indicators for harmonised statistics in order to better define, prevent and tackle this problem at EU level? 3. Does it plan to set up a European fuel poverty monitoring centre…?” (Question from Gaston Franco to the Commission 19th November 2013).

The responses from the Commission have generally referred questioners to existing legislation, notably the 2009 internal market Directives, or to the work of the Citizen’s Energy Forum and VCWG. The topic of statistics and producing EU-wide estimates of prevalence has tended to be avoided by the Commission. For instance, in response to Gaston Franco’s question, detailed above, the Commission uses stakeholder feedback as a justification for not adopting a harmonised approach to energy poverty:

> “One of the conclusions from the extensive stakeholder discussions carried out in an expert group set up under the Citizen’s Energy…was that stakeholders generally do not consider it appropriate to harmonise definitions due to large economic disparities and policies addressing poverty in the different Member States. Instead, work has been made to identify and analyse drivers of vulnerability for energy consumers and to highlight good practices in addressing energy poverty…” (Answer given by Mr Oettinger on behalf of the Commission 17th December 2013).

As mentioned earlier in the thesis, the EESC published two opinions on energy poverty between 2011 and 2014. The latter opinion document was published in 2013, and is an own-initiative opinion that explores proposals for coordinated European measures to prevent and combat energy poverty. The proposals are wide-ranging, with links to energy efficiency, renewable energy, low carbon transitions, housing policy and social welfare. Among the key recommendations from the EESC are:

- The establishment of a European energy poverty observatory, which would monitor the incidence of energy poverty, and identify best practices;
- Energy poverty indicators and harmonised statistics;
- Impact analyses of all EU energy policies to determine the economic impact on various categories of consumer;
- Incorporation of energy poverty goals into all EU policies, especially energy related;

- Hold a European year of energy solidarity, to raise public and decision maker awareness of energy poverty (European Economic and Social Committee, 2013: 21-24).

The EESC also reiterate their call for a common general definition of energy poverty, arguing that the EU has no definition or indicator of energy poverty, and the problem is dealt with in a piecemeal fashion. A broad definition of energy poverty is proposed, as follows:

> “The EESC suggests that the definition suggested in opinion TEN/420, "the difficulty or inability to ensure adequate heating in the dwelling and to have access to other essential energy services at a reasonable price", should form a basis to be further developed (taking account of the universal right of access to energy as an essential commodity) by the European poverty observatory it would like to establish” (European Economic and Social Committee, 2013: 24).

Arguably the biggest changes in this latter phase are the establishment of the VCWG in 2012 and the publication of their comprehensive guidance document in 2013. The VCWG was established by the European Commission’s Directorate-General for Energy, in collaboration with the Directorate-General for Health and Consumers, to explore the concept of a vulnerable customer, and to support implementation of the Third Energy Package by Member States. The VCWG has received input from academia, advocacy groups, national energy regulators, ombudsmen, and industry associations, in order to achieve the following deliverables:

> - Establish a qualitative and quantitative mapping of various aspects of vulnerability and measures which can contribute to addressing the issue;
> - Provide recommendations for defining vulnerable consumers in the energy sector, based on current state of play in Member States;
> - Highlight good (national) practices and appropriate non-policy solutions with long-term potential to better target vulnerability. (VCWG, 2013: 9).

The VCWG terms of reference also state that the aim of the above activities should be:

> 1. To reduce the number of vulnerable consumers, including those in energy poverty;
>
> 2. To prevent consumers from falling into energy poverty, where possible. (VCWG, 2013: 9).

The establishment of the VCWG by the European Commission and its related activities represents a critical juncture in EU policy relating to fuel poverty, with multiple possible routes that the group could follow. It could be argued that the Commission has changed the rules of the game by reframing the debate in terms of 'consumer vulnerability', and away from fuel and energy poverty concepts. However, given the analysis thus far, a more plausible answer is that the Commission is following the path it established in the 2003 internal energy market Directives, which first introduced the concept of vulnerable customers, and that the novelty of the VCWG lies in the substantial level of stakeholder engagement.

The guidance issued by the VCWG offers a thorough examination of the drivers of consumer vulnerability in energy markets, based on the following broad understanding of vulnerability:

> "…group of individuals who share one or several characteristics that are the basis of discrimination or adverse social, economic, cultural, political or health circumstances, and that cause them to lack the means to achieve their rights or otherwise enjoy equal opportunities" (VCWG, 2013: 16).

The guidance also offers some clarity concerning the relationship between energy poverty and vulnerable customers:

> "The customers and consumers who are vulnerable may also face energy and/or fuel poverty; although there is likely to be a positive correlation between the two, it may be rather low" (VCWG, 2013: 38).

Overall, however, the VCWG conclude that it is not possible to have a single EU-wide definition of a vulnerable customer. Instead, the VCWG offer several tables of potential drivers and exacerbators of vulnerability, arranged by the following themes: market conditions; individual circumstances; living conditions; and social/natural environment. The key benefit of this approach is that it broadens the focus of policy away from the prevailing triad of fuel poverty drivers, namely household income, energy efficiency and energy prices. A focus on institutional structures and barriers, such as debt policies, selling practices, and transparent energy billing, is very necessary and has the potential to bring about significant improvements to consumer experiences for relatively little effort. However, the associated risks are that Member States focus on softer consumer regulations at the expense of substantial structural adjustments to energy efficiency and housing standards, whilst claiming compliance with the 2009 Directives.

Subsequent to the VCWG guidance, the CoR published an opinion document in 2014 on the topic of affordable energy, which is the most recent policy document examined in this analysis. The CoR opinion emphasises the extent of energy poverty across Europe, and calls for short, medium and long term measures to alleviate the problem, particularly relating to energy efficiency and renewable energy. The opinion document is notably scathing about the European Commission's inaction to date on energy poverty alleviation, noting that:

> "the European Commission has so far failed to sufficiently address energy poverty as a significant policy challenge, despite pressure from the European Parliament, European Economic and Social Committee and other stakeholders" (CoR, 2014: 16).

Indeed, the aforementioned stakeholders have been consistent in calling for greater action, as detailed across the previous sections. This confirms the role of the European Commission as a significantly powerful player that has managed to circumvent the majority of petitions by the Parliament, EESC and CoR over the preceding 13 years.

Throughout the opinion document, the CoR make several points pertaining to the definition of energy poverty, including the need to include mobility costs, and its relationship to general poverty:

> "notes that in EU debates, energy poverty is reduced to the more narrowly defined concept of 'fuel poverty', yet, energy poverty is more comprehensive, since also the energy needs for communication, mobility and hygiene, which are all necessary to allow social participation, have to remain affordable" (CoR, 2014: 15).

> "believes that energy poverty should firstly be seen as an aspect of poverty more generally and that the problem should be addressed chiefly through national and EU employment, social affairs, competition, regional development and cohesion policies…However, because the EU has a shared competence with the Member States in the area of energy, and also adopts policy measures in other areas (the Single Market, climate change, etc.) which affect energy prices and access to energy, there are many arguments for addressing energy poverty specifically under energy policy" (CoR, 2014: 15).

At one point, the opinion document states a 10 per cent definition of energy poverty, which is likely to refer to the United Kingdom's approach, although no reference is made to this methodology:

> "would like to see social support for households in energy poverty (spending over 10% of income on electricity and heating bills)" (CoR, 2014: 18).

Overall, the CoR argue that an elaboration of the definition of energy poverty is essential in order to promote:

> "…recognition of the problem at the political level on the one hand, and to ensure legal certainty for measures to combat energy poverty on the other; such a definition should be flexible in view of the diverse circumstances of the Member States and their regions…" (CoR, 2014: 15).

Several suggestions are made for quantifying energy poverty. Firstly, the CoR propose a definition of energy poverty based on an EU-wide threshold for the percentage of household income paid for energy (CoR, 2014: 15). Secondly, the CoR suggest that energy poverty could be measured via the EU-SILC survey:

> "…agrees that energy poverty is one indicator of material deprivation, which could be measured by surveys on income, social inclusion and living conditions, through questions such as 'can you afford to keep your home warm when needed?' (Eurostat, 2012) and 'can you meet the cost of your transport needs?'" (CoR, 2014: 17).

In terms of the discourse on vulnerable customers, however, other than urging Member States to make good on their commitment to define vulnerable customers, the concept receives limited attention.

Discussion

This chapter has outlined the methodology and results of a qualitative analysis of fuel poverty related policy documents from a range of EU institutions. The purpose of the chapter was to establish the EU policy context by tracing and analysing the development of fuel poverty related concerns since they were first raised in official policy documents. In doing so, the chapter had a complementary aim to summarise the main discourse of the legislative and consultative institutions comprising the EU, on topics relating to fuel poverty definitions, measurement, and alleviation, in order to identify policy mandates for a pan-EU measure.

The analysis shows that concerns about fuel poverty were first raised at the EU-level in 2001, with three distinct phases in the development of policy, namely: fragmented discussions on fuel and energy poverty between 2001 and 2006; efforts to legally recognise energy poverty between 2007 and 2010; and an enhanced focus on energy poverty and vulnerable consumers from 2011 to 2014. Several critical junctures are evident in the policy timeline, for example during the preparatory stages of the 2003 and 2009 internal gas and electricity market Directives, and when the VCWG was formed and subsequently published influential guidance for Member States. Whilst the 2003 Directives were path breaking in that they formally introduced the need to protect vulnerable consumers in the gas and electricity markets, there were missed opportunities for producing genuine change at the Member State level. Similarly, the revised 2009 Directives advanced the protection of fuel poor households by acknowledging the existence of energy poverty, however, as argued by the CoR, EESC and European Parliament, the Directives did not go far enough, stopping short of defining or describing what energy poverty or a vulnerable customer is.

The previous chapter outlined the structure of the EU and how policy is processed, from which it is evident that the European Commission is a powerful player, particularly as it has a monopoly over proposing new legislation. Thereafter, veto points are introduced when the European Parliament and the Council of Ministers decide on passing legislation. The institutional design of the EU and resulting distribution of power has resulted in important fuel poverty related policy proposals being blocked at the EU-scale due to the European Commission's resistance, despite significant pressure, for example, to introduce a common definition, or at the very least guidance on what energy poverty is. There is a distinct institutional legacy regarding the concept of vulnerable customers, which was formally introduced in the 2003 internal energy market Directives, and has received *de facto* usage by the Commission as an alternative to fuel or energy poverty, culminating in the formation of the VCWG in 2012. This is an example of strong path dependency, and reproduction and reinforcement of existing paths. Bouzarovski and Petrova (2015) suggest the activities of the VCWG are path breaking, and to some extent the findings from the analysis confirm this. For instance, the VCWG guidance represents the first determined attempt by the Commission at defining vulnerable consumers. However, the focus on vulnerability is not new, but rather hitherto it had not been examined in great detail.

The VCWG guidance represents a much broader approach to understanding domestic energy issues compared to the narrower conceptualisations of fuel poverty and energy poverty, and the implications of this divergent nomenclature are wide-reaching. On the one hand, the explicit recognition of additional drivers beyond the oft mentioned paradigm of energy prices, energy efficiency and household income is a positive step for taking into consideration the divergent contexts and capabilities of households. On the other hand, it arguably adds considerable complication to the matter of measuring and identifying affected households, as is summarised later in Chapter 7, in which attempts are made at operationalising some of the drivers and exacerbators listed by the VCWG. Indeed, as Boardman (2012) argues, in England in 2009, 80% of households were defined as vulnerable due to the broad criteria used, however only one in five were fuel poor, making it a blunt policy tool. Furthermore, past experience has shown that Member States are unwilling to perform their obligations to define vulnerable groups, and it may be that Member States choose to focus only on softer consumer regulations, rather than addressing the key structural issues, such as energy efficiency, energy carrier choice, and income inequality. Whilst consumer regulations around topics such as selling practices, debt management, and energy switching, are very important in and of themselves, they will not eradicate fuel poverty.

A key characteristic of the discourse on fuel and energy poverty over time has been the inconsistent use of terminology and an absence of clarification. In the legally binding legislative Directives 2009/72, 2009/73, 2010/31 and 2012/27, energy poverty is recognised, however, no common definition or description is provided, which creates ambiguity. Within non-binding policy documents, fuel poverty is often used interchangeably with energy poverty by most of the EU institutions, and in the few instances where a definition is provided, there are inconstancies within and between institutions. For example, both the EESC and CoR include mobility related energy in their conceptualisation of energy poverty, and the European Commission distinguish between expenditure on gas and electricity, and expenditure on all energy sources. As the EESC note, the multiplicity of definitions is an issue, one that requires clarification and harmonisation. Indeed, the European Parliament, EESC and CoR have consistently called for a broad definition of fuel or energy poverty to be established at the European-level, which could be adapted to national contexts, but the Commission has remained opposed. In general, there is also support within academic and advocacy groups for a broad common definition of fuel poverty to be adopted by the EU (Morgan, 2008; EPEE, 2009a; European Anti-Poverty Network, 2010; Boardman, 2010a; Bouzarovski *et al.*, 2012), with Bouzarovski *et al.* arguing that a common definition "might give it better visibility at the member-state level" (2012: 78). It has been suggested the fuel poverty in Europe could be defined using a twice-median expenditure threshold (Boardman, 2010a). However, an expert meeting of the World Health Organization concluded that a pan-European definition of fuel poverty would not be useful and that it may be "more appropriate to give guidance on the factors to be taken into account in developing a national definition" (World Health Organization, 2007: 10).

An additional issue raised in the analysis is that current legislation concerns gas and electricity alone, with no broader legislation governing other energy sources, such as heating oil, coal, and liquid petroleum gas. This is a key gap in policy, from which it is evident that at the EU-level, protection for fuel poor households needs to be expanded and incorporated within all energy policy, as well as other relevant policy areas such as housing and health, as the EESC recommend. Generally, there is consensus across the EU institutions that addressing fuel and energy poverty does fall within the remit of energy policy. Indeed, the EESC has been especially vocal in stating that the European Commission does have competence to go further in establishing comprehensive policy frameworks, and along with the CoR, has been opposed to the use of soft law. In terms of the measures that should be taken to alleviate fuel poverty, the institutions are unanimous in stating the importance of energy efficiency.

With regard to measuring the prevalence of fuel and energy poverty across Europe, the European Commission has maintained opposition to the creation of fuel and energy poverty indicators and harmonised statistics. By comparison, the European Parliament, EESC and CoR have all given firm policy mandates for producing harmonised statistics on the incidence of fuel poverty across the EU, stating the importance of understanding the extent of the problem. This policy context reinforces the key aim of this thesis, which is to quantify the proportion of fuel poor households across the EU, in order to orientate policy action and enable the monitoring of progress. The subsequent chapters, therefore, outline the key gaps in measurement knowledge, and assess the available data, before outlining the methods for constructing a pan-EU index of fuel poverty.

Chapter 5: Measuring the incidence of fuel poverty in Europe: establishing the gaps in knowledge

Introduction

Building on the findings from the previous chapter, which provided clear policy mandates from the European Parliament, CoR, and the EESC for further research on the extent of fuel poverty in Europe, this chapter reviews the range of quantitative analyses of fuel poverty that exist across Europe. The main purpose of this chapter is to determine the extent of knowledge regarding fuel poverty measurement across the Member States of the EU. This will help to establish the core gaps in knowledge in order to inform the subsequent development of a pan-EU measure of fuel poverty in Chapters 6 and 7. The chapter begins by appraising the currently available single country studies, arranged in descending order of the quantity of studies within each country. An examination of single country studies is a useful starting point for determining national trends in fuel poverty measurement and incidence. It then discusses the available comparative European studies, before ending with a summary of the existing quantitative fuel poverty literature, and an overview of the gaps in knowledge. Although the focus of this research is on countries within the EU, notable studies conducted in non-EU countries have also been cited.

Single country studies in Europe

United Kingdom

The UK is recognised as the leading country in Europe for expertise on fuel poverty measurement and use of specialist survey data for estimating theoretical expenditure on energy (Moore, 2012). Isherwood and Hancock (1978) are credited with being among the first to define the issue of fuel poverty, with their analysis of the 1977 Family Expenditure Survey (FES) resulting in high fuel expenditure being defined as those spending more than twice the median, which at the time was 12 per cent, on fuel, light and power. Bradshaw and Hutton (1983) subsequently examined the social policy options available for addressing fuel poverty in the UK, which included a simulation of policy outcomes using 1978 FES data, National Fuel and Heating Survey data and data from the Electricity Council's 1978 Survey of Domestic Electricity Consumers.

It was not until 1991 that the issue of fuel poverty measurement was formalised in the UK, with the publication of Brenda Boardman's seminal monograph (1991), which provided the foundations for the present day definition and measurement of fuel poverty. Boardman found that the poor spent twice as much on fuel, as a proportion of income, than the rest of the population (Boardman, 1991), and determined that households unable to achieve an adequate level of energy services for ten per cent of income are fuel poor, which represented around 6.6 million households (Boardman, 1991: 207). In 2001, the Department of Trade and Industry published the first official government fuel poverty strategy, which used the ten per cent required expenditure indicator.

Reflecting the advanced nature of fuel poverty research in the UK, the Department of Energy and Climate Change (DECC) have been officially monitoring fuel poverty rates for a number of years, using a complex algorithm to calculate the level of expenditure on energy required in order to achieve an adequate standard of warmth and use of lighting and electrical items. The modelling takes into account a number of factors such as the size and energy efficiency of the property, and the number of occupants (see DECC 2010 and 2013a for further details). Table 5.1 outlines the trends in fuel poverty rates in the UK from 1996 to 2010, with a household classified as fuel poor if it needs to spend more than ten per cent of its income on fuel. As can be seen, fuel poverty rates were highest in 1996, with 6.5 million households classified as being fuel poor, but between 2001 and 2005, the incidence of fuel poverty fell dramatically to around 2.5 million households.

Table 5.1 Rates of fuel poverty in the UK from 1996 to 2010 (millions of households). Adapted from DECC (2012: 10)

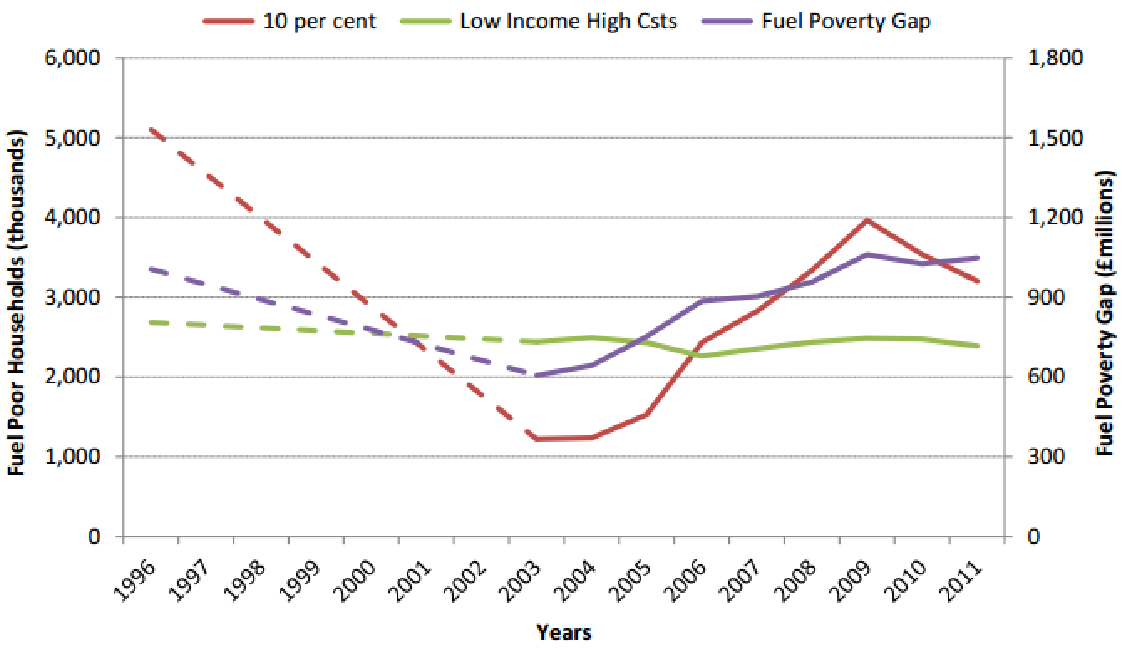
1996	1998	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
6.5	4.8	2.5	2.3	2.0	2.0	2.5	3.5	4.0	4.5	5.5	4.8

The validity of the substantial fall in fuel poverty rates has been questioned by Professor Hills, who was appointed by the Government in 2011 to review fuel poverty in the UK (see Hills, 2011; 2012). The terms of reference called for Hills to review whether fuel poverty is a distinct problem or just part of general poverty, and if it is distinct, how it should be measured, and the implications of measurement for policy (Hills, 2012). In his interim report, Hills reported that fuel poverty was a distinct problem, but criticised the dramatic 'V' shape that the ten per cent indicator produces, and asked "Did the underlying problem of fuel poverty really improve by nearly four-fifths in just seven years—suggesting that it was well on the way to being solved with little further action needed?" (Hills, 2011: 13).

In total, Hills proposed two new fuel poverty indicators. Firstly, the Low Income High Costs (LIHC) indicator, which measures the extent of fuel poverty and defines a fuel poor household as one that experiences a combination of high energy costs and low household income. Under this definition, high energy costs are defined as required fuel costs above the national median, adjusted for household composition, whilst low household income is defined as income below the sixty per cent median poverty line, adjusted for household size and composition, after energy costs are deducted. The second indicator Hills proposed was the Fuel Poverty Gap, which measures the depth of fuel poverty by determining the amounts by which the assessed energy needs of fuel poor households exceed the threshold for reasonable costs (Hills, 2012).

The majority of Hills' recommendations were subsequently adopted by the government in 2013 across England and Wales (DECC, 2013b). The main points of departure concern the equivalisation of fuel bills using the number of people in the household, rather than by household type, and DECC's decision to reject Hill's recommendation that disability related benefits be excluded from disposable household income. Fuel poverty rates in England remain moderately static from 1996 to 2011 when applying the LIHC indicator, as shown by the green trend line in Figure 5.1, with around 2.4 million households defined as having both low income and facing higher-than-median fuel costs in 2009.

Figure 5.1 Comparison of fuel poverty measures in England 1996-2011. Reproduced from DECC (2013b: 7)



Whilst the Hills review established that fuel poverty is a specific phenomenon that is distinct from general poverty, and in doing so asserted the importance of addressing fuel poverty, the adoption of the new LIHC definition in England has not been without controversy. It was particularly controversial as it resulted in a significant decrease in estimated fuel poverty rates from 2006 onwards, compared with the previous definition. The new definition shifted measurement of fuel poverty from an absolute approach to a relative one, which has important consequences for monitoring progress and eradication, as highlighted in Chapter 2. Under an absolute measure of fuel poverty, such as the previous ten per cent measure, the threshold does not vary with changes to national fuel prices, income levels, or energy efficiency standards, which makes the eradication of fuel poverty a possibility (Boardman, 2012: 144). By comparison, relative thresholds provide a more complex account of fuel poverty and the difficulty of a 'moving target' (Boardman, 2012), but potentially one that represents relative hardship more accurately (Boardman 2010a: 231).

The design of the relative fuel costs component of the LIHC has been heavily criticised by numerous academics and consumer organisations, including Walker *et al.* (2014), Consumer Focus (2012), and Boardman (2012). The criticisms cover its failure to provide an accurate picture of the extent to which households can or cannot afford their fuel costs, and similarly the failure of the linked Fuel Poverty Gap indicator to provide a true measure of fuel poverty depth or severity. Walker *et al.* (2014) note that the energy costs threshold used means that households in smaller properties, which have lower fuel costs and subsequently need a lower income to cover these costs, are less likely to be classified as fuel poor. They argue that vulnerable, lower income households tend to be the occupants of smaller dwellings (Walker *et al*., 2014: 90). Furthermore, the Consumer Focus response to the Hills review noted that the adoption of the new definition would make it impossible to hold the Government to account for achieving its statutory duty to eradicate fuel poverty (Consumer Focus, 2012: 7). In addition, it is argued that the measure has little value as an indicator since "it barely changes over time, even when there are significant changes in fuel prices and/or energy efficiency or tariff interventions" (Consumer Focus, 2012: 8).

In addition to measuring the general incidence of fuel poverty, there is a substantial body of British work that has examined the phenomenon in specific sub-groups, including households containing disabled people (Snell and Bevan, 2014; Thomson *et al*., 2013), black and minority ethnicity communities (Todd and Steele, 2006), and rural areas of England (Baker *et al*., 2008). Researchers have also examined the degree of overlap between subjective and expenditure measures of fuel poverty, as discussed in Chapter 2. For instance, Palmer *et al*. (2008) analysed English House Condition Survey microdata from 2005, finding that little overlap exists. Indeed, just 6 per cent of households in fuel poverty by the standard (required) expenditure definition said that their living rooms were not warm in winter because of the cost it took to do so (Palmer *et al*., 2008: 16). Additionally, Palmer *et al*. (2008) found that a third of households that declared they were unable to keep their living rooms warm in winter had average or above-average incomes. The study also showed that pensioners were less likely to declare an inability to keep their living rooms warm than working-age households, leading the authors to conclude that it is possible that some groups are less likely than others to complain about their homes being cold (Palmer *et al*., 2008: 16).

Waddams Price *et al.* (2012) have also explored the overlap between subjective and expenditure measures of fuel poverty via a survey of 3,417 low-income households in England in 2000 (see Cooke *et al.*, 2001 for the questionnaire), which collected a range of subjective and objective information about feeling fuel poor, and actual household expenditure on energy. The sample was intentionally skewed to low-income households that were representative of prepayment meter users, thus the results are not necessarily applicable to other socioeconomic groups. In the study a ten per cent actual expenditure on energy threshold was applied to determine fuel poverty, alongside self-reported indicators of feeling fuel poor. Their main findings were that the two measures gave very different results, but were strongly correlated, despite their differences. Many of the households that were classified as expenditure fuel poor, on the basis of spending more than ten per cent of income on energy, did not feel fuel poor, and vice versa. For instance, 28 per cent of the low-income sample spent in excess of ten per cent of income on energy, but only 16 per cent felt unable to afford sufficient energy for their home. Nevertheless, the authors of the study argue that “reintroduction of a self-reported measure by the government would be a valuable aid to policy development” (Waddams Price *et al.,* 2012: 33).

Republic of Ireland

Healy and Clinch (2002b) were among the first to explore the issue of fuel poverty and thermal comfort in Ireland by developing a national household survey for Ireland. A sample of 1,500 households was recruited in 2001 by random probability-based sampling, which is a statistically significant sample for the population of Ireland and produces a low-level margin of error (Healy and Clinch, 2002b: 331). Households were surveyed on their ability to heat the home adequately, energy expenditure, self-assessed thermal comfort levels in different rooms of the house, and the incidence of indoor cold strain[3] and shivering. In addition, living-room temperatures were measured, using a single thermometer placed at table height, at least one metre away from any person or heat source.

Based on self-reported frequency of inability to keep warm, Healy and Clinch reported that in total around 226,000 households in Ireland (17.4 per cent) suffer from some degree of fuel poverty, as summarised in Table 5.2. The authors also compared the rate of fuel poverty based on the self-reported measure against the standard quantitative measure based on households spending more than ten per cent of income on energy,

[3] Healy and Clinch define this is “Chronic exposure to low ambient temperatures in the home resulting from fuel poverty often leads to a physiological condition in humans known as ‘cold strain’” (2002b: 330).

finding that a higher number of households are classified as fuel poor under the latter measure (20.7 per cent). However, it should be noted that the study used actual expenditure, which as discussed earlier can lead to inaccurate estimates of fuel poverty prevalence. The thermal comfort and shivering questions revealed that about one-in-ten households nationwide reported thermal discomfort, with higher levels in kitchens and bedrooms. In addition, over half of fuel poor households were found to experience shivering episodes on typical cold winter evenings. Temperature readings of between 12 and 26°C were recorded across all households during March 2001, with around a third of fuel poor households found to live in dwellings where the living room is heated to levels which can result in adverse health impacts, even on the young and healthy.

Table 5.2 Healy and Clinch (2002b: 332) fuel poverty results for Ireland – ability to heat home adequately by severity

Severity		**Percentage of households**	**No. households**
1	Some difficulties (intermittent)	12.7	165,000
2	Usually not	2.5	33,000
3	Never	2.2	29,000
'Chronic' fuel poor (2+3)		4.7	62,000
Total fuel poor (1+2+3)		17.4	226,000
Total fuel poor using 10% measure		20.7	269,000

A significant contribution made by the survey was to highlight the importance of distinguishing between households that demonstrate occasional difficulties in achieving affordable warmth, and those that are chronic sufferers. By using a scale variable, the study was able to capture the severity of inability to keep warm, whereas a binary variable design, which classifies households into yes or no answers, would result in a loss of detail. In terms of the socioeconomic profile of the fuel poor in Healy and Clinch's study, it was found that the over-65s are overrepresented, particularly single female pensioners (34.8 per cent). The over-65s also declared high levels of thermal discomfort and episodic shivering, and over a half of pensioner households had living room temperatures below the WHO (1987) guidelines. Poorer social groups and households containing large numbers of dependent children were also found to be more likely to live in cold housing.

Sustainable Energy Ireland (2003) reviewed fuel poverty and low income housing in Ireland using the survey data developed by Healy and Clinch (2002b) in addition to ECHP data from 1994 to 1997. Their findings mirror those of both Healy and Clinch publications (2002a and 2000b), which is perhaps unsurprising given their involvement in the review, both in terms of the data collection and analysis. The next analysis of fuel poverty levels in Ireland was that by Scott *et al.* (2008) who examined fuel poverty using a combination of expenditure and subjective measurement approaches. In the first instance, Scott *et al.* estimated the incidence of fuel poverty among households using an expenditure approach, exploring HBS microdata for 2005 and extrapolating the results to 2008 using average disposable income growth and increases in fuel prices, as outlined in Table 5.3. Their estimated results for 2008 predicted an increase in Irish fuel poverty rates of almost four per cent. However, the authors acknowledge that the extrapolated figures may not accurately reflect the experience of low income households, and that no allowances are made for changes in household energy efficiency or change of fuel (Scott *et al.*, 2008: 5). Furthermore, the authors are using actual expenditure data, which as outlined previously has associated limitations.

Table 5.3 Scott *et al*. (2008: 4) results for the incidence of fuel poverty using an expenditure approach

Year	Percentage of households	No. households
2005	15.9	228,522
2008 (estimated)	19.4	301,368

The second part of the research by Scott *et al.* used subjective data from a range of sources, including the ECHP, Living in Ireland Survey and EU-SILC, covering the period 1994 to 2006. Using microdata, they found that self-reported rates of fuel poverty, on the basis of ability to afford to heat the home adequately and having to go without heating due to lack of money, declined over the period of 1994 to 2001, but thereafter started to increase annually, which the authors argue may be due to broader patterns of growth in GNP and employment in Ireland (Scott *et al.*, 2008). A secondary finding is that the incidence of fuel poverty is much lower when subjective indicators are used rather than an expenditure approach. Overall, the households found to be most vulnerable to fuel poverty were single adult households of all age ranges, privately rented and Local Authority tenants, and those residing in detached housing.

In a government strategy report for achieving affordable energy in Ireland (Department of Communications, Energy and Natural Resources, 2011), a range of statistics based on potential risk of fuel poverty and estimates of national prevalence are presented. Fuel poverty in Ireland is measured by reference to three levels of severity:

1. The core indicator of energy poverty: whereby a household spends more than ten per cent of its disposable income on energy services in the home.

2. An indicator of severe energy poverty: whereby a household spends more than 15 per cent of its disposable income on energy services in the home.

3. An indicator of extreme energy poverty: whereby a household spends more than 20 per cent of its disposable income on energy services in the home. (Department of Communications, Energy and Natural Resources, 2011: 12).

At the time of the report, ten per cent expenditure on energy represented twice-median expenditure, and was measured using actual household expenditure, taken from the Irish HBS. In this report, the government also outlined how a 'comprehensive measure' of fuel poverty would be developed. It was stated that the new comprehensive measure would "combine a survey of housing conditions with a formal energy poverty modelling framework to estimate what households need to spend" (Department of Communications, Energy and Natural Resources, 2011: 12), and would be developed and implemented over the next three to five years, although as yet it has not been launched.

Using HBS microdata from 2009, the report found that 20.5 per cent of all Irish households were experiencing fuel poverty, 9.8 per cent were experiencing severe fuel poverty, and 5.4 per cent were in extreme fuel poverty. By comparison, a composite indicator developed using EU-SILC microdata from 2003 to 2008 and comprising the ability to afford to heat the home, and having to go without heating due to lack of money, found that fuel poverty ranged from 8.9 per cent in 2003 through to 8.0 per cent in 2008. It is argued that the divergence in figures is a key reason for developing a comprehensive measurement framework. In terms of households most at risk, single adults aged 65 or older were found to account for nearly a third of fuel poor households (based on expenditure). In addition, owner-occupiers and households in detached dwellings had a higher risk of being fuel poor. The tenure profile is at odds with previous analyses, which show renters as most at risk. Households in the lowest income decile were said to have a 68.5 per cent chance of being fuel poor.

More recently Watson and Maitre (2014) have questioned whether fuel poverty is distinct from other general deprivation items featured in the Irish SILC survey. Using factor analysis and logit regression applied to microdata from 2004 to 2011, the authors find that there is overlap between three subjective fuel poverty indicators and other deprivation indicators, and thus argue that fuel poverty should not be treated as a distinct form of deprivation. However, it should be noted that the authors have deviated from the prevailing methods of measuring fuel poverty using subjective EU data (as established by Healy and Clinch, 2002a) and use the following three indicators: arrears on utility bills; having to go without heating during the last 12 months due to lack of money; does the household keep the home adequately warm. The leaking roof/damp/rot indicator, as featured in previous analyses of fuel poverty using SILC data (EPEE, 2009c; Thomson and Snell, 2013) and earlier ECHP analyses (Whyley and Callender, 1997; Healy and Clinch, 2002a) is instead used as part of a modified general deprivation indicator. Their analysis is problematic for several reasons, firstly in terms of consistency with previous analyses, and secondly because the authors have not fully acknowledged the limitations associated with the EU-SILC indicators, which are proxies of fuel poverty rather than direct measures. Nevertheless the study does highlight the need for better quality data that can more accurately capture the incidence of fuel poverty.

France

As discussed in Chapter 2, France acquired an official definition of fuel poverty, or energy precariousness as it also known in France, relatively recently, and considers a person to be fuel poor if: "he/she encounters particular difficulties in his/her accommodation in terms of energy supply related to the satisfaction of elementary needs, this being due to the inadequacy of financial resources or housing conditions" (Plan Bâtiment Grenelle, 2009: 16). However, there is not yet an official survey of fuel poverty in France, and so secondary data from the 2006 National Housing Survey is a key source of data. The purpose of this survey, conducted by Insee the national statistical agency, was to describe the housing conditions of households and their housing expenditure, with a focus on the physical characteristics of the housing stock and the quality of dwellings (Insee, n.d.). It has a large nationally representative sample of 37,000 households (Agence nationale de l'habitat, 2009).

Agence nationale de l'habitat (2009) have carried out a detailed analysis of fuel poverty in France using secondary data from the 2006 National Housing Survey. Their research looks at actual energy expenditure and responses to subjective indicators, according to income quartiles, as summarised in Table 5.4. The researchers chose to use a 10 per actual spend threshold for measuring fuel poverty on the basis of national average (mean) fuel expenditure representing 5.5 per cent of income. However, this approach is questionable for two reasons, firstly, as explained earlier in the thesis, the use of mean values rather than median values is problematic as fuel expenditure is asymmetrically distributed, thus a mean value can be affected by extreme values (see Moore, 2012; Fahmy, 2011). Secondly, a twice-mean value would be 11 per cent. Furthermore, the research is limited by its use of actual expenditure data.

Nevertheless, the research by Agence nationale de l'habitat reveals that whilst the majority of households across all income quartiles spend less than ten per cent of their income on fuel, there is a disparity across the income quartiles for households spending more than 15 per cent. Around 18 per cent of households in the lowest income group spend more than 15 per cent, compared to just 0.3 per cent of households in the highest income group. Overall, it is estimated that 3.8 million households are in fuel poverty on the basis of spending more than 10 per cent of income on energy. Households in the lowest income quartile also reported feeling cold in the house more often than households in the other three quartiles. When questioned about the reasons why they felt cold in the house, the most common answer across all the income quartiles was poor insulation, followed by insufficient heating.

Table 5.4 Energy expenditure levels and proportion of households feeling cold in France. Adapted from Agence nationale de l'habitat (2009: 3).

<table>
<tr><th colspan="2"></th><th>Quartile 1 (lowest)</th><th>Quartile 2</th><th>Quartile 3</th><th>Quartile 4 (highest)</th><th>Total</th></tr>
<tr><td colspan="2">Number of households</td><td>6,591,000</td><td>6,591,000</td><td>6,591,000</td><td>6,591,000</td><td>26,363,000</td></tr>
<tr><td rowspan="3">Energy expenditure</td><td>>15%</td><td>18.1%</td><td>3.3%</td><td>0.8%</td><td>0.3%</td><td>5.6%</td></tr>
<tr><td>10 – 14.9%</td><td>17.5%</td><td>8.7%</td><td>2.6%</td><td>1.1%</td><td>7.5%</td></tr>
<tr><td><10%</td><td>64.2%</td><td>87.8%</td><td>96.4%</td><td>98.5%</td><td>86.7%</td></tr>
<tr><td rowspan="2">Feeling cold in the house</td><td>Yes</td><td>19.8%</td><td>15.1%</td><td>11.0%</td><td>9.9%</td><td>14.0%</td></tr>
<tr><td>No</td><td>80.2%</td><td>84.9%</td><td>89.0%</td><td>90.1%</td><td>86.0%</td></tr>
</table>

Given the scarcity of data in France, the analysis by Agence nationale de l'habitat can be found replicated in other reports, including in the final report on fuel poverty in France by the national working group (Plan Bâtiment Grenelle, 2009). More recently Jusot and Lacroix (2014) have examined the health implications of fuel poverty in France, using secondary microdata from the 2010 National Health, Health Care and Insurance Survey. They classify a household as being fuel poor according to the following subjective measure: "During the last winter, did you suffer from the cold in your dwelling during at least 24 hours?" (Jusot and Lacroix, 2014: 7). The key findings from this research are that 13.5 per cent of the sample (5,069 individuals) report suffering from the cold, and are subsequently at a higher risk of reporting a poor health status, having a long-standing disease, and having poor mental health. However, the main limitation of this research is the fuel poverty measure used, particularly as there are no supplementary indicators available to corroborate the fuel poverty status. In addition, the researchers are using a significantly reduced sub-sample of the overall survey data due to questionnaire routing and non-response, and it is not clear how representative the findings are for the French population. Nevertheless, it demonstrates the health implications of an inadequately heated home in France.

The newest published research on fuel poverty in France is that by Legendre and Ricci (2015), who apply three different measures of fuel poverty to microdata from the 2006 National Housing Survey to quantify fuel poverty in France. The first measure is a 10% actual spend threshold, the second measure is an after fuel costs poverty threshold, whilst the third measure is derived from Hills' (2012) LIHC indicator. Across all measures income is equivalised. The second measure classifies a household as poor if they have equivalised income that is below the 60 per cent median income line, after housing costs and domestic fuel costs are deducted from both income values. The third measure is the same as the second approach, except that energy costs relate to national median fuel costs. A limitation of this research is that is relies heavily on income poverty concepts, indeed, the authors acknowledge that the second measure is identifying income poverty, rather than fuel poverty specifically (Legendre and Ricci, 2015: 2). Overall, the research finds that fuel poverty rates in 2006 were 16.6 per cent, 9.2 per cent, and 20.9 per cent respectively according to the three measures applied.

Greece

Fuel poverty in Greece has been the subject of multiple studies since 2007, from the perspective of characterising the quality of residential housing in Greece (Santamouris *et al*., 2007), measuring the impact of the financial crisis (Dagoumas and Kitsios, 2014; Santamouris *et al*., 2013), through to using energy saving interventions to combat fuel poverty in mountainous regions of the country (Katsoulakos, 2011). The first study by Santamouris *et al*. (2007) collected detailed empirical data from 1,110 households during 2004 in the major Athens area via interviews with household members and inspections of each building. Information on income, building type, energy efficiency, energy consumption and expenditure was collected, with the final data for 945 buildings divided into seven income groups for analysis.

The study by Santamouris *et al*. (2007) found that low income households were more likely to be living in older buildings with poorer energy efficiency than higher income households, and that the cost per person and unit area for heating and electricity was much higher for low income groups. On the basis of indoor temperature readings, Santamouris *et al*. (2007) find that almost all dwellings are adequately heated, with average temperatures found close to 18 - 19°C, although, Healy is critical of the temperature approach, arguing that social desirability bias may cause households to heat rooms to a higher level than normal in anticipation of the interview (Healy, 2004: 134). In terms of energy expenditure, electricity and heating combined represented around 12.1 per cent of income for the poorest group, and just 1.4 per cent in the richest group. The authors cite the UK's fuel poverty methodology as justification for using a 10 per cent threshold for fuel poverty, and a 20 per cent threshold for extreme fuel poverty, and state that 1.63 per cent of the sample is fuel poor and 0.35 per cent is in extreme fuel poverty on the basis of high expenditure on heating. However, despite recognising that the UK methodology uses required expenditure for energy services, the authors make a distinction between expenditure on heating, and expenditure on all energy in the home. On this basis, the study categorises fuel poverty as relating to just heating, and energy poverty as relating to all energy in the home, leading the authors to state that 11.3 per cent of the sample is energy poor, and 2 per cent is extreme energy poor on the basis of high combined expenditure on heating and electricity. Their understanding of fuel poverty, based on the UK's approach, is incorrect as the UK methodology includes all expenditure on energy services. Furthermore, there is no established basis for differentiating between heating and combined energy expenditure, although it is useful to see the division of expenditure. The misapplication of theory, and issues associated with taking indoor temperature readings are the main limitation of the research.

Santamouris and colleagues provided an updated survey on energy consumption in 2013, based on a survey across Greece, conducted in the spring and summer of 2012 with a total of 598 households. The sampling method is not outlined in detail, thus it is not clear whether this was intended to be a representative sample of Greece, nor how the households were recruited for the study. Overall the approach and results are relatively similar to the earlier 2007 study. The authors still misapply the UK fuel poverty approach by using a 10 per cent threshold without transferring the underlying methodology, or referring to the Greek expenditure standards, but have used a single measure for examining combined expenditure on energy, rather than distinguishing between expenditure on heating and expenditure on all energy services. Santamouris *et al*. (2013) state that 14 per cent of low income Greek households are fuel poor, and 2 per cent of high income households are fuel poor. As with their earlier study, the main limitation concerns the misapplication of methodology, in conjunction with an unclear description of the sampling procedure.

An additional study by Santamouris *et al*. was published in 2014, concerning indoor environmental quality in a sample of low income households during the winter period in Athens. Although the study does not explicitly measure fuel poverty, it provides a comprehensive account of indoor temperatures and energy consumption across a sample of 43 households from Athens. The households were recruited if they had an income of €15,000 or less, and in the period between December 2012 and April 2013 indoor temperature readings were taken at 15 minute intervals. The houses were regularly visited by trained surveyors, who downloaded temperature data and surveyed the household on energy consumption, environmental, social and health related topics Santamouris *et al*. (2014: 62). Whilst it is noted that within each house a miniature temperature sensor was placed in a well-ventilated and heat protected area, it is not clear if just one sensor was used, and in what room it was placed, both of which will impact on the reliability and range of temperatures recorded. Overall, the study found that indoor temperatures were much lower than accepted standards for thermal comfort, with many households found to be risking their health with very low temperatures. The average minimum temperature across the sample in January was 12.6°C, ranging from a low of 5°C to a high of 16.2°, while the mean average temperature was 15.9°C, with average temperatures ranging from 11.4°C to 19°C (Santamouris *et al*., 2014: 63).

Katsoulakos (2011) examined the issue of fuel poverty in mountainous areas via a case study of options for reducing conventional fuel use and the risk of fuel poverty in Metsovo, a Greek mountain town. Katsoulakos states that mountainous areas are especially vulnerable to fuel poverty because "their thermal energy needs are especially high and their economic environment is not a particularly prosperous one" (Katsoulakos, 2011: 284). A range of methods were utilised, including a survey of 200 households, thermal imaging of 90 houses, and a feasibility study of different heating options. In terms of fuel poverty, across the sample 10.7 per cent of income was required for energy costs, rising to 24 per cent in low income households, which is significantly higher than the figures reported by Santamouris *et al*. (2007; 2013).

The final study of fuel poverty is Greece is that by Dagoumas and Kitsios (2014), who have assessed the impact of the financial crisis on fuel poverty. This study uses a range of data on electricity consumption per capita, economic growth, the number of electricity disconnections, and the share of customers eligible for social electricity tariffs. Although the study does not aim to measure the incidence of fuel poverty, the macro-level analysis of fuel poverty issues is a novel contribution to the literature in Greece, and in Europe generally. The study finds a strong correlation between electricity consumption per capita and Gross Domestic Product over the period 1960–2012, with a decline in both indicators discernible from 2007 and 2008 onwards. An additional key finding relates to the increasing incapability or unwillingness of customers to pay their electricity bills, which the authors argue is strongly related to the Government's decision to incorporate a new property tax into electricity bills (Dagoumas and Kitsios, 2014: 277).

Germany

It has been noted by Bouzarovski and Petrova (2015) that there is evidence to suggest Germany has been involved with lobbying efforts to block pan-European recognition of fuel poverty in EU policy. This is because the recognition of “a distinct new group of vulnerable people in the face of energy price increases and sector restructuring commitments brought about by the low-carbon energy transition” (Bouzarovski and Petrova, 2015: 13) could have caused significant domestic political difficulties for Germany. Against this backdrop Tews (2013) examined how fuel poverty could be defined, identified and addressed, in the context of a socially responsible energy transition. Using macrodata on household expenditure on energy, the distributional effects of energy tariffs, attitudes to the energy transition, and energy consumption data on low income households taken from the Stromspar-Check energy advice scheme, Tews suggests that there is a specific fuel poverty situation in Germany. The main finding from Tews (2013) is that current energy efficiency policies do not adequately compensate for the negative effects of the distribution of the energy transition policy, which uses levies on energy bills to fund renewable energy schemes.

The only comprehensive quantification of fuel poverty in Germany can be found in Heindl (2013). Heindl uses microdata from the German socio-economic panel (SOEP) to discuss different fuel poverty measures and subsequent results for Germany. Heindl does not use the full SOEP sample (12,290 cases) as data on household income, housing costs, and energy costs data is missing in a number of cases, which reduces the usable sample to 10,193. A further 2,560 households are missing electricity costs, and the author briefly mentions using imputation to obtain estimates for these households, however, no detailed explanation of methods is offered. It seems likely that single imputation has been used, which adds a single estimated value to each missing value, rather than multiple imputation that adds a set of multiple plausible values. The lack of discussion on imputation methods is remiss as imputation is a complex technique, as will be outlined in Chapter 10. Furthermore, single imputation is not considered to be robust as it usually causes standard errors to be too small by failing to account for the uncertainty about the missing values (Sterne *et al*., 2009).

Overall Heindl applies eight different measures of fuel poverty: a 10 per cent ratio, twice-median expenditure (relative to absolute expenditure), twice-median share (relative to income), twice-mean expenditure, twice-mean share, a Minimum Income Standard (MIS)[4] inspired approach, and two Hills (2012) LIHC measures (before and after housing costs). With the exception of the 10 per cent ratio measure, all options have used equivalised household income. The key findings are that the different options yield highly variable results with respect to percentage of population identified as fuel poor, and which households are identified as fuel poor. Estimated fuel poverty in Germany ranges from 2.4 per cent, using twice-mean expenditure, through to 29.8 per cent, applying a 10 per cent ratio measure. Using the 10 per cent ratio, single households and lone parents are strongly identified as vulnerable to fuel poverty, whereas under the remaining seven measures their representation is significantly less pronounced, most likely as a consequence of using income equivalisation across the other seven measures. Overall Heindl considers the LIHC and twice-median share measures to be most appropriate for measuring fuel poverty in Germany.

The research by Heindl illustrates why using mean rather than median expenditure is problematic, with mean measures significantly underestimating fuel poverty levels compared to their median counterparts, as displayed below in Table 5.5. It also demonstrates that if the British fuel poverty methodology is going to be used, it should be transferred in full, with the 10 per cent ratio clearly producing inappropriate results, for the German context. Whilst this is an important conceptual research paper, it has a number of limitations relating to the likely use of single imputation for a significant proportion of the dataset, and the use of actual expenditure data.

Table 5.5 Application of different fuel poverty measures in Germany 2010. Adapted from Heindl (2013: 20)

Measure	Share of fuel poor in German population
10 per cent ratio	29.8%
2x median expenditure	4.1%
2x median share of expenditure	12.0%
2x mean expenditure	2.4%
2x mean share of expenditure	5.4%
Minimum Income Standard	9.9%
LIHC before housing costs	11.1%
LIHC after housing costs	13.7%

[4] The Minimum Income Standard approach defines 'adequate' income levels for different household types, based on items and services the public think are necessary to achieve a minimum standard of living.

Becker *et al*. (2014) have also examined fuel poverty in Germany, from an infrastructure perspective. Although the authors do no specifically quantify fuel poverty, they do present a discussion of how infrastructure, including energy infrastructure, is becoming an increasingly inequality-generating factor in Germany. Statistics are presented for the historical changes in electricity prices, as well as the regional disparities in electricity pricing and poverty across Germany. Becker *et al*. note that fuel poverty in Germany is closely linked to the energy transition, and requires recognition in policy by way of national and regional measurement of the incidence.

Hungary

Tirado Herrero and Ürge-Vorsatz (2010) were the first to assess fuel poverty in Hungary, using a combination of expenditure and consensual data. Using data from a survey on financial and living conditions, Tirado Herrero and Ürge-Vorsatz found that the mean energy expense of Hungarian households was around 9.7 per cent of net income between 2000 and 2007. However, as the authors used macro survey data, they were unable to provide an estimate of the actual number of households affected. Using macrodata from 2007, Tirado Herrero and Ürge-Vorsatz discovered that single households without children had the highest energy expenditure to income ratio (14 per cent), and that overall, households without children spent a slightly higher proportion of income on energy (11 per cent versus 9.6 per cent). For the consensual element of their research, Tirado Herrero and Ürge-Vorsatz utilized EU-SILC macrodata, finding that in part the results contradicted their earlier expenditure-based findings. For instance, between 2005 and 2007 domestic energy prices increased substantially, as reflected by a greater a share of income spent on fuel, whereas the number of households in Hungary reporting an inability to afford to heat their home declined (Tirado Herrero and Ürge-Vorsatz, 2010). The key limitation of the research, namely that macrodata prevents detailed analysis and estimates of the number of households affected, is recognised by the authors. Nevertheless, this research was the first to shed light on fuel poverty issues in Hungary, and supplements the macrodata analysis with case studies on fuel poverty in rural Roma communities, the thermal trap of district heating in suburban areas, pensioners in urban areas, and on governance by utility companies and local governments.

Tirado Herrero and Ürge-Vorsatz later published research identifying a specific post-communist variant of fuel poverty, caused by living in poor energy-efficiency district-heated buildings (2012). Using Hungarian HBS microdata from 2005 and 2008, a district heating sub-sample of households ('DH panel') was identified on the basis of residing in a multi-family building constructed between 1960 and 1989 in urban areas (Budapest and big cities, county capitals and other cities) and having district heating as their main source of heat (Tirado Herrero and Ürge-Vorsatz: 61). Three actual expenditure-based fuel poverty thresholds were applied to estimate fuel poverty rates, namely: energy costs are equal to or above twice-median relative energy expenditure; energy costs are equal to or above the median relative energy expenditure of the three lowest income deciles; household energy costs are larger than its food and non-alcoholic beverages costs (*ibid.*). Overall, the research found that DH panel households spent more on energy in 2005 and 2008 than other households in urban areas, and across the whole HBS sample. However, DH panel households had lower rates of fuel poverty according to the first two measures, but higher rates under the third measure. Almost one third of DH panel households spent more on energy than food in 2008. Tirado Herrero and Ürge-Vorsatz (2012) argue that fuel poverty in DH buildings is unique in that "it is not experienced in the form of a cold indoor environment (often the opposite, in fact), but as higher than average domestic heating costs" (Tirado Herrero and Ürge-Vorsatz, 2012: 67).

Researchers from Energiaklub have also investigated the characteristics of the fuel poor in Hungary (Fellegi and Fülöp, 2012), using data collected for a separate research project, entitled *NegaJoule2020*. Fellegi and Fülöp applied three different measures of fuel poverty to actual expenditure data, as outlined in Table 5.6. Firstly the authors used the British ten per cent level, without transferring the underlying methodology, and subsequently found that 80 per cent households would be classified as fuel poor, as the authors state: "this would obviously be a nonsensical approach and would make it impossible to treat the problem" (Fellegi and Fülöp, 2012: 1). It is unclear why a 20 per cent measure was applied, but this reduced fuel poverty levels to around 40 per cent. The authors finally calculated the fuel poverty threshold using a twice-median (actual) spend definition, resulting in a threshold of 34 per cent; under this definition, around 8 to 10 per cent of the Hungarian population were estimated to be in fuel poverty.

Table 5.6 Fellegi and Fülöp's (2012) fuel poverty results for Hungary

Fuel poverty rates	Fuel poverty measure applied		
	>10% expenditure	>20% expenditure	>twice-median expenditure (34%)
Percentage of population	80%	37 -40%	8-10%
Number of households	3,040,000	1,400,000 –1,500,000	300,000-380,000

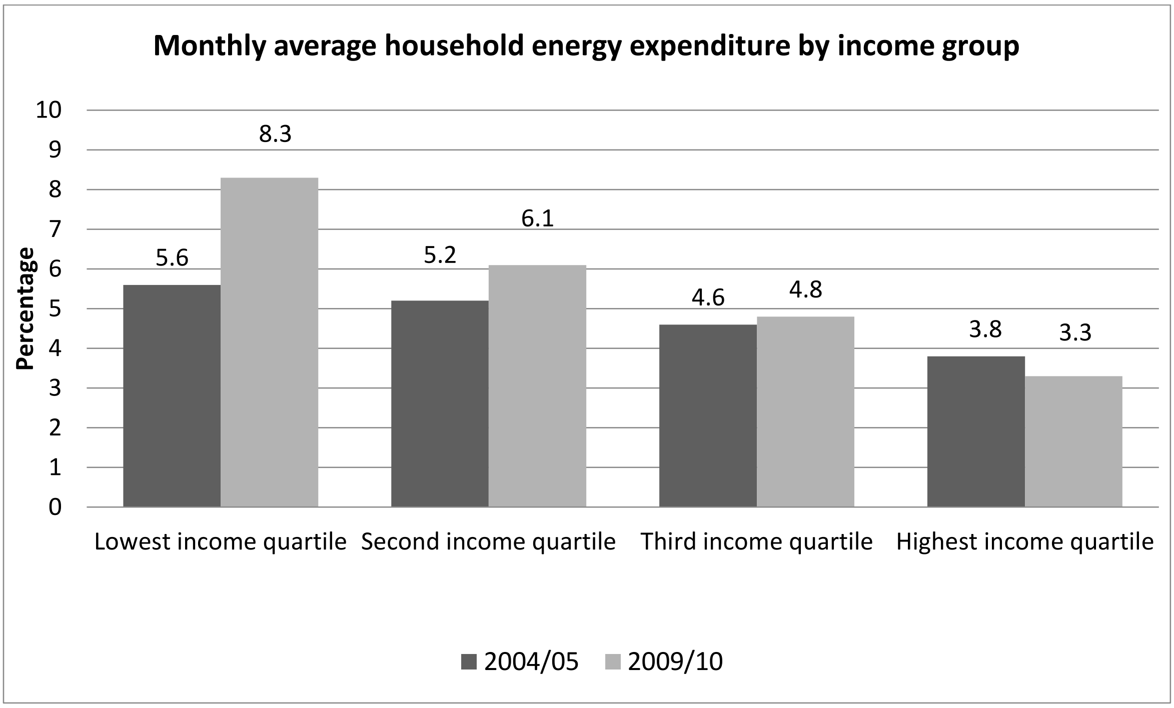
In terms of the data reliability, data was collected using a two-step, layered, quota-based sampling (Energiaklub, 2011), with the first stage of sampling designed to be representative on the basis of housing types and region, using data from the Central Statistical Office (Energiaklub, 2011: 1). However, in the second stage of sampling the research was less objective due to interviewers selecting the households for questionnaire participation by random walking, which means that "it was the interviewer who could decide on the addresses and households visited within the specified area – by observing the quotas specified" (Energiaklub, 2011: 2). Nonprobability sampling methods, such as quota-based sampling, have been criticised for introducing selection bias and unreliability, with no way to measure the precision of the sample (see Bryman, 2008). Furthermore, the authors calculated the theoretic energy demand required to heat a house to 20°C and provide hot water in the given household (Fellegi and Fülöp, 2012: 1), however, it is unclear what criteria was used to calculate energy demand, nor what the rationale was for excluding electricity for appliances, lighting and cooking.

Austria

Within Austria, no official definition of fuel poverty exists nor is specific data collected by the national statistical agency (Berger, 2012). Nevertheless, in recent years there has been a growing number of studies conducted on quantifying fuel poverty issues in Austria, starting with work by Proidl in 2009. In conjunction with Caritas, a non-profit organisation, and E-Control, the government regulator for gas and electricity in Austria, the study by Proidl (2009) involved giving energy advice to 58 households in Vienna and Lower Austria, and collecting qualitative and quantitative information about the household and their energy consumption and practices. Among the main findings of this research was that 88 per cent of the assisted households had experienced difficulties with their energy costs, indeed in nearly a third of households the electricity and/or gas supply had been disconnected at least once previously. Proidl reported that households likely to be in fuel poverty were unable to afford energy efficiency measures, thus they were trapped in a vicious circle of increasing energy bills and inability to achieve adequate warmth.

Subsequently, Kalliauer and Moser (2011) produced a short report on the issue of energy poverty, which summarises a number of issues, including rising gas and electricity prices and disconnections. Using national statistics, Kalliauer and Moser demonstrate that average household energy expenditure has increased significantly for households in the lowest income quartile between 2004/5 and 2009/10. By comparison, energy expenditure has decreased marginally for households in the highest income quartile, as shown in Figure 5.2. However, the authors misinterpret the UK's ten per cent fuel poverty threshold, and apply a ten per cent actual spend threshold to their statistics, stating that at least every tenth household spends more than ten percent and so is fuel poor (Kalliauer and Moser, 2011: 2). The report is not a rigorous assessment of fuel poverty in Austria, but in the context of an emerging field of study, it made a contribution to raising awareness of the disparity in energy expenditure across different income groups.

Figure 5.2 Monthly average household energy expenditure in Austria. Adapted from Kalliauer and Moser (2011: 3)



Since then a comprehensive examination of Austrian fuel poverty has been undertaken by Benke and colleagues (Benke and Varga, 2012; Benke *et al*., 2012) as part of a larger project on preventing fuel poverty by facilitating energy efficiency improvement and use of renewable energy sources. The study collected primary data via a questionnaire survey of 78 households from across Austria. The households were clients of various non-profit organisations, including debt advice organisations, and the surveys were conducted by social and energy counsellors. A variety of information was collected on topics such as the property type, household characteristics, energy expenditure, and subjective experiences of fuel poverty, as detailed in Benke and Varga (2012). Overall the study estimates that 313,000 people were affected by fuel poverty in Austria in 2010, and those that are particularly affected include income-poor households, lone parents, the unemployed and pensioners.

Spain

Beyond the comparative study of Spain in EPEE (2009c) and in other pan-European studies listed earlier, academic interest in the study of fuel poverty in Spain has only recently emerged, starting with a study by Tirado Herrero *et al*. (2012), which was later updated in a follow up report (Tirado Herrero *et al*., 2014). The work by Tirado Herrero *et al*. (2014) is a comprehensive assessment of fuel poverty in Spain, using microdata from the Spanish HBS and EU-SILC surveys. Analysis of actual energy expenditure from HBS shows that from 2006 to 2012 domestic energy costs in Spain represented on average 5.2 per cent of income, increasing from 4.3 per cent in 2007 to 6.5 per cent in 2012. On this basis, the authors apply a ten per cent threshold to classify fuel poor households, as this roughly equates twice-mean expenditure (Tirado Herrero *et al*., 2014). The authors note the limitations associated with using actual expenditure data, and state that their analysis is likely to produce underestimates of fuel poverty levels. A key finding from this study is that 16.6 per cent of Spanish households had disproportionate energy costs and so were fuel poor in 2012, which is equivalent to 7 million people. Unemployed people were found to be particularly affected, with a third of households containing an unemployed person spending more than ten per cent of income on energy.

Tirado Herrero and colleagues (2014) also analysed the three core indicators of fuel poverty from EU-SILC, finding that in 2012 around 9 per cent of households were unable to afford to keep their home adequately warm, 6 per cent were in arrears on utility bills, and 12 per cent lived in a dwelling that was leaking, damp and/or rotting. Across the analysis significant variation in the geographical distribution of fuel poverty was found, with rural areas disproportionately affected compared with urban areas. In addition to quantifying the prevalence of fuel poverty issues across the country, Tirado Herrero *et al*. also examined excess winter mortality, finding that the eradication of fuel poverty in Spain could potentially avoid between 2,400 and 9,600 premature deaths per year.

Sánchez-Guevara *et al*. (2014) have also contributed to quantifying fuel poverty in Spain by way of a case study of fuel poor households in the Madrid region. The study used EU-SILC and Spanish Family Budget Income survey data (HBS) from 2006 to 2011, although it is not clear whether the obtained data was at the micro or macro scale. Using actual energy expenditure data from the HBS, the authors developed a fuel poverty ratio based on equivalised actual fuel costs divided by equivalised household income, and applied a ten per cent threshold to represent fuel poverty. The study also used five, 15 and 20 per cent expenditure thresholds too. Using the ten per cent threshold, the authors report that 13 per cent of households in Madrid were fuel poor in 2011, which is only slightly lower than overall Spanish rate reported by Tirado Herrero *et al*. (2014). A lower incidence of fuel poverty was found using the three key indicators from EU-SILC.

Belgium

A comprehensive study of fuel poverty in Belgium was undertaken by Huybrechs *et al.* (2012), who used quantitative and qualitative methods to explore the issue. In terms of quantifying the issue, Huybrechs *et al.* present EU-SILC results for inability to afford adequate warmth and arrears on utility bills, as shown in Table 5.7, finding that 550,000 people in Belgium declared they were unable to pay to keep their home adequately warm in 2009. However, the authors are critical of this figure, stating that it is far less than in previous years, but does not coincide with warmer winters or lower energy prices (Huybrechs *et al.*, 2012: 68). Huybrechs *et al.* speculate that the lower figure on ability to afford to heat the home could be due to an increase in arrears on utility bills, and increased debt.

Table 5.7 EU-SILC data on ability to keep home adequately warm and paying utility bills on time in Belgium 2004 – 2009. Adapted from Huybrechs *et al*., 2012: 69.

	2004	2005	2006	2007	2008	2009
Inability to pay to keep home adequately warm (%)	6.4	14.1	14.5	14.6	6.4	5.1
Arrears on utility bills (%)	5.2	5.7	5.1	4.7	5.1	5.9

Huybrechs *et al.* also use actual expenditure data from the Belgian HBS to examine the average share of expenditure on energy, by income decile. Using data points from 1999 and 2009, they found that energy expenditure represented a larger proportion of expenditure for households in the poorest income deciles, compared with households in the richest income deciles. Between 1999 and 2009 expenditure on energy increased for all income groups, but was particularly pronounced in the bottom three income deciles. However, the authors misapply the UK's ten per cent definition, by asserting that potentially all households in the first decile could be in fuel poverty as they spend more than ten per cent of income on fuel (Huybrechs *et al.*, 2012: 70). An additional limitation is the use of average figures, rather than median figures, as these can be affected by extreme values.

At the time of writing a multidisciplinary study is also currently underway in Belgium by Bartiaux *et al*. (2014), who are proposing to use secondary data from EU-SILC and the Generations and Gender Programme Survey (GGP). The latter data source is a pan-European survey operated by the United Nations, which has not previously been used for measuring the incidence of fuel poverty.

Italy

Fuel poverty in Italy has only recently been studied in-depth by Miniaci *et al*. (2014), who present a detailed assessment of the affordability of gas and electricity using microdata from the 1998 to 2011 Surveys on Family Budgets, a form of HBS. Miniaci *et al*. use a residual income MIS approach, which examines if households have sufficient financial resources to fund minimum levels of consumption of other goods, after paying for energy. The authors also examine actual energy expenditure in relation to minimum standards, as determined by the minimum amounts required for gas and electricity budget items, to identify under-consumers and over-consumers of energy. The minimum standards are derived from the official Italian poverty line calculations. Their approach is similar to Hills (2012), except that they use absolute poverty and expenditure measures rather than relative.

One of the main findings of Miniaci *et al*. is that by any measure energy consumption in Italy has become less affordable since the start of the financial crisis in 2007. Furthermore, they find that all measurement approaches are consistent in identifying households containing children, those claiming difficulties in paying their bills on time, living in poorly maintained accommodations, tenants, and residents in Southern regions of Italy as particularly vulnerable to fuel poverty (Miniaci *et al*., 2014: 299). A secondary part of their research was an analysis of the effectiveness of a gas and electricity benefit scheme introduced in 2008. Using EU-SILC microdata from 2011, they investigated the extent to which the benefit's eligibility criteria matches households with the greatest energy affordability problems. Overall they found that energy benefits have little impact on fuel poverty, with no more than 59 per cent of those with affordability problems qualifying for gas and electricity benefits. The authors recognise the limitations associated with using actual expenditure data, but also note that a required expenditure approach is particularly data demanding, which is why this type of data is not widely available.

Denmark

To date fuel poverty related issues have not been discussed in Nordic countries, at either the government level or in academic literature, perhaps due to the relatively low incidence of self-reported energy and housing condition problems in this region (see Thomson and Snell, 2013). The exception is a masters dissertation by Sam Nierop (2014), which examined fuel poverty in Denmark. Using macro data on household expenditure on energy, electricity disconnections, and EU-SILC indicators from 2003 to 2012, Nierop presents a comprehensive examination of potential fuel poverty in Danish households. Among the key findings from the research are that around one per cent of households were disconnected from the electricity grid in 2013, and in the lowest income quintile more than eight per cent of income is devoted to energy costs. Single persons under the age of 60 on low incomes, and pensioners in detached housing were found to be particularly vulnerable to fuel poverty. The author has recognised the limitations of their research, namely that actual energy expenditure could underestimate fuel poverty levels, and that macrodata prevents detailed analysis of dynamics at the household-level.

The Netherlands

Fuel poverty in the Netherlands has only been examined once by Haffner and Boumeester (2014) in their study of housing affordability, which takes a housing policy perspective. Their research uses 2012 data on income, rents, and fuel costs from WoON, a Dutch cross-sectional Housing Survey, with a household weight applied to make the results valid for all Dutch households. By firstly looking at the share of income spent on energy costs, the study by Haffner and Boumeester shows that the ratio of income to energy costs in the Netherlands is highest in the lowest income decile (8.7 per cent for dwellings with a regulated tenant and 8.6 per cent for liberalized tenancies), and lowest in the highest income decile (5.3 and 5.0 per cent respectively for regulated and liberalized tenancies) (Haffner and Boumeester, 2014: 6).

However, the authors are critical of the expenditure ratio approach for its inability to determine affordability. Instead, Haffner and Boumeester advocate the use of 'socially acceptable' norms thresholds for energy costs (and rent) derived from basic and comparative expenditures. Basic expenditures are the minimum amounts required for a certain budget item, whereas comparative expenditures are the average amounts that similar households with a similar income spend on particular budget items (Haffner and Boumeester, 2014: 8). The norm energy costs for low-income groups is based on the basic expenditure, whilst for higher-income groups, Haffner and Boumeester using the average amount of the basic and comparative expenditures for energy costs. Using this methodology, it is found that the cost of energy lies above the norm for a large portion of tenants in the regulated rental market, with the norm ranging from 5.2 per cent of income for tenants in the fifth income decile, through to 8.7 per cent of income for tenants in the first decile. As Haffner and Boumeester note, this is significantly lower than the established British 10 per cent norm, thus highlighting the importance of using locally derived thresholds for ensuring relevance of measurement. The limitation of the study is its use of actual expenditure data, plus it is not clear whether the norm ratios are derived from mean or median calculations. However, it introduces a novel way of measuring energy affordability, and provides nationally representative data for the Netherlands.

Multi-country European studies

European Union

The first comparative study of fuel poverty in Europe was conducted by Whyley and Callender (1997), who used European Community Household Panel (ECHP) data to conduct a small comparative study of fuel poverty in the UK, Republic of Ireland, the Netherlands and Germany. The ECHP was a panel survey, in that it entailed successive surveys of the same sampling units to measure change over time (OECD, 2001), running from 1994-2001. The ECHP provided comparable data on "income information, financial situation in a wider sense, working life, housing situation, social relations, health and biographical information" (Eurostat, 2010c). It is hard to assess the work by Whyley and Callender due to the inaccessibility of the full study report, despite contacting the authors and original funders, thus only the published executive summary has been used. Their executive summary suggests that they were using microdata, however, there is no indication of the survey year used, nor what statistical methods were employed.

Across the four study countries they found that households in the UK and Ireland suffered from a worsened incidence of fuel poverty than households in the Netherlands and Germany (Whyley and Callender, 1997: i), on the basis of living in damp housing, lacking central heating or electric storage heaters, and having inadequate heating facilities. The authors also explored potential drivers of fuel poverty, finding that lone parents, single households, and people with children were consistently more likely to live in homes with fuel poverty attributes compared with other household types. They also established that tenant households were the most vulnerable to fuel poverty, especially in Ireland and the UK. Lastly, Whyley and Callender found a strong association between reliance on social assistance and experiencing the indicators of fuel poverty. Unfortunately the authors did not provide results tables in the executive summary, nor did they explore associations between the fuel poverty indicators.

Healy and Clinch (2002a) later expanded on this work, and calculated the extent of fuel poverty in fourteen European Union countries using ECHP longitudinal microdata from 1994-1997. Healy and Clinch employed a consensual approach in their research, using six key indicators of fuel poverty, as outlined in Table 5.8. As explored in Chapter 2, the consensual fuel poverty approach is derived from the work by Peter Townsend (1979) and David Gordon (Gordon *et al.*, 2000), and is concerned with household ability to afford items that the majority of the general public consider to be essential. Subjective indicators, such as household ability to heat the home adequately, require a value judgement, in this instance around affordability and adequacy, meaning they are good for determining individual and household perceptions, but may be unreliable given the subjectivity. Objective indicators on the other hand, require less of a value judgement, and thus may be seen as less biased, although they are still self-reported indicators.

Table 5.8 Fuel poverty indicators used by Healy and Clinch (2002a), and their corresponding symbol.

Subjective indicators	Objective indicators
(α) Households unable to heat home adequately	(δ) Presence of damp walls and/or floors
(β) Households unable to pay utility bills	(λ) Lacking central heating
(π) Households lacking adequate heating facilities	(μ) Rotten window frames

Healy and Clinch derived a variety of composite fuel poverty scores by assigning a weight to each of the six indicators, and modifying the weights to create different scenarios. They argued that this tests the effects of changing methodological assumptions (Healy and Clinch, 2002a: 5). Table 5.9 summarises the weighting formulas used for the scenarios, based on the Greek symbols assigned to each variable, as shown in Table 5.8. For example, in scenario 1 the indicator which determines if a household is unable to heat their home adequately is selected as a key indicator and given strong preference.

Table 5.9 Summary of the weighting factors used by Healy and Clinch (2002a)

Scenario	Weighting
1: Key Indicator Given Strong Preference	$0.5\ \alpha + 0.1\ \beta + 0.1\ \pi + 0.1\ \delta + 0.1\ \lambda + 0.1\ \mu$
2: Equal Weights	$0.17\ \alpha + 0.17\ \beta + 0.17\ \pi + 0.17\ \delta + 0.17\ \lambda + 0.17\ \mu$
3: Subjective Indicators Only	$0.33\ \alpha + 0.33\ \beta + 0.33\ \pi$
4: Objective Indicators Only	$0.33\ \delta + 0.33\ \lambda + 0.33\ \mu$
5: Key Indicator and Objective Indicators Given Preference	$0.5\ \alpha + 0.17\ \delta + 0.17\ \lambda + 0.17\ \mu$
6: Key Indicator Given Moderate Preference	$0.33\ \alpha + 0.134\ \beta + 0.134\ \pi + 0.134\ \delta + 0.134\ \lambda + 0.134\ \mu$

As displayed in Table 5.10 below, Healy and Clinch found that the rates of fuel poverty were consistently highest in Greece, Portugal, Spain and Italy, despite the perception that milder southern European countries are unaffected by fuel poverty (Healy and Clinch, 2002a).

Table 5.10 Healy and Clinch's composite fuel poverty scores (Healy and Clinch, 2002a: 47)

Country	1	2	3	4	5	6
Austria	4.7	6.5	3.1	9.8	6.0	5.6
Belgium	8.0	11.0	6.1	15.8	9.9	9.5
Denmark	3.6	3.9	3.2	4.5	3.9	3.7
Finland	4.8	4.9	4.4	5.4	5.1	4.9
France	9.1	10.4	8.6	12.2	9.8	9.8
Germany	4.0	5.5	2.7	8.3	5.0	4.7
Greece	36.0	29.7	34.7	24.6	35.3	32.8
Ireland	8.3	9.6	6.9	12.4	9.5	9.0
Italy	16.1	12.5	14.5	10.6	16.1	14.3
Luxembourg	4.2	5.0	3.7	6.3	4.8	4.6
Netherlands	5.1	7.2	3.2	11.1	6.7	6.2
Portugal	56.4	44.4	38.7	50.1	62.8	50.3
Spain	37.8	26.3	20.6	32.1	43.8	31.9
UK	8.4	10.2	7.9	12.5	9.3	9.3

In addition to creating a composite index of fuel poverty in EU14 countries, Healy and Clinch also comprehensively explored the profile of fuel poor households, by way of cross tabulation and Probit regression analysis. Their findings compare favourably with Whyley and Callender, for instance, in terms of household type they report that single parents and lone pensioners were the most at risk groups for experiencing fuel poverty (Healy and Clinch, 2002a: 23). Similarly, the authors found that tenants suffered from the highest levels of fuel poverty among the tenure types, and unemployed households or those on other forms of social assistance were the most at risk income source group. Additional findings were that separated, divorced and widowed households demonstrated higher levels of fuel poverty than married households, and there was a linear relationship between educational attainment and fuel poverty. Finally, Healy and Clinch reported that the property types worst affected by fuel poverty varied by country, but overall the incidence of fuel poverty was highest in apartment blocks.

The main limitations of the analysis by Healy and Clinch (2002a) are that they did not explore the associations between indicators, via correlation testing, and they did not attempt to quantify the number of indicators concurrently reported by households, thus the research does not provide an insight into the intensity of fuel poverty issues at the household-level. Nevertheless, the work by Healy and Clinch was a comprehensive and scientific study that significantly increased knowledge about the prevalence of fuel poverty across Europe.

The work by Whyley and Callender (1997) and Healy and Clinch (2002a) was the last research to be conducted using ECHP data as in 2001 the survey was replaced with the EU Statistics on Income and Living Conditions (EU-SILC). The EU-SILC dataset aims to be a “reference source for comparative statistics on income distribution and social exclusion at European level” (Eurostat, 2010a), and as Clemenceau and Museux (2007) comment, is a significant improvement on its predecessor, which suffered from issues of reliability, varied response rates and incomplete geographical coverage (Clemenceau and Museux, 2007). However, several variable changes occurred during the transition from ECHP to EU-SILC which has made it more difficult to model EU fuel poverty, including the loss of a variable from the main survey asking if a dwelling has central heating or electric storage heaters, and the merger of three separate housing condition variables (leaky roof, damp walls, floors foundations, and rot in window frames or floors) to form a single variable in EU-SILC.

To date, there have been two key studies that have used EU-SILC microdata, the European Fuel Poverty and Energy Efficiency project (EPEE) (2009c), and Thomson and Snell (2013). The first study, EPEE, was co-financed by the European Commission, and analysed fuel poverty in five countries, the UK, Spain, Italy, Belgium and France, using EU-SILC microdata from 2005. The study used three proxy indicators of fuel poverty, and the results are summarised in Table 5.11. As can be seen, Belgium fared the worst in terms of the number of households unable to afford to keep their home adequately warm, with a similar percentage of households reporting that they occupy a property that leaks, or has damp or rot. Spain and Italy also had a noticeably high prevalence of households living in damp, rotting or leaking housing. By comparison, France and the UK had among the lowest prevalence of fuel poverty based on the three indicators.

Table 5.11 EPEE (2009c) fuel poverty results

Country	Unable to keep home warm	Leaking/damp/rot	Arrears on utility bills
Belgium	14.6%	14.8%	5.3%
France	6.2%	12.2%	6.4%
Italy	10.9%	22.7%	9.0%
Spain	9.0%	17.2%	3.3%
UK	5.7%	13.4%	0.1%

The EPEE project conducted national analyses of the drivers of fuel poverty in the five countries using descriptive statistics, finding that whilst the drivers varied by country and indicator, overall there were some similarities in aggravating factors, namely that tenants, lone parents, and single pensioner households experienced the highest levels of fuel poverty. The main limitations of this research are that it only focused on five countries, the analysis was statistically simple, and the data is from 2005, prior to the enlargement of the EU.

More recently, Thomson and Snell (2013) have conducted a larger analysis of fuel poverty across Europe, using EU-SILC microdata from 2007 to look at the full collection of Member States (EU27), with the exception of France and Malta due to missing data. Their work attempted to replicate the composite fuel poverty index introduced by Healy and Clinch (2002a), however, as stated previously, several variables were lost in the transition from ECHP to EU-SILC, and so their analysis is based on the following three indicators:

- (α) Ability to pay to keep the home adequately warm
- (β) Arrears on utility bills within last 12 months
- (γ) Presence of a leaking roof, damp walls or rotten windows

Thomson and Snell produced four scenarios of EU fuel poverty, as outlined in Table 5.12 and Table 5.13 below.

Table 5.12 Summary of the weighting factors used by Thomson and Snell (2013)

Scenario	Weighting
One	$0.50\ \alpha + 0.25\ \beta + 0.25\ \gamma$
Two	$0.25\ \alpha + 0.50\ \beta + 0.25\ \gamma$
Three	$0.25\ \alpha + 0.25\ \beta + 0.50\ \gamma$
Four	$0.33\ \alpha + 0.33\ \beta + 0.33\ \gamma$

Table 5.13 Thomson and Snell's composite fuel poverty scores (Thomson and Snell, 2013: 568)

Country	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Average
Austria	6.2	5.9	8.2	6.7	6.75
Belgium	9.2	8.5	11.9	9.8	9.85
Bulgaria	31.1	31.2	30.5	30.6	30.85
Cyprus	23.8	17.8	22.8	21.2	21.4
Czech Republic	7.5	6.4	9.2	7.6	7.68
Denmark	2.7	3.3	4.8	3.6	3.6
Estonia	6.8	8.1	11.0	8.5	8.6
Finland	3.8	4.7	4.3	4.2	4.25
Germany	7.6	6.9	9.4	7.9	7.95
Greece	16.8	16.6	17.5	16.8	16.93
Hungary	16.2	16.4	21.3	17.8	17.93
Ireland	7.3	8.2	9.5	8.2	8.3
Italy	13.8	14.0	16.1	14.5	14.6
Latvia	18.9	17.0	20.6	18.6	18.78
Lithuania	19.9	15.1	19.8	18.1	18.23
Luxembourg	4.5	4.6	8.1	5.7	5.73
Netherlands	5.5	5.5	8.9	6.6	6.63
Poland	19.0	15.7	19.0	17.7	17.85
Portugal	23.4	15.3	19.5	19.2	19.35
Romania	24.6	24.0	24.4	24.1	24.28
Slovakia	6.4	5.7	7.2	6.3	6.4
Slovenia	14.2	15.7	20.2	16.5	16.65
Spain	7.6	7.1	10.3	8.2	8.3
Sweden	4.1	5.0	5.5	4.8	4.85
UK	6.5	5.0	8.4	6.6	6.63

The findings from Thomson and Snell (2013) demonstrate that the prevalence of fuel poverty is greatest in Eastern, Central and Southern European countries, particularly in Bulgaria where over 30 per cent of the population is estimated to be suffering from fuel poverty. In addition to compiling composite fuel poverty scores, Thomson and Snell also conducted logistic regression modelling, and found that across Europe living in a rural location, and being a tenant household increased the odds of experiencing fuel poverty indicators. The limitations of the research by Thomson and Snell (2013) are that it did not consider the relationship between indicators, it uses data from only one survey year, the data for EU27 is incomplete, and fewer predictor variables were used in the regression models compared with Healy and Clinch (2002a).

In addition to the research listed above that uses microdata, there have also been cross-national studies of fuel poverty that use macro EU-SILC data, namely by Bouzarovski (2013), and Grevisse and Brynart (2011). Macrodata is data that has been derived from microdata by aggregating household variable results into averages and frequencies (see United Nations Statistical Commission and Economic Commission for Europe, 2000). Whilst macrodata is more readily available than microdata, it is a poorer form of data that can only be used for country-level, rather than household-level, analyses of fuel poverty. The use of macrodata is perhaps due to access issues, particularly as Eurostat will only grant microdata access to organisations that they recognise as a research entity, and even then research projects will not necessarily be approved. Alternatively, the choice of macrodata usage could be due to a lack of training in data analysis, or simply a lack of knowledge about the limitations associated with aggregated macrodata.

Grevisse and Brynart (2011) used a variety of Eurostat macrodata to study fuel poverty in seven EU countries: Belgium, Denmark, France, Hungary, Romania, Spain, and the UK. It is not obvious why these seven countries in particular have been chosen, and no explanation is offered in the methodology. Nevertheless, using the inability to afford adequate warmth, and arrears on utility bills indicators, Grevisse and Brynart show that fuel poverty issues are highest in Romania. They further examine the indicators using the official EU measure of relative income poverty, which is having income below a threshold of 60 per cent of national equivalised median income. They find that the incidence of fuel poverty is much higher in households below the poverty line across all countries. The authors also look at macro Eurostat data concerning average expenditure on electricity, gas and other fuels split by income quintile, which is derived from Household Budget Survey (HBS) data. This is useful for understanding how the proportion of income spent on energy varies by income group, with households in the first quintile typically spending the highest proportion of income on energy. Subsequently, the authors discuss national averages for total energy consumption, dwelling surface area, and diffusion of central heating, in addition to the Gini coefficient[5]. A key limitation of this study is that it attempts to present information on known (in the UK at least) drivers of fuel poverty, without being able to test this relationship on data concerning the incidence of fuel poverty, which means the authors are making assumptions about the nature of European fuel poverty, which are not necessarily well founded.

By comparison, Bouzarovski (2013) presents a clearer overview of fuel poverty issues in his review of energy poverty in the EU. Using EU-SILC macrodata from 2003 to 2009 for

[5] The Gini coefficient is a measure of inequality of income distribution.

EU27 countries and Norway, Bouzarovski presents a composite index comprised of the three indicators used by EPEE (2009c) and Thomson and Snell (2013), plus an additional indicator concerning housing expenditure burden. The average of the 2003 to 2009 data is taken, rather than presenting each year separately. The index is slightly unusual in that the weights for the four indicators add up to more than 1, as demonstrated below:

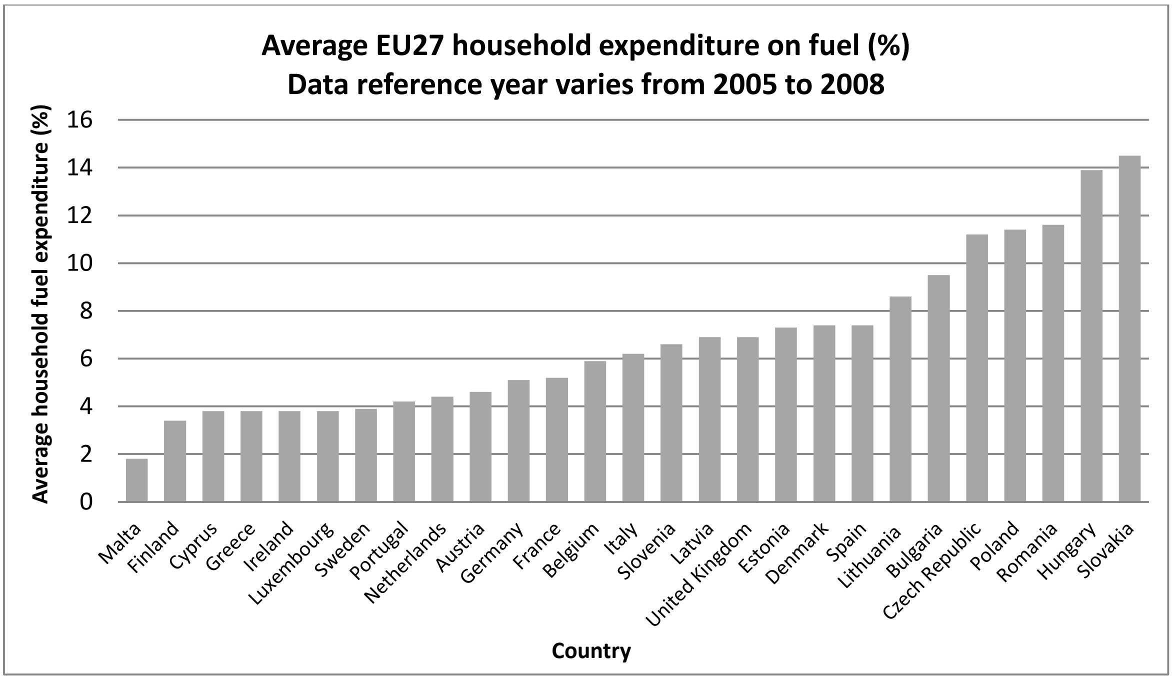
Composite index = 1.0 Inability to keep warm + 0.33 arrears on utility bills + 0.33 high housing costs burden + 0.33 leaks/damp/rot

A possible negative consequence of this weighting structure is that fuel poverty rates are exaggerated. Indeed Bouzarovski reports a composite fuel poverty score of 44.5 per cent for Bulgaria, which is over 10 percentage points higher than any of the scenarios produced by Thomson and Snell (2013). Although the results are higher, the patterns reported by Bouzarovski compare favourably with earlier research, showing that fuel poverty is highest in Eastern and Central European countries. As with the research by Grevisse and Brynart (2011), Bouzarovski's research is limited by the use of macrodata, which prevents an examination of information at the household-level.

All of the comparative studies outlined so far have one key commonality: the use of consensual data. This is due to the inaccessibility of standardised EU microdata concerning household energy expenditure. To date the only published research on fuel poverty that has used household energy expenditure microdata is a European Commission staff working paper (European Commission, 2010a). The European Commission use actual household fuel expenditure, derived from the HBS, to produce crude estimates of European fuel poverty levels. The HBS are national consumption expenditure surveys that are conducted across the EU, from which the weights for the Consumer Price Index are calculated, however, they are not standardised at the European level, with significant variation in sampling and frequency of surveys. Indeed, the reference year for the data used by the European Commission (2010a) varies from 2005 to 2008 depending on the country.

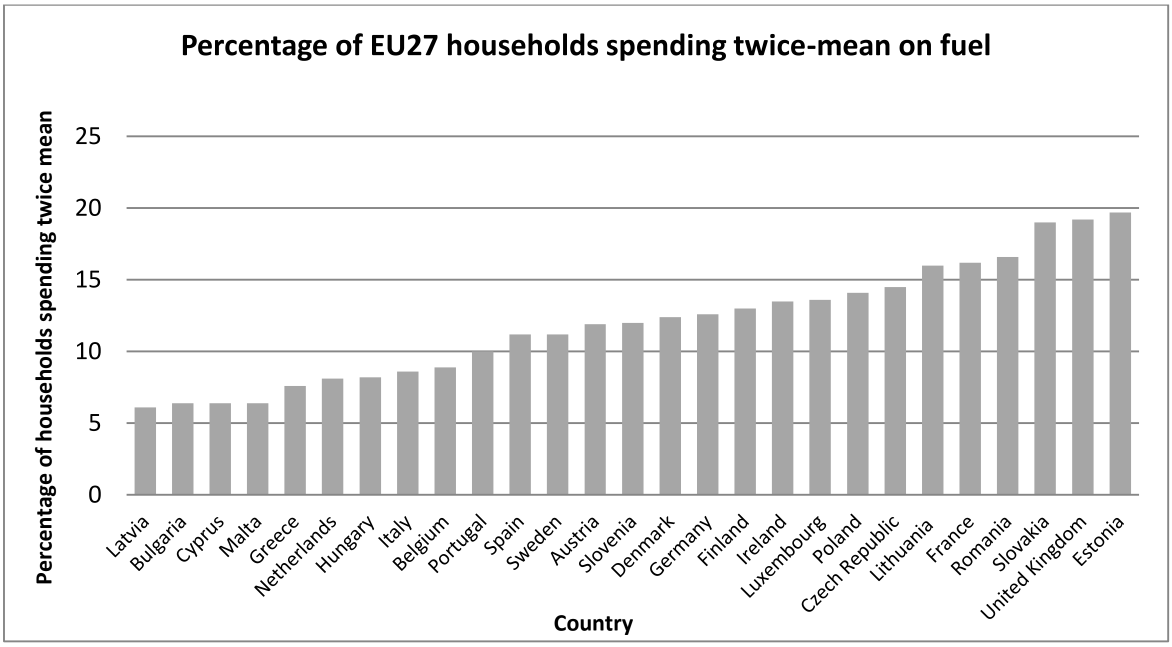
In line with the European Commission's proposed relative measure of fuel poverty, with households classed as fuel poor if they spend more than double the national average on fuel (European Commission, 2010a), fuel poverty is estimated using a twice-mean expenditure concept. Figure 5.3 depicts average household expenditure on fuel across each European country, showing that average household expenditure on fuel is highest in Eastern and Central Europe, with households in Hungary and Slovakia spending the most (13.9% and 14.5%), whilst households in Malta and Finland spend the least amount of income on fuel (1.8% and 3.4% of income respectively).

Figure 5.3 Average household expenditure on fuel. Source: European Commission, 2010a: 16



When a twice-mean expenditure concept is applied, as depicted in Figure 5.4, the incidence of fuel poverty is found to be highest in Estonia and the United Kingdom, and the lowest in Latvia and Bulgaria. However, as discussed in Chapter 2, actual expenditure on fuel is a poor indication of fuel poverty as low income households often spend significantly less on fuel than would be required to maintain a warm home (Moore, 2012). Furthermore, the use of mean values, rather than median, could be misleading as it gives weight to ‘atypically’ high values (Fahmy, 2011; Moore, 2012).

Figure 5.4 Percentage of households spending twice-national mean on fuel. Adapted from European Commission (2010a: 16)



Central and Eastern Europe and Central Asia

In addition to research focussed on EU countries, there has also been substantial research conducted on a wider geographical scale, focusing on Central and Eastern Europe and Central Asia in particular. These regions have three unique features that mean fuel poverty related issues are likely to be more pronounced than in other regions of Europe, namely the region’s cold climate, the legacy of central planning[6], and the significant drop in household incomes that has occurred over previous decades (Lampietti and Meyer, 2002: 5).

Early work by Lampietti and Meyer (2002) for the World Bank reported on heating strategies in urban areas of Eastern Europe and Central Asia. The report used household survey data from eight countries, of which two are EU Member States: Armenia, Croatia, Kyrgyz Republic, Latvia, Lithuania, Moldova, and Tajikistan. Although this study does not

[6] This refers to the Union of Soviet Socialist Republics, and satellite states, that existed until 1991. The Soviet Union favoured heavily centralised policy, and in terms of energy it prioritised the production and (over)consumption of carbon-intensive and polluting fuels, in combination with low efficiency of energy production, transmission and use (see Buzar, 2007a).

explicitly discuss fuel poverty or energy poverty, it does make an important contribution to knowledge on predicted energy consumption, fuel choices, and heating patterns. Among the key findings were that the 'non-poor' enjoyed a higher quality heat supply than the 'poor' at only slightly greater cost (Lampietti and Meyer, 2002). Furthermore, it was found that the energy demand of the poor is less income and price elastic than that of the non-poor, implying that heating price increases lead to greater proportionate welfare losses and a search for substitute fuels, such as firewood (Lampietti and Meyer, 2002). A key weakness of the study is that it does not outline how poor and non-poor households are defined and operationalised in the analysis.

The European Bank for Reconstruction and Development (EBRD) (2003) later examined the affordability of electricity and energy poverty in South East Europe. The study was concerned with the extent to which energy prices are cost reflective, and subsequently how affordable energy is for different consumer groups. EBRD's research was conducted in eight countries, including three EU Member States: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Moldova, Romania, and Serbia and Montenegro. Using survey data on household consumption and expenditure, in addition to a review of electricity sector reform in each country, the study found that electricity affordability was a problem for many household groups in South East Europe, including pensioners, unemployed, and those on a low income (EBRD, 2003). Furthermore, the research found that many countries had not yet developed sufficient social safety nets to protect fuel poor consumers.

The main contributor to knowledge on fuel poverty in the Central and Eastern European region is Stefan Bouzarovski who has previously published using the name Buzar (2007a; 2007b; 2007c). Buzar's earlier work focussed predominantly on fuel poverty issues in Macedonia and the Czech Republic (an EU candidate, and Member State respectively), which he conceptualised as energy poverty. Substantial field-based research was conducted across these two countries, by way of: secondary data analysis of the Macedonian Expenditure Survey, the Czech Family Budget Survey and other relevant data sources; two quota-based surveys of 200 households in two Macedonian cities; twenty in-depth interviews (10 per country) with households; and 45 semi-structured interviews with government officials, company representatives and NGO activists in both countries (Buzar, 2007a). This research generated numerous findings, such as that domestic energy deprivation in Eastern Europe is contingent on the relationship between the socioeconomic implications of post-socialist energy reforms, inadequate energy efficiency, and the mismatch between housing needs and heating systems (Buzar, 2007c: 1908). Households that were found to suffer from the worst incidence of fuel poverty were those containing unemployed adults and/or young children, in addition to pensioners. Buzar found that a significant number of households in each country may be living in energy poverty, ranging from between 4 and 11 per cent in the Czech Republic, and up to 60 per cent in Macedonia (Buzar, 2007b: 238). Furthermore, Buzar reported that the demographic profiles of the fuel poor were not entirely consistent with the more general pattern of income poverty (*ibid*.). As the author acknowledges, the main limitations of the research relate to secondary data quality, in terms of the surveys lacking direct fuel poverty measures, and issues of comparability between the two national surveys (Buzar, 2007a; 2007b).

Gaps in knowledge and methods

It is evident from the range of studies reviewed in this chapter that the recognition and analysis of fuel poverty incidence is growing rapidly across Europe, with an increasing number of studies emerging from countries that have not previously engaged with fuel poverty research. Single country studies of fuel poverty exist across twelve different Member States, with the broader comparative studies addressing the research deficit in the remaining Member State countries, as Table 5.14 below summarises. However, it is clear that no standard approach for measuring fuel poverty exists, with significant diversity in approaches between studies. At the national-level, a mixture of consensual and expenditure based approaches are used to quantify fuel poverty, whilst at the European-level consensual methods have prevailed. These trends have mainly been shaped by the availability of relevant data, or lack thereof.

Table 5.14 Summary of studies of fuel poverty across the EU

Country / region	Key quantitative studies
United Kingdom	• Isherwood and Hancock (1978), credited with first defining high fuel expenditure as spending more than twice the median on fuel, light and power. • Bradshaw and Hutton (1983), examined the options available for addressing fuel poverty. They analysed 1978 FES data, National Fuel and Heating Survey data and data from a 1978 Survey of Domestic Electricity Consumers. • Boardman (1991) formalised the topic in her monograph. • Department of Trade and Industry (2001), the first official government fuel poverty strategy, which used the 10 per cent required expenditure indicator. • Department of Energy and Climate Change (2010, 2013b), official monitoring documents. • Hills (2011, 2012), preliminary and final report from the official review of fuel poverty, which introduces the LIHC measure.
Ireland	• Healy and Clinch (2002b), conducted a representative household survey across Ireland, which collected data on a range of topics, including energy expenditure, thermal comfort, and ability to keep the home warm. • Sustainable Energy Ireland (2003), reviewed fuel poverty using Healy and Clinch's (2002b) survey and ECHP data from 1994 to 1997. • Scott *et al.* (2008), examined fuel poverty using microdata from the 2005 HBS, as well as ECHP, Living in Ireland Survey and EU-SILC data covering the period 1994 to 2006. • Department of Communications, Energy and Natural Resources (2011), in this government strategy report for achieving affordable energy a range of statistics are presented on potential risk of fuel poverty and estimates of national prevalence. • Watson and Maitre (2014), assessed whether fuel poverty is distinct from other general deprivation items featured in the Irish SILC survey. The authors used microdata from 2004 to 2011.
France	• Agence nationale de l'habitat (2009), analysed 2006 microdata from the National Housing Survey, which included expenditure and consensual data. • Jusot and Lacroix (2014), examined the health implications of fuel poverty measured via a subjective indicator, using microdata from the 2010 National Health, Health Care and Insurance Survey. • Legendre and Ricci (2015), apply three different measures of fuel poverty to microdata from the 2006 National Housing Survey.
Greece	• Santamouris *et al*. (2007), collected a range of data from households during 2004 in the major Athens area. • Katsoulakos (2011) examined the issue of fuel poverty in mountainous areas via a case study in a Greek mountain town. • Santamouris *et al*. (2013) provides an updated survey across the whole of Greece, although it is not clear whether this is a representative survey. • Santamouris *et al*. (2014), examines indoor environmental quality in a

	sample of low income households during the winter period in Athens, but does not explicitly measure fuel poverty. • Dagoumas and Kitsios (2014), is a macro-level analysis of the impact of the financial crisis on fuel poverty.
Germany	• Tews (2013), uses macrodata from a range of sources to explore the distributional effects of the low carbon transition. • Heindl (2013), uses actual expenditure microdata from the 2010 SOEP to apply different fuel poverty measures. • Becker *et al.* (2014), examine fuel poverty from an infrastructure perspective. They do no specifically quantify fuel poverty, but present statistics on changes in electricity prices, and regional disparities in electricity pricing and poverty.
Hungary	• Tirado Herrero and Ürge-Vorsatz (2010), use macrodata from HBS and EU-SILC. • Tirado Herrero and Ürge-Vorsatz (2012), examine fuel poverty in a sub-sample of multi-family buildings supplied with district heating, using HBS microdata from 2005 and 2008. • Fellegi and Fülöp (2012), present findings from a household survey on energy expenditure they conducted, although the methodology is not robust.
Austria	• Proidl (2009), collected qualitative and quantitative information about energy practices and expenditure from 58 households in Vienna and Lower Austria. • Kalliauer and Moser (2011), short analysis of household energy expenditure using macrodata. • Benke and Varga (2012) and Benke *et al*. (2012), present a comprehensive examination of fuel poverty based on a questionnaire survey of 78 households across Austria, and other data sources.
Spain	• Tirado Herrero *et al.* (2012; 2014), present a comprehensive assessment of fuel poverty using microdata from the Spanish HBS and EU-SILC surveys. • Sánchez-Guevara *et al*. (2014), use EU-SILC and HBS data to create a case study of fuel poor households in the Madrid region.
Belgium	• Huybrechs *et al.* (2012), used data from HBS, and EU-SILC, in addition to qualitative methods, to explore fuel poverty.
Italy	• Miniaci *et al*. (2014), present a detailed assessment of the affordability of gas and electricity using microdata from the 1998 to 2011 HBS. In addition, they used 2011 EU-SILC microdata to explore eligibility for an energy benefits scheme.
Denmark	• Nierop (2014), this masters dissertation uses a range of macrodata on household energy expenditure, electricity disconnections, and EU-SILC indicators, from 2003 to 2013.
The Netherlands	• Haffner and Boumeester (2014), study housing and energy affordability using 2012 data on income, rents, and fuel costs from a

	Dutch cross-sectional Housing Survey.
Pan-EU	• Whyley and Callender (1997), used ECHP to examine fuel poverty in four countries. However, only the executive summary is available. • Healy and Clinch (2002a), studied 14 EU countries using ECHP microdata from 1994-1997, and derived a composite indicator. • EPEE (2009c), studied the phenomenon in five countries using EU-SILC microdata from 2005. • European Commission (2010a), is a working document that estimated fuel poverty using a twice-mean expenditure concept and HBS data. • Grevisse and Brynart (2011), used macrodata from EU-SILC to study the issue in seven countries. • Thomson and Snell (2013), used EU-SILC microdata from 2007 to examine fuel poverty across 25 Member States, and replicated the composite measure used by Healy and Clinch. • Bouzarovski (2013), employed EU-SILC macrodata from 2003 to 2009 to examine country-level trends across EU27 and Norway. A composite index was produced, however, it exaggerates fuel poverty rates due to the weighting scheme used.
Central and Eastern Europe and Central Asia	• Lampietti and Meyer (2002), used survey data from eight countries to examine heating strategies. Fuel poverty is not explicitly discussed. • EBRD (2003), examined the affordability of electricity and energy poverty in South East Europe. The research was conducted in eight countries using survey data on household consumption and expenditure, in addition to a review of electricity sector reform in each country. • Buzar (2007a; 2007b; 2007c), is the main contributor to knowledge on fuel poverty in the Central and Eastern European region. The research is focussed primarily on Macedonia and the Czech Republic, using substantial field-based research, in addition to secondary data analysis.

The merits of expenditure and consensual measures of fuel poverty were discussed in Chapter 2, which concluded that an expenditure measure supported by estimated required energy expenditure is the most accurate method of quantifying fuel poverty. However, it was also found that this approach is currently impossible to apply beyond the UK as no other country collects detailed data on housing conditions capable of determining theoretical energy demand (Moore, 2012). Given this barrier, the alternatives are to use less favourable actual fuel expenditure data, or consensual indicators. Actual fuel expenditure data can lead to an underestimation of fuel poverty incidence as low-income households often consume significantly less than required to maintain a warm home (Moore, 2012; Hirsch *et al*., 2011), however, despite this limitation, an actual expenditure based approach has been used to measure fuel poverty in all of the single country studies. By comparison, consensual indicators, such as those concerning adequate warmth, utility bill arrears and housing conditions, are widely available, in part because the data is less complex to collect, and are said to be useful for potentially capturing the "wider elements of fuel poverty, such as social exclusion and material deprivation" (Healy and Clinch, 2002a: 10). However, consensual indicators have been criticised for their potential error of exclusion, whereby households may not identify themselves as fuel poor even though they may be characterised as fuel poor under other measures (Dubois, 2012; Boardman, 2011), and for the degree to which subjective measures overlap with expenditure measures (Palmer *et al.*, 2008; Waddams Price *et al*., 2012).

In terms of the quality of previous comparative research, all pan-EU academic studies have used consensual data from ECHP and EU-SILC, due to the absence of a dedicated survey of fuel poverty, and the lack of standardised data concerning household fuel expenditure. Furthermore, the last pan-EU analysis of microdata was conducted using data from 2007 (Thomson and Snell, 2013), which means it is likely the data will have been collected before households experienced the worst increases in gas and electricity prices, as well as decreasing incomes overall due to the global financial recession. The age of many of the comparative studies and the data used means that they are at risk of becoming obsolete as society rapidly changes to adapt to both the recession, and the transition to a low carbon economy. An additional concern is that no one has rigorously examined the relationship between indicators to determine the intensity of fuel poverty issues across the EU.

By comparison, many of the national level analyses have incorrectly partially transferred the UK's ten per cent methodology. By using a ten per cent actual expenditure threshold that is not grounded in the specific context of the country under study, researchers risk producing invalid results. The work by Haffner and Boumeester (2014) in the Netherlands, and Fellegi and Fülöp (2012) in Hungary, demonstrates the consequences of misapplying the UK definition. As with the comparative studies, many of the single country studies use data that is at risk of becoming outdated and irrelevant, indeed, the analysis of fuel poverty in France relies heavily on data that is almost a decade old. A further concern is that a high number of single country studies were found to have used macrodata, which is of poorer quality to microdata and cannot be used for detailed analysis at the household-level. This is perhaps due to access issues, lack of training in data analysis, or simply a lack of knowledge about the limitations associated with aggregated macrodata.

Since the review of fuel poverty measurement in England by Hills (2012) there has been a noticeable trend in non-UK studies to equivalise income, and occasionally to equivalise fuel costs too. However, this has not always been accompanied by a justification for equivalisation, nor an acknowledgement of the substantial effects that equivalising income and fuel costs can have. The OECD state that the choice of equivalence scales requires value judgements about the priority assigned to the needs of different individuals such as children or the elderly, as equivalising income will change the size of the poor population and its composition (OECD, 2013). Moore (2012) notes that the issue of whether to use equivalised income in fuel poverty measurement is controversial, with disagreement on the related issue of equivalising, or partially equivalising, fuel costs too. Both Moore (2012) and Palmer *et al*. (2008) have demonstrated the substantial change in the composition of households classified as fuel poor and low income respectively, that can be brought about by equivalising incomes. This is not necessarily an argument against equivalising income and fuel costs, but rather it indicates the need for researchers to be cognisant of the implications of equivalisation on the household groups classified as fuel poor, and to maintain full transparency when reporting the results of research.

The emerging literature shows that in developing a pan-European approach to measuring fuel poverty, country specific contexts must be acknowledged. For example, Tirado Herrero and Ürge-Vorsatz (2012) demonstrate that particular attention needs to be paid to the characteristics of district heating systems as many do not allow individual dwellings to regulate the temperature or timings. Such systems are widespread in Central and Eastern European countries, which led to Tirado Herrero and Ürge-Vorsatz (2012) identifying a new variant of fuel poverty.

In all, this chapter has demonstrated that whilst an increasing number of studies have been conducted in recent years, knowledge about fuel poverty is still lacking at the European-scale, and non-existent in many countries of the EU. For instance, the current literature is unable to determine what the intensity of fuel poverty issues is at the household-level across the EU, nor what increases household propensity to be fuel poor and if this differs substantially between EU countries. Furthermore, the quality of existing research is highly variable across Europe. To begin to address the identified gaps in knowledge, the subsequent chapter will assess the presently available pan-EU microdata that could be used to measure fuel poverty rates, with a focus on survey content, coverage, and availability. Thereafter, Chapter 7 outlines the methods for constructing a pan-EU fuel poverty measure.

Chapter 6: Analysis of currently available data

Introduction

In the preceding chapter, all known empirical investigations into fuel poverty across the EU were outlined in order to establish the state of the art in fuel poverty measurement and to identify the core gaps in knowledge. It emerged that no dedicated pan-EU survey of fuel poverty exists, and beyond the UK no dedicated national surveys exist either. This absence of nationally-representative data on domestic energy deprivation has been attributed to inadequate political awareness about insufficiently heated homes (Buzar, 2007a: 101), but may also be due to the significant costs associated with running representative surveys. The consequence of this data paucity is that researchers have to rely on alternative data that was not designed for the purpose of fuel poverty measurement, which is likely to impose significant constraints on the research process and outcomes.

During the literature review in Chapter 5, several statistical surveys emerged as key sources of pan-EU data that could be used to quantify fuel poverty, such as EU-SILC and HBS. The following chapter will now focus on reviewing these data sources, in addition to currently unutilised alternatives such as the Eurobarometer survey. Using academic literature, grey literature, survey methodology, and basic secondary data analysis of the pan-European datasets, the overall aim of the chapter is to critically appraise the options for quantifying EU fuel poverty, with a focus on survey content, coverage, and availability.

Currently available pan-EU data

Based on the surveys discussed in the previous chapter, and via data catalogue searches on the UK Data Service and GESIS - Leibniz-Institut für Sozialwissenschaften websites, five different surveys and one ad-hoc survey component have been identified as potential sources of pan-EU data on fuel poverty related issues. These are: Eurobarometer; European Quality of Life Survey; EU-SILC; EU-SILC ad-hoc housing conditions module;

GGP; and HBS. The EU-SILC and HBS surveys have previously been used for investigations into fuel poverty by numerous researchers and organisations, including European Commission (2010a), Scott *et al*. (2008), and Miniaci *et al*. (2014), whilst the GGP is being used for fuel poverty measurement for the first time in an ongoing study by Bartiaux *et al.* (2014). The additional EU-SILC ad-hoc survey component was found during the course of investigating the main EU-SILC survey, and the remaining two new surveys were located via data catalogue searches.

In order to comprehensively evaluate the various surveys, datasets for each survey were accessed and then evaluated using descriptive statistics. Table 6.1 below summarises the nature of the secondary data access. Microdata, which is detailed data at the level of individual respondents/households, was obtained for the majority of data sources, with the exception of the EU-SILC 2012 ad-hoc module and the HBS. Macrodata was used instead for these two surveys, which as mentioned in the previous chapter is data that has been derived from microdata by aggregating household variable results into averages and frequencies (see United Nations Statistical Commission and Economic Commission for Europe, 2000), thus restricting the range of statistical analyses that can be performed.

Table 6.1 Summary of secondary data access

Dataset	Micro/macro	Source
Eurobarometer 72.1 (2009), 73.2 + 73.3 (2010) and 74.1 (2010)	Micro	European Commission (2012a, 2012b, 2013)
EU Statistics on Income and Living Conditions, main survey 2005-2012	Micro and Macro	Eurostat contract, and Eurostat online Data Explorer
EU Statistics on Income and Living Conditions 2007 and 2012 housing conditions ad-hoc module	Micro and Macro	Eurostat contract, and Eurostat (2012c)
European Quality of Life Survey 2007 and 2012	Micro	European Foundation for the Improvement of Living and Working Conditions (2009b, 2014)
Generations and Gender Programme Survey Wave 1	Micro	United Nations Economic Commission for Europe (2011)
Household Budget Surveys	Macro	European Commission (2010a)

Over the course of this chapter, each of the data sources will be assessed individually according to their country coverage, sampling, and the relevant fuel poverty variables they contain. This will be followed by a concluding summary that outlines the key limitations of each survey, and selects a data source for quantifying EU fuel poverty.

Eurobarometer

The Eurobarometer is a series of public opinion surveys that have been conducted since 1973 on behalf of the European Commission (GESIS, 2013), with coverage across the EU28 countries. The Eurobarometer surveys employ a repeated cross-sectional design, with regular sample sizes ranging from 500 respondents in smaller countries (Luxembourg, Cyprus, Malta), 1,000 respondents in the majority of countries, through to 6,000 respondents in a limited selection of large countries, such as Germany (GESIS, 2012a). Eurobarometer uses a multi-stage random probability sampling design, whereby primary sampling units (PSU) are first selected from each of the administrative regions in every country from sampling frames that are stratified by the degree of urbanisation (GESIS, 2013: 7). Subsequently, a cluster of starting addresses is selected from each PSU at random, with further addresses chosen systematically at random (*ibid.*). The final stage of sampling involves selecting a single respondent, aged 15 or over, from each household at random, using the closest birthday rule (*ibid.*). The interviews are conducted face-to-face in the respondent's homes, with some countries using Computer Assisted Personal Interview techniques (GESIS, 2013).

The surveys are designed to provide regular monitoring of public attitudes across the EU via specific trend questions. To date, Eurobarometer data has not been used to quantify fuel poverty, even though there have been three editions of the Eurobarometer survey that provide data on fuel poverty related issues. Eurobarometer 72.1 (2009) and 74.1 (2010) contain the following two survey questions:

1. There are some things that many people cannot afford, even if they would like them. For each of the following things on this card, can I just check whether your household can afford it if you want it? Keeping your home adequately warm. (GESIS, 2012a, 2013).

2. Looking at the next 12 months, would you say there is a high risk, some risk, not much of a risk or no risk at all of falling behind with paying utility bills (electricity, water, gas, etc.) on time? (*ibid.*).

Eurobarometer 73.2 + 73.3 (2010) contains a further three variables that concern housing condition:

3. Do you have any of the following problems with your current home? Damp walls/floors/foundation (GESIS, 2012b).
4. Do you have any of the following problems with your current home? Rot in window frames or floor (*ibid.*).
5. Do you have any of the following problems with your current home? A leaking roof (*ibid.*).

These five variables can be used as proxy indicators of fuel poverty, and collectively contribute to measuring different aspects of the multi-dimensional phenomenon. For instance, as the discussion on minimum room temperatures in Chapter 2 demonstrates, fuel poverty is fundamentally concerned with households achieving adequate warmth. Therefore, the first variable is a key proxy as it encompasses the standard qualitative definition of a fuel poor household (Healy and Clinch, 2002a). Indeed, the CoR has recently stated that this variable can be used to measure energy poverty (CoR, 2014). However, as outlined in Chapter 2, this variable has been criticised for the potential error of exclusion, whereby households may not identify themselves as fuel poor by this measure, even though they may be classified as fuel poor under alternative measures (Dubois, 2012). Furthermore, the concept of 'adequate warmth' is subjective and culturally specific, meaning that a "home normally considered well-lit and warm in one geographical context may not be seen as such in another" (Bouzarovski, 2013: 3). On the other hand, some of these listed flaws could be mitigated by cross-referencing this indicator with objective indicators concerning dwelling quality and economic strain (Bouzarovski, 2013).

By comparison, experiencing financial difficulties with utility bills may indicate a household is struggling to afford adequate energy services (Thomson and Snell, 2013). Furthermore, people unable to keep up to date on utility bills may suffer from disconnection of supply (Healy and Clinch, 2002a), which will significantly endanger health, as discussed in Chapter 2. However, a key flaw with this indicator is that it refers to a range of utility bills, including water and refuse collection charges (where applicable), which may create an overestimation of fuel poverty based on this indicator alone. The results for this variable should therefore be read with caution.

The final three variables all concern housing condition, and could be used to indicate poor energy efficiency and/or dangerous energy practices. For example, the presence of damp walls or rotten windows may indicate a property is being continuously unheated or ineffectively heated (Healy and Clinch, 2002a), which is a possible consequence of fuel poverty. Furthermore, as EPEE note, dampness can cause the very fast deterioration of a building, and an alteration in the mechanical properties of walls, doors and windows (EPEE, 2009a: 14). In this regard, damp can become a vicious circle, whereby “the more damaged an accommodation is, the more difficult it is to heat it, as dampness develops quicker” (EPEE, 2009a: 14), necessitating an increase in energy consumption to maintain thermal comfort (EPEE, 2009a). Similarly, a leaky roof is likely to compromise the energy efficiency of a property, and lead to additional damp and rot problems. However, a key limitation of the housing condition variables is that they do not provide an indication of the proportion of the property affected by damp, rot, or leaks. Consequently, researchers are unable to determine the severity of the condition, resulting in households with issues of damp, rot and/or leaky roofs treated as a homogeneous group in analyses, whereas in reality there is likely to be an underlying scale.

Compared to the EU-SILC counterparts seen in the previous chapter and as outlined below, it is evident that some of the Eurobarometer variables offer more detail. For instance, the housing condition indicators are three separate variables, whereas the EU-SILC equivalent is a combined variable. This allows researchers to distinguish between issues of damp, which may be minor, and households that have a leaking roof, which could be a more substantial housing fault. The risk of falling behind on utility bills variable also offers a good level of detail by using a scale response format (high risk, some risk, *etc*.) rather than a binary format, which is used extensively in EU-SILC. However, it should be noted that this variable refers to future risk, whereas the EU-SILC equivalent refers to existing defaults and arrears on utility bills in the preceding twelve months. Furthermore, the key fuel poverty variables in the Eurobarometer series are not asked at the same time, or to the same sample.

Microdata from all three Eurobarometer datasets has been analysed to produce summary figures for EU27, as displayed in Table 6.2. The cross-national EU27 weight has been applied to the data in order to produce population averages for the EU. In general, the results compare favourably with EU-SILC figures, for instance surveys 72.1 and 74.1 demonstrate inability to keep home warm is 7.5% and 8% respectively, which is close to the EU-SILC estimates of 9.2% and 9.4% for corresponding years.

What is particularly interesting about the results shown in Table 6.2 is the risk of falling behind on utility bills over the next 12 months. The EU-SILC figure for people currently in arrears is 8.9% across both years, which is significantly lower than the percentage of people who consider there to be some risk of them falling behind (15.4% and 16.1%), but also around twice as high as the percentage of people who consider there to be a high risk (3.4% and 3.8%). The scale variable format used in Eurobarometer helps to distinguish between different groups of people in terms of their perceived risk of falling behind on utility bill payments.

Also of note are the results for the three housing condition variables, which clearly show that issues of damp are the most prevalent house condition issue, compared with a leaking roof and rotten windows/floor. In EU-SILC, the combined leaks, damp, rot variable is noticeably higher than the other two EU-SILC fuel poverty indicators, perhaps due to widespread issues of damp. In this regard, it may be beneficial to further compare and contrast the two datasets.

Table 6.2 Summary statistics from Eurobarometer 72.1, 73.2 + 73.3, and 74.1 based on analysis of Eurobarometer microdata

Indicator	72.1 (2009)	73.2 + 73.3 (2010)	74.1 (2010)
Inability to keep home warm	7.5%	N/A	8.0%
Risk of falling behind on utility bills over next year	High risk: 3.4% Some risk: 15.4%	N/A	High risk: 3.8% Some risk: 16.1%
Leaking roof	N/A	6.0%	N/A
Damp walls/floors	N/A	12.1%	N/A
Rot in windows/floor	N/A	6.1%	N/A

In addition to the aforementioned consensual indicators, Eurobarometer 72.1 and 74.1 also ask respondents for their opinion about minimum acceptable living standards. Respondents are asked to choose five items from a list, which includes keeping one's home adequately warm when it is cold outside, and having access to gas, electricity, tap water (GESIS, 2013). Whilst these opinion variables cannot be used to measure the incidence of fuel poverty related problems, they could be used to determine public opinion on what items are necessary, which is an important foundation for consensual measures (see Gordon *et al*., 2000). Indeed Chapter 2 revealed a weakness of previous pan-European consensual fuel poverty research, namely that the indicators have not been tested with the general public prior to analysis, thus consensus is assumed to exist across twenty-eight diverse countries.

Analysis of Eurobarometer 72.1 and 74.1 microdata from 2009 and 2010 respectively (with a cross-national EU27 weight applied), shows that while respondents from the majority of European countries concur that adequate warmth and access to gas, electricity and water are essential, it is not unanimous across the EU. Indeed, as shown in Table 6.3, in 2010 just 34.2 per cent and 44.5 per cent of respondents in Slovakia and Bulgaria consider access to gas, electricity and water a necessity, and only 22.7 per cent and 32.9 per cent of respondents in Malta and Portugal respectively, consider adequate warmth a necessity. The implication of these results is that caution needs to be applied in the analysis of indicators related to adequate warmth in Malta and Portugal, countries where adequate warmth is not widely considered a necessity. It also suggests a need to further assesses the quality and validity of consensual fuel poverty indicators in a pan-European context. Conversely, the design of the survey question, which asks respondents to choose 5 items from a list of 14 items, means that the results shown in Table 6.3 are not a measure of the degree of concern about those particular items, nor does it necessarily imply that the respondents do not think adequate warmth and gas, electricity and water access are essential, per se. Rather, it demonstrates that other items, such as having a place to live that is well maintained and kept in a decent state of repair, or having access to a basic bank account, are assigned higher priority.

Table 6.3 Public opinion about what is necessary to afford to attain a minimum adequate standard of living, based on analysis of Eurobarometer 72.1 and 74.1 microdata

Country	% who think it's necessary to keep home adequately warm		% who think it's necessary to have access to gas, electricity, tap water	
	72.1 (2009)	74.1 (2010)	72.1 (2009)	74.1 (2010)
Austria	71.2%	70.0%	70.6%	68.2%
Belgium	64.6%	65.6%	77.3%	76.2%
Bulgaria	69.6%	74.7%	35.3%	44.5%
Cyprus	51.7%	52.4%	66.7%	65.1%
Czech Republic	69.7%	65.9%	70.0%	70.2%
Denmark	64.8%	64.5%	74.2%	77.1%
Estonia	61.8%	61.7%	61.1%	60.0%
Finland	72.8%	71.6%	74.6%	73.0%
France	58.3%	60.4%	78.5%	79.8%
Germany	74.6%	74.9%	75.7%	70.4%
Greece	73.1%	60.5%	53.8%	50.0%
Hungary	66.5%	71.9%	70.1%	66.6%
Ireland	80.5%	82.8%	55.5%	71.0%
Italy	52.9%	54.5%	56.4%	59.1%
Latvia	45.6%	53.7%	65.9%	64.2%
Lithuania	57.9%	57.2%	59.6%	61.8%
Luxembourg	67.2%	53.8%	65.7%	66.7%
Malta	25.6%	22.7%	72.1%	72.7%
Netherlands	59.7%	61.5%	84.3%	88.2%
Poland	53.2%	55.5%	62.0%	62.2%
Portugal	29.6%	32.9%	59.7%	56.9%
Romania	46.5%	51.0%	54.6%	59.6%
Slovakia	63.1%	66.4%	38.0%	34.2%
Slovenia	69.0%	68.4%	74.8%	80.7%
Spain	48.5%	45.5%	48.8%	64.1%
Sweden	67.6%	71.1%	60.7%	62.1%
United Kingdom	66.4%	63.8%	73.0%	72.5%

Overall, the Eurobarometer survey is one of the smallest examined in this chapter in terms of sample size. Although the sampling framework used ensures it is nationally representative, the sample size restricts analysis power in terms of investigating differences between groups, and sub-national variations. The broader issue for fuel poverty measurement is how often the relevant indicators have been asked in Eurobarometer surveys. Given the transient nature of the Eurobarometer series, it cannot be used for investigating fuel poverty on an annual basis. However, the Eurobarometer data should not be completely disregarded as it offers unique data on perceived risk of falling behind on utility bills, and public opinion concerning minimum living standards. It also offers the opportunity to conduct a more detailed examination of housing conditions due to the use of three separate variables.

EU-SILC (Main survey)

As discussed in previous chapters, the EU-SILC is the successor to the ECHP, and aims to be a "reference source for comparative statistics on income distribution and social exclusion at European level" (Eurostat, 2010b: 10). The EU-SILC survey was launched in 2003 on the basis of a 'gentlemen's agreement' in six Member States (Belgium, Denmark, Greece, Ireland, Luxembourg and Austria) and Norway (Eurostat, 2010b: 15). Since 2003 the survey has expanded its coverage, corresponding with successive EU enlargements. Data for EU27 has been available since 2007, and for EU28 since 2010. It provides comparable annual data in two formats, cross-sectional and longitudinal. EU-SILC is the largest dataset available, with a minimum pan-EU sample of 121,000 households cross-sectionally, and 90,750 households longitudinally.

As noted in the previous chapter, EU-SILC has made significant improvements on its predecessor, the ECHP, which suffered from issues of reliability, varied response rates and incomplete geographical coverage (Clemenceau and Museux, 2007). However, there have also been several major modifications, which reduce the comparability and reliability of EU-SILC compared with ECHP. Firstly, the ECHP was input harmonised, which means it was based on harmonised questionnaires in each country. By comparison, EU-SILC is output harmonised, that is each country is given "the specification of a set of social and economic indicators which should be provided by the new data set, but it is up to each of the member states to decide how these are to be collected" (Iacovou *et al*., 2012: 1). As Eurostat (2006) note, the large flexibility in sampling design means that depending on the country, EU-SILC microdata could be sourced from:

- Two or more national sources (surveys and/or registers);
- One or more existing national sources combined or not with a new survey;

• A new harmonised survey to meet all EU-SILC requirements called the integrated design. (Eurostat, 2006: 1).

A further point of departure is in the longitudinal panel design. The ECHP was a fixed panel survey, with the same individuals re-interviewed year after year, whereas the EU-SILC uses a rotating panel, whereby individuals are "interviewed usually for a maximum of four years, and the sample is regularly refreshed with new members" (Iacovou *et al*., 2012: 1). However, Eurostat argue that there are major problems associated with fixed panels, specifically "cumulative respondent burden and sample attrition, as well as the greater complexity in control and follow-up of the lag sample" (Eurostat, 2010b: 19), whereas rotating panels overcome some of those issues, whilst producing useful longitudinal data.

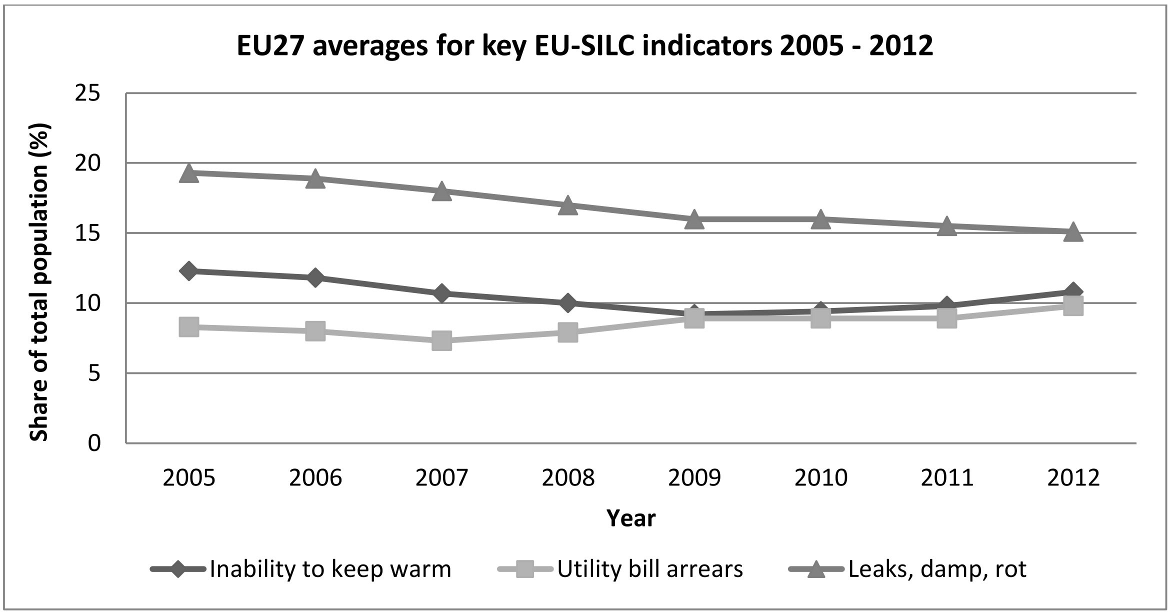
In terms of variable changes, a number of fuel poverty relevant variables were dropped from the main annual survey in the transition to EU-SILC, leaving three key variables in the main EU-SILC survey that can be used as proxy indicators of fuel poverty:

1. Can your household afford to keep its home adequately warm?
2. In the last twelve months, has the household been in arrears, i.e. has been unable to pay on time due to financial difficulties for utility bills (heating, electricity, gas, water, etc.) for the main dwelling?
3. Do you have any of the following problems with your dwelling / accommodation? − a leaking roof − damp walls/floors/foundation − rot in window frames or floor (Eurostat, 2010b).

The reasons for using these as proxies of fuel poverty have been discussed in the previous section. Specific flaws of the EU-SILC data are that all the variables are in binary format, with respondents only able to answer 'yes' or 'no', which fails to capture variation in severity and frequency. Furthermore, no follow up question is asked to households that say they cannot afford to heat their home, which prevents further insight. Unlike the Eurobarometer data, EU-SILC does not distinguish between a leaking roof, damp walls, or rotten windows. A further issue with this indicator is that Eurostat are proposing to remove it from the main annual survey and instead include it in the ad-hoc housing conditions module (Eurostat, 2012a), which has only been used every five years to date.

Figure 6.1 displays the average figures for the three EU-SILC indicators from 2005 through to 2012, across the 27 EU Member States (EU27)[7]. Generally the responses have been highest for the leaks, damp, rot indicator, followed by inability to keep warm and the utility bill arrears indicator. With the exception of the utility bill arrears, the situation was worst in 2005, with 19.3% of the population living in a home that was damp, rotten or leaking, and 12.3% of the EU27 population unable to attain adequate warmth.

Figure 6.1 EU27 averages for EU-SILC indicators 2005 – 2012 based on analysis of Eurostat macrodata



Despite some of the data flaws mentioned above, EU-SILC is the largest standardised survey currently available, and is the prevailing source of data on fuel poverty issues across Europe, especially as the very large sample offers the potential to conduct in-depth modelling of fuel poverty, including at the sub-national level. In their review of fuel poverty in Northern Ireland, Liddell *et al.* (2011) acknowledge that whilst EU-SILC and the broader consensual approach has a number of flaws, use of EU-SILC "allows a modest opportunity to explore energy circumstances among households in the European Union; in the absence of robust and continuous data on household expenditure and income it remains a useful source of information" (Liddell *et al*., 2011: 61-62).

[7] Please note, the results for 2005 and 2006 predate the accession of Romania and Bulgaria to the EU in 2007, but their individual results are included in the EU27 average.

EU-SILC (Ad-hoc modules)

Complementary to the main annual EU-SILC survey, Eurostat also run several ad-hoc modules on topics such as intergenerational transmission of disadvantages, and social participation (Eurostat, 2012b). The sample for the ad-hoc modules is the same as for the main survey. Of particular interest are the 2007 and 2012 housing conditions modules. In the 2007 housing conditions module, there are four variables that are useful for fuel poverty measurement:

1. Dwelling comfortably warm during winter time
2. Dwelling equipped with heating facilities
3. Dwelling comfortably cool during summer time
4. Dwelling equipped with air conditioning facilities (Eurostat, 2009b).

The interesting unifying characteristic of these variables is that they are concerned with the equipment present in the dwelling. Unlike the adequate warmth question in the main survey, which asks about ability to pay, the two subjective thermal comfort questions in the ad-hoc module are trying to determine if the household is unable to achieve adequate warmth or coolness as a result of their central heating or air conditioning system being inefficient and/or because the property is insufficiently insulated (Eurostat, 2009b). This is important as it provides an assessment of the energy efficiency capabilities of the property, albeit subjective. The first variable, concerning the ability to achieve adequate warmth, is a useful proxy indicator of fuel poverty as households living in a property with unsuitable heating and/or insulation are likely to be unable to achieve comfortable living conditions. Indeed, in this situation households will be forced to make difficult choices: to try to heat their home anyway, perhaps by way of additional unfixed heaters, facing the risk of higher energy bills and potential debt; or to use little or no heating, and consequently live in the cold (EPEE, 2009a: 10). The second variable determines whether a household has central heating installed, or other forms of fixed heating, such as electrical radiators, fixed gas heaters or similar (Eurostat, 2009b: 4). It can be used as a proxy indicator of fuel poverty as households that lack central heating or other forms of fixed heating will struggle to efficiently heat their home (Healy, 2004).

The latter two variables concerning adequate coolth and air conditioning have not been utilised in fuel poverty research to date, despite the strong evidence for excess summer mortality, as outlined in Chapter 2. Consequently, there is limited European evidence around summer time cooling difficulties, although there have been calls for a broader fuel poverty measure that encompass cooling relating difficulties in summer (Ürge-Vorsatz and Tirado Herrero, 2012; Healy, 2004). However, the difficulty with using the air conditioning variable is that EU-SILC finds the majority of households do not have a system, as shown later in Table 6.4. It is questionable, therefore, whether it can be used as an indicator of fuel poverty if most of the population lack that item. By comparison, the comfortably cool variable certainly warrants further investigation.

The 2012 module retains the first three variables listed above, but drops the air conditioning question. This slightly reduces the amount of technical energy efficiency information available on the property. However, the 2012 module does introduce a new variable that measures the size of the dwelling in square metres, by measuring the floor space inside the outer walls but excluding non-habitable cellars and attics (Eurostat, 2012c). This variable could be useful for ascertaining the size of the property, and in conjunction with variables on the number of people living in the property and the number of rooms, it can be used to determine under or over-occupancy. Furthermore, floor space has been found to be one of the best single proxies for energy demand (Walker *et al.*, 2012).

Table 6.4 summarises the 2007 and 2012 figures for the variables described above. As can be seen there has been a significant improvement in the coverage of heating facilities across Europe in the five year interval, in conjunction with a decrease in the number of households that report they are unable to keep comfortably warm or cool.

Table 6.4 Summary results from the 2007 and 2012 EU-SILC ad-hoc modules (share of total population), based on analysis of Eurostat macrodata

Statement	2007 (EU27)	2012 (EU28)
Not comfortably warm during winter time	14.8%	12.9%
Not equipped with heating facilities	6.0%	1.5%
Not comfortably cool during summer time	25.8%	19.2%
Not equipped with air conditioning facilities	89.2%	-
Average size of dwellings	-	102.3m^2

Whilst the ad-hoc modules improve the richness of data concerning fuel poverty issues, particularly as they go beyond financial factors, the utility of these variables is constrained by the infrequency of the housing conditions ad-hoc module, which prevents annual trends to emerge. Nevertheless, the ad hoc data could be matched to the corresponding main survey for 2007 and 2012, enabling a broader assessment of fuel poverty issues.

European Quality of Life Survey (EQLS)

The EQLS has been conducted three times by the European Foundation for the Improvement of Living and Working Conditions (also known as Eurofound), in 2003, 2007 and most recently in 2012. As the name implies, the aim of the EQLS is to explore the quality of life throughout Europe, and data is available for all EU28 Member States. The survey focuses on living conditions, attitudes, health and wellbeing (see Eurofound, 2009a). The EQLS survey has a slightly larger sample than the Eurobarometer surveys, with approximately 2,000 respondents from Germany, 1,500 respondents from France, Italy, Poland and the UK, and 1,000 respondents from the remaining EU countries (Eurofound, 2009a: 2).

The sampling design used in most of the countries for the EQLS is very similar to the Eurobarometer, following a multi-stage, stratified and clustered design (Eurofound, 2009a), with a single respondent chosen from each household for a face-to-face interview. A key difference is that persons aged 18 years and over are eligible for selection (*ibid.*), compared with Eurobarometer's 15 years or over criteria.

As with the Eurobarometer survey, EQLS data has not yet been utilised for fuel poverty measurement, despite containing four core variables:

1. There are some things that many people cannot afford, even if they would like them. For each of the following things on this card, can I just check whether your household can afford it if you want it? Keeping your home adequately warm.
2. Has your household been in arrears at any time during the past 12 months, that is, unable to pay as scheduled utility bills, such as electricity, water, gas?
3. Do you have any of the following problems with your accommodation? Rot in windows, doors or floors.
4. Do you have any of the following problems with your accommodation? Damp or leaks in walls or roof (Eurofound, 2009a).

The first two variables are identical to the counterparts in the main EU-SILC survey, however, unlike the EU-SILC variable, housing conditions is split into two separate variables. This enables researchers to distinguish between issues of damp, and rot.

Table 6.5 has been produced using microdata from the 2007 and 2012 editions of the EQLS. A cross-national EU27 weight has been applied in both years in order to calculate averages for the EU population. The results demonstrate that since 2007 there has been a marginal EU-wide improvement in the prevalence of rot in windows, doors or floors, but no change in the prevalence of damp. There has also been a noticeable increase in the percentage of people unable to afford to keep their home warm, as well as an increase in arrears on utility bills.

Across both years the housing condition variables are much lower than the corresponding data points for the leaks, damp, rot variable in EU-SILC, which were 18.0% in 2007 and 15.1% in 2012. Conversely, the EQLS figures for arrears on utility bills are higher than the EU-SILC figures: 7.3% and 9.8% respectively, compared with EQLS's 12.5% and 15.0%. Finally, the EQLS reports inability to attain adequate warmth to be lower in 2007, at 8.9%, whereas the EU-SILC figure is 10.7%, but in 2012, the EQLS figure increases to 11.7% whilst the EU-SIC remains stable at 10.8%. This difference in figures can be partly attributable to potential sampling errors in the EQLS, which has a much smaller sample than EU-SILC, however, it does also suggest the need to further examine the differences between surveys.

Table 6.5 Summary statistics from EQLS 2007 and 2012, based on analysis of EQLS microdata

Indicator	2007	2012
Inability to keep home warm	8.9%	11.7%
Rot in windows, doors or floors	9.2%	8.6%
Damp or leaks in walls or roof	11.9%	11.9%
Arrears on utility bills	12.5%	15.0%

The main limitation of this survey is the size of the national samples. Whilst they are nationally representative, they are too small to allow a detailed analysis of subgroups, such as unemployed people or single-parent families (Eurofound, 2009a: 95). A further limitation is that the survey is not conducted annually, preventing yearly monitoring of fuel poverty trends.

Generations and Gender Programme Survey (GGP)

The GGP is conducted across 19 countries worldwide, of which 13 are EU Member States. The main goal of the GGP is to improve understanding of demographic and social development, with a particular focus on the relationships between children and parents, and the relationships between partners (United Nations Economic Commission for Europe, 2007). The GGP has a large average sample of 9,000 respondents per country, and aims to survey nationally representative samples of men and women between the ages of 18 and 79 (United Nations Economic Commission for Europe, 2007: 6). The GGP uses a panel design, with at least three panel waves anticipated, each with intervals of three years between any two waves (United Nations Economic Commission for Europe, 2007: 5). This time period was chosen as it is considered sufficient to observe many demographic events for analysis, whilst ensuring that dropout from panel follow-up would be reasonably low (*ibid*.). The sampling design varies by country, but typically involves simple random sampling from the national population register, rather than the systematic multi-stage cluster sampling employed by other surveys in this chapter.

Data from this survey has only been used once to date for fuel poverty purposes by Bartiaux *et al*. (2014) in their ongoing research project focussing on Belgium. The GGP dataset contains the three core indicators of fuel poverty present in the preceding consensual datasets, namely:

1. There are some things many people cannot afford even if they would like them. Can I just check whether your household can afford these, supposing you wanted them? Keeping your home adequately warm.
2. Has your household been in arrears at any time during the past 12 months, that is, unable to pay as scheduled any of the following? Utility bills, such as for electricity, water, gas.
3. Do you have any of the following problems with your accommodation? Leaking roof, damp or rot walls, floors, foundation or window frames (United Nations Economic Commission for Europe, 2007).

Using Wave 1 microdata, an attempt was made to estimate the prevalence of fuel poverty related issues in 13 EU countries present in the GGP, with a household weight applied to produce population figures. However, there are significant levels of missing and incomplete data for the three core indicators; the dashes in Table 6.6 below indicate the data is entirely missing, whilst * indicates high levels of missing data, in excess of 50 per cent, for individual variables. Using a dataset with high levels of missing data has the potential to produce larger standard errors, lead to a reduction in the power to find significant results, and to introduce bias in effect estimates (Howell, 2008), thus for these reasons it would be advisable to avoid using this data source in its current form.

Table 6.6 Summary results from GGP survey, based on analysis of Wave 1 microdata

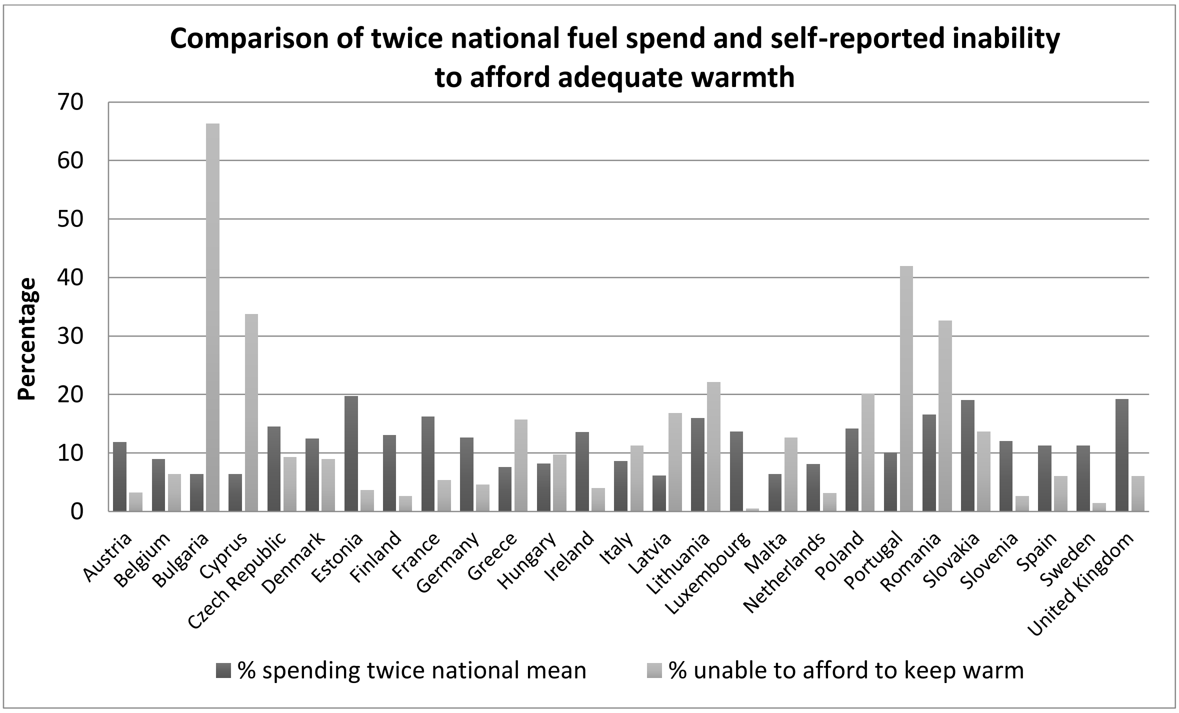
Country	Leaks, damp, rot	Inability to keep warm	Utility bill arrears
Austria	-	2.6%	17.3%
Belgium	16%*	7.5%	8.1%
Bulgaria	23.3%*	18.4%	26.3%
Czech Republic	17.8%*	8.1%	7.1%
Estonia	-	-	-
France	-	6.2%*	4.9%
Germany	-	-	-
Hungary	-	-	14.5%
Italy	-	-	-
Lithuania	-	8.4%	2.2%
Netherlands	-	-	-
Poland	-	17.4%	-
Romania	-	14.3%	14.6%

HBS

The HBS are national consumption expenditure surveys that are conducted in all EU28 countries and contain data on household expenditure on goods and services, including household energy. The main purpose of HBS is to compile weights for Consumer Price Indices and national accounts (Eurostat, 2014a). However, at present there is significant variation in sampling methods, variable design and how often Member States conduct HBS, ranging from annually to every five years (Eurostat, 2014a), thus the data is not yet standardised across the EU. For the 2005 HBS round, the achieved sample sizes ranged from 1,570 (NL) to 52,217 (DE), see Eurostat (2009a) for more details. Whilst the microdata should be obtainable on an individual country basis from many, if not all, of the national statistical offices (subject to licensing), Eurostat do not currently make the combined EU data publicly available. To date only the European Commission (2010a) have accessed EU HBS data to examine fuel poverty, as detailed in the previous chapter.

In the previous chapter, the macro data provided by the European Commission was used to show the average proportion of actual household income that is dedicated to fuel expenditure, and the percentage of households across EU27 that spend twice the national average on fuel. Rather than repeat those charts here, the data is instead matched to the EU-SILC adequate warmth indicator by data reference year, which varies from 2005 to 2008 depending on the country. The results in Figure 6.2 show a varying pattern between the two indicators, with differences ranging from only 1.5 percentage points in Hungary and 2.5 percentage points in Belgium, through to 59.9 percentage points in Bulgaria and 31.9 percentage points in Portugal. In most instances (59.3 per cent), the HBS scores are higher than the corresponding EU-SILC indicator, but overall it demonstrates a less erratic pattern than the self-reported ability to afford adequate warmth indicator.

Figure 6.2 Comparison of percentage of households spending twice-mean, and self-reported inability to keep warm. Source: EU-SILC and European Commission, 2010a



Whilst the use of actual fuel expenditure has its limitations for measuring fuel poverty, as discussed in earlier chapters, the HBS data has been used to quantify EU and national-level fuel poverty due an absence of alternative expenditure microdata (see for example, European Commission (2010a), Huybrechs *et al*. (2012), Sánchez-Guevara *et al*. (2014)) . The HBS data does therefore have potential for further utilisation. However, it would require a significant time investment as further exploratory work would be needed to determine if currently available HBS data could be partially harmonised by uprating the income and energy expenditure data to the same reference year, by using microsimulation modelling that incorporates changes to inflation, poverty and energy prices.

Summary

Over the course of this chapter, five different surveys, and one ad-hoc survey, have been critically assessed to determine their suitability for measuring the incidence of EU fuel poverty issues. It is evident from this assessment that a paucity of suitable data at the EU level is limiting the measures that can be applied universally as well as preventing rigorous assessment of fuel poverty across the EU. There is no dedicated survey of fuel poverty, and no standardised household microdata on energy expenditure, energy consumption, or energy efficiency. As a result, researchers are mainly reliant on subjective data concerning the *consequences* of fuel poverty, such as arrears on utility bills and the presence of damp in the home, rather than data on the *causes* of fuel poverty, such as high energy costs and specific energy demands. In Table 6.7 below, all of the data sources have been summarised according to the relevant variables they contain, and their associated limitations.

Table 6.7 Summary of available surveys and their limitations

Survey	Relevant variables	Limitations
EU-SILC main survey 2003 - present	• Ability to afford to keep home warm • Utility bill arrears • Dwelling is leaking, damp or rotting	• Subjective data • Eurostat are considering dropping the leaks/damp/rot variable
EU-SILC 2007 housing conditions ad-hoc module	• Dwelling equipped with heating facilities • Comfortably warm during winter time • Dwelling equipped with air conditioning facilities • Comfortably cool during summer time	• The module has only been run every five years • Subjective data
EU-SILC 2012 housing conditions ad-hoc module	• Dwelling equipped with heating facilities • Comfortably warm during winter time • Comfortably cool during summer time • Size of the dwelling (m^2)	• The module has only been run every five years • Subjective data • Loss of air conditioning variable
HBS	• Household energy expenditure	• The HBS surveys are not harmonised, with wide variation in sampling • Pan-EU dataset not released to public • Produces actual energy expenditure data
Eurobarometer 72.1 (2009) and 74.1 (2010)	• Ability to afford to keep home adequately warm • Risk of falling behind with paying utility bills on time	• Small samples • Subjective data • Eurobarometer changes topic each edition, with little repetition
Eurobarometer 73.2 + 73.3 (2010)	• Dwelling is leaking, damp or rotting	• Small samples • Subjective data • Eurobarometer changes topic each edition, with little repetition
EQLS 2003, 2007 and 2012	• Rot in windows, doors or floors • Damp or leaks in walls or roof • Ability to afford to keep home adequately warm • Utility bill arrears	• Small samples • Subjective data • The survey is not conducted annually
GGP	• Living floor space • Dwelling is leaking, damp or rotting • Ability to afford to keep home adequately warm • Utility bill arrears	• Significant levels of missing and incomplete data • Subjective data • Does not cover all EU countries

Of the data sources available, the GGP is too incomplete to be useable at present, and does not have full EU coverage. The HBS data is potentially a rich source of information on actual energy expenditure patterns, however, it is not standardised and would require a substantial amount of work to obtain the twenty-eight separate datasets from each Member State, and to subsequently determine if it is possible to partially harmonise the data by uprating to the same reference year. The Eurobarometer and EQLS both have relatively small samples, especially in comparison to the EU-SILC, and they are not conducted frequently. Nevertheless, the Eurobarometer and EQLS data does offer some potential for cross-examination of the core indicators in EU-SILC. Furthermore, the Eurobarometer data is useful for exploring public opinion of minimum living standards.

It is evident that at present, in the absence of alternative data, EU-SILC is the only viable option for detailed assessment of EU fuel poverty. This is because it is the largest standardised survey currently available, and due to the large national samples it offers the potential to conduct detailed modelling of fuel poverty with sub-groups. Furthermore, the main survey can be combined with the 2007 and 2012 ad-hoc modules to improve the richness of data concerning fuel poverty issues. Whilst it is not the ideal source of data, it is the most comprehensive option available and enables an interim assessment of fuel poverty levels to be made, therefore this thesis will utilise EU-SILC data. The subsequent chapter moves forward to outline how the EU-SILC data will be used to produce a pan-European composite index of fuel poverty, in order to address the identified gaps in knowledge.

Chapter 7: Methods and data for constructing a pan-EU fuel poverty measure

Introduction

The preceding chapters have established the need for further empirical research at the European level that quantifies fuel poverty levels. Chapter 4 highlighted the strong policy mandates that have been issued by the European Parliament (2008a), EESC (2013), and CoR (2014) for harmonised statistics and estimates of fuel poverty in the EU. Subsequently, Chapter 5 outlined the significant gaps in knowledge that exist around understanding the extent and nature of fuel poverty across the EU. Existing academic literature has reinforced this standpoint, stressing the need for more research that quantifies fuel poverty in order to generate knowledge about fuel poverty in Europe (Bouzarovski *et al.*, 2012; Thomson and Snell, 2013). As well as highlighting gaps in knowledge, Chapter 5 also determined the parameters of earlier pan-EU studies, in terms of what data sources and indicators were used, and how these indicators were analysed. In doing so, Chapter 5 has provided the foundations for developing conceptual frameworks to guide the development of pan-EU composite indices, as outlined later in this chapter. Following on from this, Chapter 6 provided an analysis of the pan-European statistical datasets that are presently available, finding that the EU-SILC survey is the largest standardised survey currently available, and is the only viable option for quantifying fuel poverty across the EU.

Building on earlier chapters, the purpose of this chapter is to state the methods used for developing a pan-EU composite index of fuel poverty. This chapter begins by outlining the empirical research questions, the rationale for using secondary data is then provided, followed by a discussion of the initial data preparation, criteria for evaluation, and ethical considerations. It goes on to summarise the rationale and methods for constructing composite indices of fuel poverty. Over the course of the chapter, three potential indices are created, each with an accompanying delineation of the methods of construction, and summary results.

Secondary analysis of quantitative data

Empirical research questions

To address the lack of evidence concerning fuel poverty in Europe, a secondary analysis of quantitative survey data will be conducted. The overall question which this element of research addresses is:

What levels of fuel poverty exist across the Member States of the EU?

In order to answer this key research question, a series of interrelated sub-questions have been developed, as outlined below in Table 7.1.

Table 7.1 Secondary data analysis sub-research questions

Question	Theme
a. Does fuel poverty exist in all Member States of the EU?	Levels of fuel poverty in the EU
b. What is the intensity of fuel poverty issues across the EU Member States?	
c. Do the rates of fuel poverty in the EU change over time?	Longitudinal changes
d. What increases household propensity to be fuel poor?	Household characteristics
e. Does this differ between Member States?	

The choice of research questions has been driven by the gaps in knowledge established in earlier chapters, and the five sub-questions are grouped into three key themes: levels of fuel poverty in the EU; longitudinal changes; and household characteristics. The first two questions are essential for gaining an understanding of what levels of fuel poverty exist across EU27, especially as in recent years there has not been a full pan-EU analysis published that uses up to date microdata, as determined in Chapter 5. Furthermore, none of the existing studies have examined the interrelation of indicators at the household-level to determine intensity of fuel poverty issues. As can be seen from question three, the analysis will be longitudinal in nature, utilising data from 2007 through to 2011, which will help to establish key changes over time, particularly pre- and post-global recession. This form of analysis is absent from the existing literature base. The final two questions are concerned with the characteristics of fuel poor households, and are essential for gaining a better understanding of the nature of fuel poverty in Europe, and whether the predictors of fuel poverty are similar or divergent. A detailed focus on household characteristics has not been possible in earlier studies that have used macrodata (such as Huybrechs *et al*., 2012; Bouzarovski, 2013), due to the aggregated nature of the data, and is an additional gap in knowledge in the existing literature.

Rationale for secondary analysis of quantitative data

The incidence of fuel poverty can be determined using various methods, with both primary and secondary data, as reviewed in Chapter 2. As highlighted in Chapter 5, several researchers have collected their own primary data concerning fuel poverty via small-scale household surveys and semi-structured interviews (for example, Buzar, 2007a; Fellegi and Fülöp, 2012; Healy and Clinch, 2002b). However, for comparative analysis of the 27 countries comprising the EU, secondary analysis of survey data is the most feasible approach for addressing the research questions listed above, given time and resource constraints. Indeed, the precedence for using secondary survey data for researching fuel poverty across multiple European countries is well established, following the work by Healy and Clinch (2002a), EPEE (2009c), and Thomson and Snell (2013).

At its simplest, secondary analysis can be defined as the analysis of data that was collected by someone else for another primary purpose (Vartanian, 2010; Smith *et al*., 2011). Secondary dataset analysis is a well-established methodology (Smith *et al*., 2011), that offers numerous advantages, including the opportunity to address high impact questions using high-quality data that would otherwise be prohibitively expensive and time-consuming to collect (Bryman, 2008; Smith *et al*., 2011). Official surveys, such as EU-SILC, have been rigorously produced with large representative samples, enabling the results to be generalised to the wider population. Furthermore, secondary survey datasets often provide the opportunity for longitudinal analysis, and the analysis of specific sub-groups (Vartanian, 2010).

Conversely, the limitations associated with secondary analysis are a lack of familiarity with the data, particularly with large complex datasets that may require a substantial period of familiarisation to fully understand (Vartanian, 2010). Furthermore, there are issues associated with handling complex data, which is frequently collected at various separate levels, such as at the individual and household level, and a lack of control over the data quality (Bryman, 2008). Good quality secondary data analysis requires a distinct skill set and substantial effort (Smith *et al*., 2011). One of the most pertinent critiques, however, is that secondary data often lacks the key variables desired for analysis meaning that how a concept is defined in the research may differ significantly from the definitions of such concepts in the survey data (Smith *et al*. 2011; Vartanian, 2010). This means that an alternative conceptual framework must be devised, as has occurred within this research as there is not a dedicated EU survey of fuel poverty, necessitating the use of a consensual approach.

Data selection and initial preparation

The EU-SILC survey is the most viable data source for in-depth assessment of fuel poverty across the EU. As well as considerably large sample sizes per country, EU-SILC is a harmonised survey instrument, which enables reliable comparisons to be made between countries in the EU. Furthermore, the main survey can be combined with the 2007 ad-hoc module on housing conditions to improve the richness of data concerning fuel poverty issues. For these reasons, EU-SILC microdata from 2007 to 2011 has been selected. The dataset versions used can be found in Table A2-1 in Appendix 2. The starting point of 2007 was chosen as this is the earliest data point available that includes all countries in the newly enlarged EU27. By comparison, 2011 was the latest data point available at the time of analysis. Consequently, this research analyses fuel poverty across EU27, which excludes Croatia who joined the EU in 2013. Household-level data files have been used as policy is generally implemented at this scale, with eligibility for assistance schemes often determined by household characteristics.

The first stage of the initial preparation was gaining familiarity with the EU-SILC data, in terms of its purpose, structure, and the range and format of the variables, the results of which are summarised in the preceding chapter. Smith *et al*. (2011) argue this is an essential process that requires in-depth background reading of survey documentation. In terms of data preparation, the EU-SILC files are provided in a comma separated values (.csv) format, and so the files were first converted to SPSS system files to enable analysis using SPSS Statistics 22, a statistical software package designed for the social sciences.

The EU-SILC microdata comes in four separate files each survey year, namely household register, household data, personal register, and personal data files. The required variables were aggregated from individual to household level, where necessary, and the files were merged to create a single household-level dataset for each survey year using household ID and country as the identifiers. Subsequently, non-EU countries were removed from each file, and the relevant variables in each data file were checked for completeness. Table A2-2 in Appendix 2 outlines the key data quality issues encountered.

Criteria for evaluation

The key concepts concerning criteria for the evaluation of research were introduced and discussed in Chapter 4, in relation to evaluating the policy document analysis. Chapter 4 outlined how reliability, replication, and validity are three of the most prominent criteria for the evaluation of social research (Bryman, 2008: 31), and are particularly relevant for appraising quantitative research. Indeed Dale (2006: 143) argues that the ground rules for survey research are well-established and reasonably well agreed, particularly in comparison to qualitative research. The following section thus evaluates the research in terms of reliability, replication and validity.

Reliability

As described earlier in the thesis, reliability refers to whether the research results are repeatable, and is a central concern in quantitative research (Bryman, 2008). The theory of reliability is inherently concerned with the ability to measure a concept consistently. Reliability is a core concern for this research as instead of using direct measures of fuel poverty it uses proxy indicators, due to the absence of suitable energy expenditure and housing data. To minimise issues of unreliability, the research has been grounded in the existing published academic and policy literature, and follows the prevailing methods. Furthermore, a critical approach to analysis has been undertaken, by reflecting on and making readers aware of the flaws and limitations associated with the data. The issue of consistency is tested both internally and temporally, firstly by examining the internal components of the proposed pan-EU measures, by way of descriptive statistics, correlation testing and factor analysis, and secondly by examining the indicators over a five year period, where possible.

Replication

Replicability pertains to the ability of other researchers to replicate the findings from a study. To ensure replicability, researchers must describe their research process in detail, including explicit mention of the analysis decisions made and about the quality of data used (Dale, 2006). For instance, Lambert (2010) recommends keeping a paper trail for the whole lifecycle of quantitative analysis in the form of clearly annotated syntax files. He argues that this ensures the research is reproducible for the individual researcher, and replicable for everyone else (Lambert, 2010). To this end information about the secondary data selection process, data preparation, index construction, and analysis procedures has been outlined in detail across this chapter and Appendix 2 to ensure the research process is transparent and replicable, and throughout the data preparation and analysis phases detailed syntax files have been kept.

Validity

Four main types of validity were outlined in Chapter 4, namely:

- Measurement (or construct) validity, which is concerned with whether a concept is accurately measured;
- Internal validity, which relates mainly to the issue of causality;
- Ecological validity, which is concerned with whether findings are applicable to people's everyday lives in natural settings;
- External validity, which concerns the generalisation of findings beyond the research context (Bryman, 2008: 32-33).

Smith *et al*. (2011) assert that the first step in assessing measurement validity is to read the questions as they were asked in the survey. They further state that some questions have face validity, whereas others are worded in ways that make the measure meaningless, problematic, or open to a range of interpretations (Smith *et al*., 2011: 926). As detailed earlier in this chapter, the process of checking the formatting of the variables was conducted for all components used in the analysis. Question wording and possible answers were checked to confirm that they are capable of addressing known aspects of fuel poverty, based on the scientific literature base. Furthermore, as will be presented in Chapter 9, the validity of the composite indices is tested by comparing them to existing national measures of fuel poverty, which have been derived through other methods. This approach can be categorised as ‘convergent validity’, however, Bryman cautions that it may not be very easy to establish which of the two measures presents the more accurate picture (Bryman, 2008: 152).

Internal validity relates to the extent to which there is confidence in a researcher’s causal inferences (Bryman, 2008), with research that uses experimental design, such as randomised control trials, seen as the gold standard. However, it is not always feasible to apply experimental design to the study of social phenomena, thus the limitations of the cross-sectional data used in this study must be acknowledged when interpreting the research findings. By comparison, ecological validity assesses the extent to which measurement techniques capture the daily life conditions of the people discussed in the research, and consequently the degree to which the behaviours recorded in a study reflect the behaviours that actually occur in natural settings. This is a difficult criteria to apply to the research in question as little is known about the lived experience of those in fuel poverty, particularly outside of the UK and Ireland. An accurate assessment of the ecological validity of this research would necessitate ethnographic research methods, which are beyond the scope of the study, although such research is necessary.

In terms of the external validity, the findings from this research should be generalizable to the national population in each country as EU-SILC employs rigorous random sampling methods in order to obtain representative samples. Furthermore, the household cross-sectional weight has been applied during the analysis, which enables an estimation of the household cross-sectional target population (Museux, 2006). As Verma *et al.* (2007) discuss, there is some debate concerning the appropriateness of weighting sample data, however, they argue that “in the case of an intensive and complex survey of limited size, such as a household panel like EU-SILC, we believe…in most situations it is both necessary and useful to weight the sample data to compensate for imperfections” (Verma *et al*., 2007: 12).

Ethical considerations

This element of the research uses restricted microdata. To gain access to the microdata, a research proposal for this thesis was submitted as part of an application from the University of York to Eurostat. As part of the contractual arrangement, an individual confidentiality declaration was made, as detailed in Appendix 2, which outlines the terms of use that must be adhered to. However, the ethical considerations for this analysis are minimised somewhat by the use of scientific-use anonymised data rather than secure-use non-anonymised data.

Developing a composite index of fuel poverty

Based on the existing academic evidence (notably Healy and Clinch, 2002a; Healy, 2004; Bouzarovski, 2013), a composite index approach has been taken as this is considered the best way of utilising the consensual indicators that are presently available in EU-SILC. The overall objective is to create a composite index that is most suitable for capturing the multidimensional nature of fuel poverty and comparing rates across the EU, whilst also retaining usability for analysis at the household-level to determine factors that exacerbate fuel poverty. Over the course of this section the benefits and limitations of composite indices will be outlined, followed by a brief description of the key stages involved with constructing a composite index, and the core decisions made during the research process. Subsequent to this section, each of the three potential fuel poverty indices will be outlined separately, providing further detail on their construction.

Overview of composite indexes

A composite index can be defined as “a combination of multiple sources of information measured in or of a system in order to provide a summary of the system that is itself not directly measurable” (Dobbie and Dail, 2013: 270). The use of composite indices is widespread with application in many research areas, for example in applied nursing for pain management (Titler *et al*., 2009), and child well-being research (Bradshaw and Richardson, 2009). Better known examples of indices include the Human Development Index and the Consumer Price Index. There is also precedence in the field of energy poverty and fuel poverty research, with measures such as the Energy Development Index by the International Energy Agency (2012), the Multidimensional Energy Poverty Index by Nussbaumer *et al*. (2012), an EU14 composite fuel poverty indicator by Healy and Clinch (2002a), and a EU26 fuel poverty measure by Thomson and Snell (2013).

Composite indices are not uncontroversial, however. The criticisms levied include the fact that by combining variables, the process of creating a composite index involves a reduction in information, value judgements and assumptions (Nussbaumer *et al*., 2012). A related issue is that certain dimensions of performance that are difficult to measure may be ignored in an index (OECD, 2008), which could lead to inappropriate policies. Composite indices also risk sending misleading policy messages if the analysis of results is too simplistic and/or if the index is poorly constructed (OECD, 2008: 13; Nussbaumer *et al*., 2012: 233). Furthermore, having a single composite score may disguise serious failings in some dimensions (OECD, 2008: 13).

Conversely, supporters of indices argue that they can summarise complex, multi-dimensional information in a format that is easily understood, and are therefore a valuable tool for benchmarking performance, particularly between countries, and for decision makers (OECD, 2008; Jacobs *et al*., 2004; Nussbaumer *et al*., 2012). A composite index can be easier to interpret than a battery of separate indicators (OECD, 2008), indeed Nussbaumer *et al*. argue that “tracking trends over time, or carrying out cross-country comparison, based on a ‘dashboard’ of indicators might prove impracticable” (2012: 232). Furthermore, simple composite indices can facilitate communication with the general public and media (OECD, 2008: 14), thus increasing the dissemination of research findings and citizen involvement with research.

Stages of index construction

The OECD (2009: 8) makes the following important observation about index construction:

> There is no such thing as a neutral and objective composite measure. There is no escape from making choices on what to include in the index and how to

> group measures...The issue is thus not whether to make judgements, but how to make the best and most transparent choices.

The construction of the fuel poverty indices has been guided by the process outlined by the OECD (2008) in their methodology handbook on constructing composite indicators. The handbook was jointly prepared by the OECD and the Econometrics and Applied Statistics Unit of the Joint Research Centre of the European Commission, and is considered to be the most comprehensive source of information about the construction of composite indices (Dobbie and Dail, 2013). The stages addressed in this chapter are: conceptual framework, data selection, missing data, multivariate analysis, normalisation, weighting and aggregation, and uncertainty and sensitivity analysis.

Conceptual framework

The OECD state that a theoretical, or conceptual, framework can "provide the basis for the selection and combination of single indicators into a meaningful composite indicator under a fitness-for-purpose principle" (OECD, 2008: 15). As outlined earlier in the thesis, the working definition of fuel poverty used in this research refers to all problems that households encounter in their daily interaction with domestic energy, including difficulties maintaining adequate internal temperatures, and high energy costs. Building on earlier conceptual studies outlined previously in the thesis, three overlapping conceptual frameworks have been developed:

1. EU fuel poverty can be measured using the three prevailing proxies from the main EU-SILC surveys. This is an adaption of Thomson and Snell (2013) and Bouzarovski (2013), and will be applied to the *Core EU-SILC Index of Fuel Poverty* (CIFP).
2. The three EU-SILC proxy indicators require supplementary data on energy efficiency. This adapts the work of Healy and Clinch (2002a) and Healy (2004) by incorporating ad-hoc EU-SILC variables to replicate the full suite of indicators used in their research. This framework will be applied to the *Expanded EU-SILC Index of Fuel Poverty* (EIFP).
3. A broader measure of potential fuel poverty risk is required. This attempts to operationalise VCWG (2013), which identified drivers of consumer vulnerability in retail energy markets. This framework will guide the *EU Fuel Poverty Risk Index* (FPRI).

The first and second framework extend the existing body of published research by replicating the variables used in earlier work, which enhances the reliability and validity of the research. The main points of departure with earlier research concern the aggregation and analysis methods. By comparison, the third framework deviates substantially from the prevailing methods used in EU fuel poverty research, and attempts to operationalise the drivers of consumer vulnerability identified by the VCWG. The VCWG guidance document (2013) was introduced earlier in the thesis as part of the policy document analysis stage, and represents a shift change in how issues of fuel poverty are addressed in EU policy. This framework has been included as the VCWG's drivers of vulnerability could provide a useful basis for shifting the measurement of EU fuel poverty away from the conventional subjective measures, towards more 'objective' measures. It is recognised that whilst the concepts of consumer vulnerability and fuel poverty are overlapping, they are not necessarily identical, thus some caution has been applied in the choice of index items.

Data selection

After establishing the conceptual framework for the indices, the subsequent step was to select appropriate data. It is stated that the items used in an index should be chosen on the basis of "their analytical soundness, measurability, country coverage, relevance to the phenomenon being measured and relationship to each other" (OECD, 2008: 15). However, as highlighted in previous chapters, pragmatically there are limitations on what types of indicators can be used for pan-European analyses of fuel poverty due to an absence of standardised data on household fuel expenditure and housing conditions. At present the best alternative is the EU-SILC, and so datasets from 2007 to 2011 have been chosen as the main source of data given the wide coverage and harmonised nature of the datasets. This has necessitated the use of proxy indicators, which are used to "tap concepts that are less directly quantifiable" (Bryman, 2008: 145). Chapter 6 debated the merits of the proxies used in this research, such as the affordable warmth variable in EU-SILC, which asks households if they are able to afford to keep their home adequately warm, finding that the indicators address slightly different aspects of the multi-dimensional phenomenon.

Missing data

After preparing the datasets for each survey year (see 'Data selection and initial preparation' above), all of the potential variables that could be used in the analysis were checked for completeness. Table A2-2 in Appendix 2 outlines the key data issues that were encountered. On the whole, where there is missing data it tends be missing on a large scale, for example, Malta is missing from the 2007 and 2008 surveys, and Ireland is missing in 2011. Certain countries also choose to opt out of some variables, this is particularly an issue for the region and degree of urbanisation variables. In these circumstances the solution has been to exclude the country or variable from analysis.

For the variables and countries not mentioned in Table A5-2, the data is mostly or entirely complete. For dealing with missing data in these circumstances the OECD outline three methods, namely case deletion, single imputation, or multiple imputation (OECD, 2008:24). Case deletion is the simplest method, and involves omitting the missing records from analysis. The rule of thumb for when not to use case deletion is if a variable has more than five per cent missing values, cases are not deleted (OECD, 2008: 24). However, this approach has been criticised for ignoring possible systematic differences between complete and incomplete samples, and generating larger standard errors (OECD, 2008: 24).

Imputation, on the other hand, involves replacing missing data with substituted plausible values. As the name implies, single imputation adds a single value to each missing value, whilst multiple imputation adds a set of multiple plausible values, reflecting the uncertainty in the estimation (Donders *et al*., 2006). Of the two imputation methods, single imputation is considered to be less robust as it "usually causes standard errors to be too small, since it fails to account for the fact that we are uncertain about the missing values" (Sterne *et al*., 2009: 340). By comparison, multiple imputation is a more demanding method in terms of computational processing and data storage. This is because instead of just altering the original dataset, multiple imputed data sets are created in which different imputations are based on a random draw from different estimated underlying distributions (Donders *et al*., 2006: 1089). However, multiple imputation is an advanced technique that requires specialist training, indeed as Sterne *et al*. note "multiple imputation should not be regarded as a routine technique to be applied at the push of a button" (Sterne *et al*., 2009: 342). This research has opted to use case deletion and exclude cases with missing values on the key variables. This option has been chosen for two reasons, firstly the levels of missing values are below the five per cent threshold for case deletion, and secondly, the researcher has not been trained in single or multiple imputation, which are specialist statistical methods.

Multivariate analysis

Exploratory multivariate analysis is a very important stage of index construction, which should "investigate the overall structure of the indicators, assess the suitability of the data set and explain the methodological choices" (OECD, 2008: 15). One of the most widely used statistical tests in the construction of composite indices is Cronbach's alpha, which is used to measure the internal consistency of composite measures (Bryman, 2008; Tavakol and Dennick, 2011). However, this particular statistical test is not appropriate for the fuel poverty indices as it operates on the assumption of measuring unidimensional concepts (Tavakol and Dennick, 2011). Fuel poverty is not a unidimensional concept, rather it is inherently multidimensional. As an alternative to Cronbach's alpha, the composite indices have been assessed using two types of correlation coefficients, and exploratory factor analysis.

The two types of correlation coefficients used are Phi and Tetrachoric, which are both measures of association for dichotomous variables (Ekström, 2008). The Phi coefficient, which approximates the Pearson correlation coefficient, is commonly used in the analysis of categorical variables via cross-tabulation tests. By comparison, the Tetrachoric correlation coefficient is less widely used and lacks the popularity of Phi, which has been partly attributable to difficulties related to its computation (Ekström, 2008). Indeed, to estimate the Tetrachoric correlation coefficients the TETRA-COM program for SPSS developed by Lorenzo-Seva and Ferrando (2012) was used as the feature is not available as a standard option in SPSS.

The core difference between the two correlation coefficients is that the Tetrachoric coefficient is the linear correlation of a so-called underlying bivariate normal distribution, which is to say it assumes a continuous underlying distribution, whereas the Phi-coefficient is the linear correlation of an underlying bivariate discrete distribution (Ekström, 2008: 4). It is debatable whether the latent traits measured in this research are truly discrete; are people *occasionally unable* to attain adequate warmth, but report that they are *able* to afford to heat their home? Likewise with the arrears on utility bills indicator, this is capturing a range of possibilities, from people at one end of the scale who have no problems paying on time, to people in the middle who occasionally struggle to balance their budget but always pay on time, through to people who consistently accrue energy debt. Indeed work by authors such as Anderson *et al*. (2010), and Brunner *et al*. (2012) has highlighted the heterogeneous nature of the way in which households respond to fuel poverty. It is for these reasons that the Tetrachoric correlation coefficient is used, although the Phi coefficient is also presented alongside.

In addition to testing the correlations between pairs of variables, exploratory factor analysis (EFA) is used to investigate the possible underlying factor structure of the variables used in the indices. Factor analysis is a widely applied statistical method in the social sciences (Costello and Osborne, 2005), and it operates by grouping together individual variables that are collinear to form 'factors' (OECD, 2008). Following the extraction of factors, it is common for the results to be rotated. As Jacobs *et al.* (2004) explain, the aim of rotated factor analysis is to produce results that can be more readily interpreted, "if factor loadings or correlations could be produced on a plot, with each variable represented as a point, the axes of this plot could be rotated in any direction without changing the relative locations of the points to each other" (2004: 69). This research uses oblique rotation, which simply means that the factors are allowed to correlate after rotation (Field, 2009), although oblique rotation does not require factors to be correlated (Fabrigar *et al*., 1999).

Normalisation

After establishing the final list of indicators to be used in an index, the OECD (2008) state that they should be normalised in order to render them comparable. This involves examining extreme values and transforming the variables to use the same measurement scale. As will be outlined later in the chapter, the majority of indicators used are in binary format, whereby they use a yes/no arrangement. To normalise the indicators, the remaining non-binary categorical variables were transformed to binary format. The OECD states that the benefits of using binary scores are that it ensures comparability across measures and countries, and it is a simple and transparent methodology (OECD, 2009:

10). The shortcomings, however, are that there is potential for a lot of variation in the raw data to be lost, and comparability across time depends on the choice of reference point for at least one of the binary scores (OECD, 2009: 10).

Weighting and aggregation

This stage of index construction, after the selection of indicators, is arguably the most difficult and controversial (Bradshaw and Richardson, 2009; Nussbaumer *et al*., 2012). The OECD recommend that indicators be “aggregated and weighted according to the underlying theoretical framework” (OECD, 2008: 15), with Nussbaumer *et al*. (2012: 233) stating that the components of an index need not necessarily have the same relative or symmetrical importance. Weighting decisions are critically important because they can have a profound effect on the outcome of a composite index, with the potential to significantly change country rankings if a particular indicator is given more or less weight (OECD, 2008: 46). However, the justification for such decisions is not always readily available, indeed Nussbaumer *et al*. argue that theoretically sound frameworks to derive rational weighting approaches are difficult to construct, and the process of assigning weights is challenging, arbitrary and value-driven” (2012: 233).

Given that knowledge and analysis of pan-European fuel poverty is generally at a nascent stage, the use of no weights, which is equivalent to equal weights, is preferred as there is currently no scientific basis for applying differential weights. The decision to abstain from imposing weights is not unusual, with Bradshaw and Richardson (2009) doing so in their pan-European child wellbeing index. However, as knowledge expands and data improves over time, there is scope to modify the indices. There is also potential for future research on weighting the indices using expert judgement, which is commonly used in index construction to derive weighting schemes (OECD, 2008).

In terms of aggregating the individual items in the indices, the binary format of the indicators limits the types of aggregation that can take place. However, overall there are two main ways in which this indices could be constructed. Firstly, they could be constructed at the country-level, whereby the results for each proxy indicator of fuel poverty are aggregated to a single national figure, and then combined with other aggregated proxy indicators. This is the method that has predominated in pan-EU fuel poverty studies to date (Healy and Clinch, 2002a; Healy, 2004; Thomson and Snell, 2013;

Bouzarovski, 2013), using both micro and macro EU-SILC data. This method has several advantages, firstly, it does not necessarily require microdata, and so the macrodata published online by Eurostat can be used. Eurostat's macrodata is published several months in advance of the microdata, and is freely accessible to everyone, thus expanding access to a potential policy tool. Furthermore, the macrodata comes in a prepared format, removing the significant processing time associated with raw microdata.

However, the approach used to date has been unable to identify whether households experience multiple proxy indicators in combination, and thus whether a scale of severity exists. This can only be constructed at the household-level using microdata. Furthermore, the use of macrodata limits the type and range of analyses that can be conducted. Given this gap in research, a summative index derived at the household-level has been chosen for the three indices as this more accurately reflects individual household struggles in attaining adequate energy services. A summative index, sometimes also called an additive index, simply adds together values for target indicators. For instance, in the first index outlined below (Table 7.5), the number of proxy indicators of fuel poverty that the households report experiencing is summed, with a possible range of answers from 0 (the household does not suffer on any dimension) through to 3 (the household suffers on all dimensions).

Nussbaumer *et al*. (2012: 233) state that the simple additive model is most commonly used in index building, particularly for its transparency and ease of use, although they also argue that this model involves certain trade-offs around loss of information and transparency. To counteract this issue, this research follows the recommendation by Nussbaumer *et al*. (2012) of using hybrid reporting, whereby the results of the composite index are reported alongside the individual indicators, thereby reconciling "the advantages of a single, easy-to understand and -interpret composite metric, acknowledging its crude and imperfect nature, with the benefits of providing more detailed information" (Nussbaumer *et al*., 2012: 233).

Uncertainty and sensitivity analysis

The final stage that needs to be undertaken before presenting and analysing the indices is an assessment of the decisions taken on aspects such as normalisation, the choice of weights, and the aggregation method (OECD, 2008: 16). The OECD argue this analysis is necessary because index building involves subjective judgements, and the uncertainties associated with the modelling process should be evaluated (OECD, 2008: 117). To some extent the amount of uncertainty and sensitivity analysis that can be conducted depends on the type of indicators used, for instance, an index comprised of binary variables that have been derived from continuous variables could uses sensitivity analysis to test the effects of using different cut-off points in constructing the binary variables. By comparison, the format of the majority of the variables used in this research were pre-determined, and where transformations have been made, such as deriving a binary variable for renters from the categorical tenure variable, these decisions are relatively uncontroversial. Therefore sensitivity analysis has been undertaken, but only where deemed appropriate.

Index 1 – Core EU-SILC Index of Fuel Poverty (CIFP)

The first potential index utilises the three prevailing proxies of fuel poverty that have been used by EPEE (2009c), Thomson and Snell (2013), and Bouzarovski (2013) to explore the phenomenon in Europe since 2005. The variables are:

- Ability to afford to keep the home adequately warm
- Leaking roof, damp walls/floors/foundation, or rot in window frame or floor
- Arrears on utility bills in last 12 months

The reasons these variables are considered appropriate proxies for fuel poverty was outlined in detail in the preceding chapter, however, to summarise, the first variable encompasses the subjective element of fuel poverty, namely achieving adequate warmth in the home, whilst the second variable is an indication of a property that is being under-heated, and whose energy efficiency has possibly degraded. By comparison, the last variable highlights households that are struggling to afford adequate energy services.

Table 7.2 displays the EU26 summary results for the three proxy variables, at the household level. There is some degree of variability between the variables, with households most often reporting living in a property that is leaking, damp, or rotting, and least often reporting being in arrears on utility bills. For brevity and consistency only the summary results and correlation matrices for 2007 are shown for this index, especially as the subsequent two indices have been constructed only using variables from the 2007 housing conditions ad-hoc module and main survey.

Table 7.2 Household summary results for CIFP indicators EU26. Data: EU-SILC 2007

Variable	2007 EU average
Inability to keep home adequately warm	10.7%
Leaking roof, damp, or rot	17.2%
Arrears on utility bills	6.4%

Correlations and factor analysis

After visually inspecting the variables, the first stage of analysis was to test the correlations between indicators, to highlight possible issues of multicollinearity. Tables 7.3 and 7.4 below display the Phi and Tetrachoric correlation matrices for the various pairings of variables. Across all variables, the Phi correlation coefficient indicates weak relationships, whereas the Tetrachoric correlation results demonstrate moderate relationships between the variables. Watson and Maitre (2014) note that the correlations will always be higher for Tetrachoric matrices compared to Phi due to the assumptions outlined earlier in the chapter concerning underlying distributions, with the Tetrachoric coefficient assuming there is continuous, rather than discrete, distribution.

The fact that none of the variables are highly correlated is an indication that the variables are capturing different aspects of the multidimensional phenomenon that the index is aimed at measuring. In other words, "there is no doublecounting resulting from including two closely related indicators in the composite indicator" (Tarantola *et al*., 2002: 12).

Table 7.3 Phi coefficient correlation matrix for CIFP indicators. Data: EU-SILC 2007

No.	Variables	1	2	3
1	Utility arrears	1.00	.14	.20
2	Leak/damp/rot	.14 ***	1.00	.19
3	Cold home	.20 ***	.19 ***	1.00

*** $p < .001$

Table 7.4 Tetrachoric correlation matrix for CIFP indicators. Data: EU-SILC 2007

No.	Variables	1	2	3
1	Utility arrears	1.00	.35	.47
2	Leak/damp/rot	.35 ***	1.00	.39
3	Cold home	.47 ***	.39 ***	1.00

*** $p < .001$

Factor Analysis, via Unweighted Least Squares, was conducted on the three items using the Tetrachoric correlation matrix to explore the underlying factor structure. Bartlett's test of sphericity was significant, indicating that overall the correlations between variables are significantly different from zero and so are sufficiently large for EFA, $\chi^2 = 93738.88$, $p < .001$. Kaiser's (1960) eigenvalue-greater-than-one rule is the most widely used procedure for determining the number of components to retain in factor analysis and is considered standard practice (OECD, 2008). Based on this rule only one component was retained, and in combination this component explained 60.89% of the variance. However, given the limited number of variables analysed, it was unlikely that more than one component would be statistically valid, particularly as Costello and Osborne (2005) state that a factor with fewer than three items is generally weak and unstable. As only one factor was extracted, no rotation occurred.

Summative index

Having explored the underlying structure of the data, and finding no serious issues, a summative index was constructed. The EU-wide results for this summative index are outlined in Table 7.5, showing that just over a fifth of all households across EU26 experience one of the three proxy indicators. The figures drop off sharply for households experiencing two and three proxy indicators, indeed, just over 1 per cent of household endure all three indicators. Although, it should be kept in mind that this still represents over two million households experiencing an inability to keep warm, accrued energy debt, and living in a home that is leaking, damp, and/or rotting.

Table 7.5 EU26 results for the CIFP. Data: EU-SILC 2007

Summative index	Frequency	Percent
0	146,076279	73.2
1	40,832739	20.5
2	10,487108	5.3
3	2,197047	1.1

This index is the first measure to show the interrelation of fuel poverty issues at the household-level in Europe. It reveals that of the 26.9 per cent of households experiencing some combination of indicators, the majority (76.2 per cent) only report enduring one indicator, which is in conflict with the a priori prediction that households would experience several of the indicators at once. A detailed examination of the index results at the country-level is provided in the subsequent chapter.

Index 2 – Expanded EU-SILC Index of Fuel Poverty (EIFP)

Although the combination of three EU-SILC indicators used in the CIFP is the most common, the original work by Healy and Clinch (2002a), which predates research using EU-SILC, can be more closely matched with the addition of two variables from the 2007 ad-hoc housing conditions module:

- Dwelling equipped with heating facilities
- Dwelling comfortably warm during winter time

These variables concern the presence and adequacy of heating facilities. The first variable determines whether a household has central heating, or other forms of fixed heating, such as electrical radiators, fixed gas heaters and similar (Eurostat, 2009b: 4). The criteria used by Eurostat is that the heating should be available in most rooms (*ibid.*). As Healy (2004) argues, households lacking central heating or other forms of fixed heating will struggle to efficiently heat their home. The second variable is relatively similar to the core indicator that asks about ability to afford to heat the home adequately, but instead focuses on the following two concepts: if the heating system is efficient enough to keep the dwelling warm, and if the dwelling is sufficiently insulated against the cold (Eurostat, 2009b: 11).

Table 7.6 provides a summary of the results for the variables used in the EIFP. Note that the results are for EU-24 only as the central heating variable is missing in Romania, the adequate heating variable is missing for Ireland, and Malta is absent for the 2007 survey year. The results for the ‘dwelling comfortably warm during winter time’, which has been renamed ‘cold due to inadequate heating system and/or insulation’ to avoid confusion with the affordability variable, has significant higher results than for the variable indicating the household has no fixed heating. This suggests that although the concentration of heating systems across Europe is generally high, the adequacy of the systems is perhaps poor.

Table 7.6 Household summary results for the EIFP indicators EU-24. Data: EU-SILC 2007

Variable	2007 EU average
Inability to afford to keep home adequately warm	10.7%
Leaking roof, damp, or rot	17.2%
Arrears on utility bills	6.4%
No central heating or other fixed form of heating	5.6%
Cold due to inadequate heating system and/or insulation	14.6%

Correlations and factor analysis

The correlations between variables are all significant, *** $p < .001$. As before, the Phi coefficient, shown in Table 7.7, indicates negligible to weak correlations, whilst the Tetrachoric coefficient, displayed in Table 7.8, indicates moderate to strong correlations, particularly between the two subjective warmth variables. None of the correlation coefficients suggest that multicollinearity is likely to exist, however, as the values are below .80, which has been suggested as the threshold for very high correlations (Bartz, 1999).

Table 7.7 Phi coefficient correlation matrix for the EIFP indicators. Data: EU-SILC 2007

No.	Variables	1	2	3	4	5
1	Utility arrears	1.00	.14	.20	.02	.13
2	Leak/damp/rot	.14 ***	1.00	.18	.06	.23
3	Cold home	.20 ***	.18 ***	1.00	.20	.41
4	No heating system	.02 ***	.06 ***	.20 ***	1.00	.21
5	Dwelling efficiency	.13 ***	.23 ***	.41 ***	.21 ***	1.00

*** $p < .001$

Table 7.8 Tetrachoric coefficient correlation matrix for the EIFP indicators. Data: EU-SILC 2007

No.	Variables	1	2	3	4	5
1	Utility arrears	1.00	.35	.48	.10	.34
2	Leak/damp/rot	.35 ***	1.00	.38	.19	.44
3	Cold home	.48 ***	.38 ***	1.00	.49	.68
4	No heating system	.10 ***	.19 ***	.49 ***	1.00	.49
5	Dwelling efficiency	.34 ***	.44 ***	.68 ***	.49 ***	1.00

*** $p < .001$

EFA via Unweighted Least Squares was conducted on the five items, using the Tetrachoric correlation matrix shown in Table 7.8. Bartlett's test of sphericity was significant, χ^2 = 292067.79, p < .001. Overall only one factor fulfilled the Kaiser eigenvalue rule, and so just one factor was extracted, resulting in no rotation. This factor explained 52.53% of the variance.

Summative index

On the basis of the correlation testing and factor analysis, the five items have been combined into one index. As occurred in the previous index, a summative approach has been used in order to capture the severity of fuel poverty related issues in the EU, as shown in Table 7.9. This index finds that overall more households report experiencing one or more indicator compared with the previous index (33.1 per cent versus 26.9 per cent in the CIFP), with some households stating they have all five issues. This suggests that the inclusion of addition objective variables broadens the number of households classified as experiencing fuel poverty related issues, although the difference in target population (EU-24 versus EU-26) needs to be taken into consideration. Of the households declaring problems, the majority (62.5 per cent) experience only one issue.

Table 7.9 EU-24 results for EIFP. Data: EU-SILC 2007

Summative index	Frequency	Percent
0	125,121870	67.0
1	38,745709	20.7
2	14,332991	7.7
3	6,459250	3.5
4	2,008402	1.1
5	180135	0.1

Index 3 – EU Fuel Poverty Risk Index (FPRI)

As outlined earlier in the chapter, the VCWG's drivers of vulnerability could provide a useful basis for shifting the measurement of EU fuel poverty away from the conventional subjective measures, towards a more objective measure of risk factors. Publication of the VCWG guidance in 2013 indicated a shift in the way issues associated with fuel poverty are conceptualised at the European-scale by decision makers. Given this shift in language and understanding, an exploration of operationalising the drivers of vulnerability is important for creating a measurement tool that is relevant for policymaking. However, this is a conceptually difficult index as the concepts of consumer vulnerability and fuel poverty are overlapping, but not necessarily identical. For this reason not all of the drivers suggested in VCWG (2013), as depicted in Table 7.10 below, are likely to be utilised.

Table 7.10 Summary of the VCWG Drivers of Vulnerability. Non-italicised text indicates key factors, dashed text in italics indicates exacerbators. Modified from Vulnerable Consumer Working Group (2013: 42-47).

Market Conditions Final energy price levels Level of competition - *Debt policies* - *Selling and pre contractual practices* - *Bill transparency and accessibility* - *Available payment methods* - *Inclusiveness of corporate systems*	**Individual Circumstances** Income level Health and disability IT skills/internet access Education: literacy/numeracy skills - *Age* - *Single-parent/large family/carer* - *Retired/unemployed* - *Immigrant/ethnic minority* - *Prepayment meters*
Living conditions Under-occupancy Type of heating system Quality of housing stock - *Equipment efficiency* - *Location* - *Tenancy*	**Social/Natural Environment** State of economy Climate - *Governance* - *Social inclusion*

By examining the full range of EU-SILC variables, and additional Eurostat data, a range of variables have been identified as potential matches for many of the factors outlined above in Table 7.10. The potential matches are detailed below in Table 7.11, accompanied by a discussion of whether the variables will be utilised.

Table 7.11 Matching available data to VCWG factors

VCWG factors	Potential match
Income level	HX080 Poverty indicator identifies whether households are above or below an ‘at risk of poverty threshold’ (60% of national median income). This is a standard official EU measure of relative poverty.
Under-occupancy	HH030 Number of rooms available to the household and HX040 Household size could be used to compute a new variable that identifies under-occupancy, as is standard practice by Eurostat (2015). However, HH030 is coded 1 through to 5, then ‘6 or more’. This means it will not be able to identify under-occupancy in households that contain more than 5 people, although the impact is relatively minor as only two per cent of the 2007 sample contained 6 or more adults.
Type of heating system	The closest match is MH040 Dwelling equipped with heating facilities, which identifies household that have central heating or other fixed forms of heating. However, this is only available for 2007 as it is an ad-hoc variable.
Equipment efficiency	MH050 Dwelling comfortably warm during winter time could be used as a proxy for this driver. As outlined earlier in the chapter, this variable refers to the equipment of the dwelling in terms of heating system efficiency and insulation (Eurostat, 2009b: 11), although it is based on the subjective opinion of the household.
Quality of housing stock	This could be measured using HH040 Leaking roof, damp walls/floors/foundation, or rot in window frame or floor, although it will not be as accurate as an energy efficiency variable.
Location	DB100 Degree of urbanisation could be used as a proxy for location as it identifies household in urban, intermediate, and rural areas. However, as identified in the data quality table in Appendix 2, this variable is missing across a number of countries every survey year. Furthermore, several countries have amalgamated categories, reducing compatibility. For these reasons, DB100 will not be used.
Tenancy	HH020 Tenure status can be used to create a binary flag variable for households that privately rent their house at full market rate (rather than subsidised below-market rate), as the VCWG report identified private renters as a key risk group.
Health and disability	PH020 Suffer from any chronic (long-standing) illness or condition is asked in the personal register file, but the answers could be aggregated to the household level in order to identify households containing at least one person with a chronic illness or disability.
Education	PE040 Highest ISCED level attained. This variable is based on the International Standard Classification of Education, with values ranging from 0, pre-primary education, through to 5, first stage of tertiary education and second stage of tertiary education. The question is asked at the personal level and so would need aggregating to the household level. However, in order to maintain compatibility with the other variables listed thus far, which have been in binary format, this scale variable would need further transformation, resulting in a loss of detail and artificial groupings. Furthermore, in many fuel poverty studies educational attainment has been used in the context of exploring the impacts of fuel poverty (Liddell, 2008; Somerville *et al*., 2000), as explored in Chapter 2, rather than as way of measuring fuel poverty. Although it is recognised that educational attainment can be a good proxy for household income and poverty (Healy, 2004), for the reasons listed above, and because HX080 will be used to measure relative poverty, this variable will be excluded from the index.

Retired / unemployed	PL030 Self-defined current economic status, a personal-level variable, could be used to obtain two separate aggregated flag variables for retired and unemployed.
Single-parent	A flag variable could be created for single parent households from HX060 Household type. However, whilst a flag variable for 'large family' could also be created, it will not be formed as this has not been clearly defined in the VCWG report, and it is likely to be a subjective concept that varies between countries. Nevertheless, equivalised household income is used in variable HX080, which should address the VCWG's concerns about large families having to make their budget stretch further (2013: 45).
Climate	Heating degree days could be used as a proxy as they express the severity of the cold in a specific time period, taking into consideration the amount of time when the outside temperature falls below a pre-specified base temperature. Eurostat have published heating degree day data at the NUTS 2 level for all Member States, but only up until 2009. In theory, this could matched into the EU-SILC data using DB040 Region, to create a regional climate variable. However, transforming this variable by collapsing it into categories would be somewhat arbitrary, with no established justification for choosing particular cut-off points in the data. Furthermore, the region variable has its own limitations, as outlined above. Therefore, climate will not be included in the index.
Final energy prices and level of competition	These could be determined using Eurostat's macrodata on national annual retail prices for electricity and gas, and macrodata on the market share of the largest generator in the electricity market. However, the application of the retail price data to microdata would be flawed because the energy prices are summed to a single country average, which hides regional variations in pricing, as well as the significant differences that can result from using different payment methods. Therefore, the figures are unlikely to bear much resemblance to the actual prices paid by households. Similarly, the market share data is not particularly suitable for microdata analysis, but would be an interesting indicator to use in macro-scale comparisons of countries. Another issue is potential multicollinearity due to the fact energy prices and market share could be perfectly predicted using the country variable. For these reasons, energy prices and market share will not feature in the microdata analysis.

In total, ten variables have been selected for this exploratory index, and where necessary they have been modified. The variables are:

1. Household is below the 60% of equivalised national median income threshold.
2. Under-occupancy
3. Dwelling does not have central heating or other forms of fixed heating
4. Dwelling is energy-inefficient (in terms of heating and insulation, self-assessed)
5. Leaks, damp or rot in dwelling
6. Tenant paying rent at market rate
7. Someone in household has a chronic illness or disability
8. Retired

9. Unemployed
10. Single parent

This index only uses one of the three core proxy indicators of fuel poverty that are typically used from EU-SILC, focussing instead on less subjective drivers, such as individual circumstances, under-occupancy of the property, and aspects relating to the adequacy of heating and insulation. The summary EU-24 results for all ten variables are listed below in Table 7.12.

Table 7.12 Household summary results for FPRI indicators EU-24. Data: EU-SILC 2007

Variable	2007 EU average
Below the 60% poverty line	17.6%
Under-occupying property	71.8%
No central heating or other fixed form of heating	5.6%
Cold due to inadequate heating system and/or insulation	14.6%
Leaking roof, damp, or rot	17.2%
Tenant paying rent at market rate	21.2%
Chronic illness or disability	46.2%
Retired	34.3%
Unemployed	9.0%
Single parent	4.1%

The figure for under-occupancy is noticeably high, with nearly 72 per cent of the EU population classified as under-occupying their properties. This is problematic as the index should generally only capture the minority of households, although examination of the data by country reveals considerable variability, ranging from a low of 28.3 per cent in Latvia through to 92.4 per cent in Spain. Removal of this variable would be disappointing as it is the only indicator of property size, and would reduce the amount of detail contributing to the index. Conversely, it could artificially increase the index results, therefore the index will be modelled with and without the under-occupancy variable to assess the impact.

Correlations and factor analysis

Tables 7.13 and 7.14 shows the Phi and Tetrachoric correlation coefficients for the FPRI indicators. Across both tables the correlations are quite varied, ranging from negligible to moderate, with the significance of the correlations between several pairs of variables classified as not significant. As in the previous two indices, the absence of very strong correlations is a good indication of the coverage of the variables, however, the levels of very weak correlations and non-significance is cause for some concern about the quality of the FPRI.

Table 7.13 Phi coefficient correlation matrix for the FPRI variables. Data: EU-SILC 2007

No.	**Variables**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	Leaks, damp, rot	1.00	-.09	.06	.23	.12	.01	.09	.00	.08	.03
2	Under-occupancy	-.09 *NS*	1.00	.04	-.07	-.05	-.01	.03	.13	-.15	-.02
3	No heating system	.06 ***	.04 ***	1.00	.21	.10	-.00	.04	.03	.04	-.01
4	Dwelling efficiency	.23 ***	-.07 *NS*	.21 ***	1.00	.13	.04	.08	.02	.07	.03
5	Poverty line	.12 ***	-.05 *NS*	.10 ***	.13 ***	1.00	.06	.06	.03	.16	.08
6	Tenant	.01 ***	-.01 *NS*	-.00 *NS*	.04 ***	.06 ***	1.00	-.05	-.11	.03	.08
7	Chronic illness	.09 ***	.03 ***	.04 ***	.08 ***	.06 ***	-.05 *NS*	1.00	.29	.01	-.06
8	Retired	.00 ***	.13 ***	.03 ***	.02***	.03 ***	-.11 *NS*	.29 ***	1.00	-.11	-.14
9	Unemployed	.08 ***	-.15 *NS*	.04 ***	.07 ***	.16 ***	.03 ***	.01 ***	-.11 *NS*	1.00	.02
10	Single parent	.03 ***	-.02 *NS*	-.01 *NS*	.03 ***	.08 ***	.08 ***	-.06 *NS*	-.14 *NS*	.02 ***	1.00

NS not significant *** $p < .001$

Table 7.14 Tetrachoric coefficient correlation matrix for the FPRI variables. Data: EU-SILC 2007

No.	**Variables**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	Leaks, damp, rot	1.00	-.14	.19	.44	.25	.03	.16	.00	.19	.11
2	Under-occupancy	-.14 *NS*	1.00	.10	-.12	-.09	-.02	.04	.21	-.28	-.04
3	No heating system	.19 ***	.10 ***	1.00	.49	.27	-.01	.09	.06	.16	-.11
4	Dwelling efficiency	.44 ***	-.12 *NS*	.49 ***	1.00	.28	.11	.15	.03	.20	.12
5	Poverty line	.25 ***	-.09 *NS*	.27 ***	.28 ***	1.00	.13	.10	.05	.36	.26
6	Tenant	.03 ***	-.02 *NS*	-.01 *NS*	.11 ***	.13 ***	1.00	-.10	-.22	.10	.26
7	Chronic illness	.16 ***	.04 ***	.09 ***	.15 ***	.10 ***	-.10 *NS*	1.00	.44	.02	-.19
8	Retired	.00 ***	.21 ***	.06 ***	.03 ***	.05 ***	-.22 *NS*	.44 ***	1.00	-.27	-.69
9	Unemployed	.19 ***	-.28 *NS*	.16 ***	.20 ***	.36 ***	.10 ***	.02 ***	-.27 *NS*	1.00	.10
10	Single parent	.11 ***	-.04 *NS*	-.11 *NS*	.12 ***	.26 ***	.26 ***	-.19 *NS*	-.69 *NS*	.10 ***	1.00

NS not significant *** $p < .001$

Using the Tetrachoric correlation matrix shown in Table 7.14, EFA using Unweighted Least Squares and oblique Promax rotation was run on the ten items. Bartlett's test of sphericity was significant, indicating that overall the correlations between variables are significantly different from zero and so are sufficiently large for EFA, $\chi^2 = 492444.75$, $p < .001$. Oblique rotation produces two types of matrices, pattern and structure, as shown in Tables 7.15 and 7.16. The pattern matrix contains the factor loadings, which are a gauge of the "substantive importance of a given variable to a given factor" (Field, 2009: 644), and is the matrix that most researchers interpret (Field, 2009), whilst the structure matrix is a representation of the relationship between factors, based on the pattern matrix and the correlation coefficient matrix. A cut off point of .30 has been applied to the output displays, meaning that values below this point are not shown in order to aid interpretation. This is considered the minimum value a factor loading should achieve (Costello and Osborne, 2005; Reise *et al*., 2010).

A three-factor structure was evident in the FPRI, as shown in Tables 7.15 and 7.16. These three factors fulfilled the Kaiser eigenvalue cut-off rule of 1, and cumulatively explained 55.65 per cent of variance. However, the interpretability of factors is important, for example one face test is whether each factor can be easily named. At present, in Table 7.15 there appears to be a strong grouping of items relating to individual circumstances in factor 1, and living conditions in factor 2 (with the exception of 'poverty line'), whereas the grouping of items in factor 3 is unclear, thus the pattern matrix lacks full interpretability. Fabrigar *et al*. state that a model that "fails to produce a rotated solution that is interpretable and theoretically sensible has little value" (Fabrigar *et al*., 1999: 281). In this circumstance, the application of relevant theory and previous research is necessary (Fabrigar *et al*., 1999). Furthermore, the factor analysis literature suggests that a factor with fewer than three items is likely to be weak and unstable (Costello and Osborne, 2005), indicating that the two items in factor 3 would benefit from being redistributed.

Table 7.15 EFA Pattern Matrix after Promax rotation for the FPRI variables. Data: EU-SILC 2007

Pattern Matrix			
	Factor 1	**Factor 2**	**Factor 3**
Leaks, damp, rot		.47	
Under-occupancy			-.42
No heating system		.55	
Dwelling efficiency		.83	
Poverty line		.39	
Tenant	-.30		
Chronic illness	.39		
Retired	.94		
Unemployed			.73
Single parent	-.76		

Factor loadings < .30 were suppressed in the output display

Table 7.16 EFA Structure Matrix after Promax rotation for the FPRI variables. Data: EU-SILC 2007

Structure Matrix			
	Factor 1	**Factor 2**	**Factor 3**
Leaks, damp, rot		.50	
Under-occupancy			-.40
No heating system		.53	
Dwelling efficiency		.79	
Poverty line		.47	.38
Tenant			
Chronic illness	.38		
Retired	.99		-.41
Unemployed		.32	.73
Single parent	-.72		

Factor loadings < .30 were suppressed in the output display

Repeating the factor analysis with the under-occupancy variable removed produces a two-factor structure, as shown in Tables 7.17 and 7.18. However, this arrangement also fails on plausibility and full interpretability, with the unemployment and poverty line variables grouping strongly with living condition variables.

Table 7.17 EFA Pattern Matrix after Promax rotation for the FPRI variables, minus under-occupation. Data: EU-SILC 2007

Pattern Matrix		
	Factor 1	**Factor 2**
Leaks, damp, rot	.64	
No heating system	.64	
Dwelling efficiency	.77	
Poverty line	.65	
Tenant		.45
Chronic illness	.32	-.56
Retired		-.90
Unemployed	.49	
Single parent		.82

Factor loadings < .30 were suppressed in the output display

Table 7.18 EFA Structure Matrix after Promax rotation for the FPRI variables, minus under-occupation. Data: EU-SILC 2007

Structure Matrix		
	Factor 1	**Factor 2**
Leaks, damp, rot	.64	
No heating system	.63	
Dwelling efficiency	.77	
Poverty line	.64	
Tenant		.45
Chronic illness	.31	-.55
Retired		-.90
Unemployed	.50	.30
Single parent		.82

Factor loadings < .30 were suppressed in the output display

Whilst the factor analyses have been interesting for exploring the underlying structure of the variables, the factors lack interpretability. As one of the central aims of this particular index is to produce a measure of fuel poverty that is derived from the VCWG guidance (2013), it may be more appropriate to match the variables with the VCWG's categorisation of items as summarised earlier in Table 7.10, particularly as the guidance document was derived from the meetings of experts from academia, industry and consumer organisations. On this basis, the final arrangement of items is shown below in Table 7.19.

Table 7.19 FPRI factors

Individual circumstances	Living conditions
Poverty line	Leaks, damp, rot
Chronic illness	Under-occupancy
Retired	No heating system
Unemployed	Dwelling efficiency
Single parent	Tenant

Summative index

Continuing on from the previous two indices, a summative index approach has been used. Table 7.20 shows the disaggregated results for the two components of the FPRI, for EU24. The results show that a higher proportion of households report issues classified under 'living conditions' than those listed under 'individual circumstances', although the results for experiencing two and three items are broadly similar. However, when under-occupancy is excluded from the index, as shown for the living conditions component in Table 7.21, the results change substantially indicating that this variable does have a very strong impact on the index.

Table 7.20 EU-24 results for the two components of the FPRI. Data: EU-SILC 2007

Number of items	Individual circumstances		Living conditions	
	Frequency	Percent	Frequency	Percent
0	59557279	31.0	26605294	14.1
1	65956195	34.3	100659618	53.4
2	53524050	27.8	45379157	24.1
3	12520977	6.5	13036709	6.9
4	809528	0.4	2800686	1.5
5	379	0.0	166184	0.1

Table 7.21 EU-24 results for the living conditions component of the FPRI, with under-occupancy removed. Data: EU-SILC 2007

Number of items	Living conditions with under-occupancy removed	
	Frequency	Percent
0	109557928	58.0
1	56448154	29.9
2	18355323	9.7
3	4158209	2.2
4	327270	.2

Table 7.22 below displays the final results for the FPRI, in both its original state with ten items, and in a revised form with under-occupancy removed. For both versions of the index, the highest number of items reported by households is 8, slightly short of the full range available. This is likely to be a consequence of the concurrent use of the single parent, unemployed, and retired variables; a household is very unlikely to contain all three types, although it is not an impossibility in a multi-generation household.

Table 7.22 EU-24 results for the FPRI. Data: EU-SILC 2007

Number of items	Original		Under-occupancy removed	
	Frequency	**Percent**	**Frequency**	**Percent**
0	10500080	5.6	36095204	19.2
1	40361871	21.5	54385987	28.9
2	53171734	28.3	53322347	28.4
3	47693687	25.4	28165289	15.0
4	23955984	12.8	11336715	6.0
5	8789597	4.7	3687539	2.0
6	2682286	1.4	812582	0.4
7	486355	0.3	77489	0.0
8	49043	0.0	2362	0.0
9	0	0.0	0	0.0
10	0	0.0	-	-

The very low values for the percentage of households not reporting any of the items across Tables 7.20 and 7.22 is cause for concern, especially as in the previous two indexes an overall majority of households were not reporting any of the items. Histograms of the original and modified FPRI have been produced, in Figure 7.1 and Figure 7.2 below, and as can be seen the distributions of the FPRI index resemble the normal distribution in shape. Composite deprivation and poverty measures are intended to capture the lower tail of the distribution, whereas the original FPRI actually increases from 0 through to 2, before tapering off, although this is slightly corrected for by removing under-occupancy. Overall, it is this structure that sets the index apart from the CIFP and EIFP; whereas they concentrated on whether a household lacked certain socially necessitated items and services, the FPRI shifts the focus to individual risk factors, such as renting or being unemployed. In this context, the VCWG derived index is best considered as an index of the likely risk of fuel poverty occurring, with multiple items indicating increased risk.

Figure 7.1 Histogram of the FPRI for EU24. Data: EU-SILC 2007

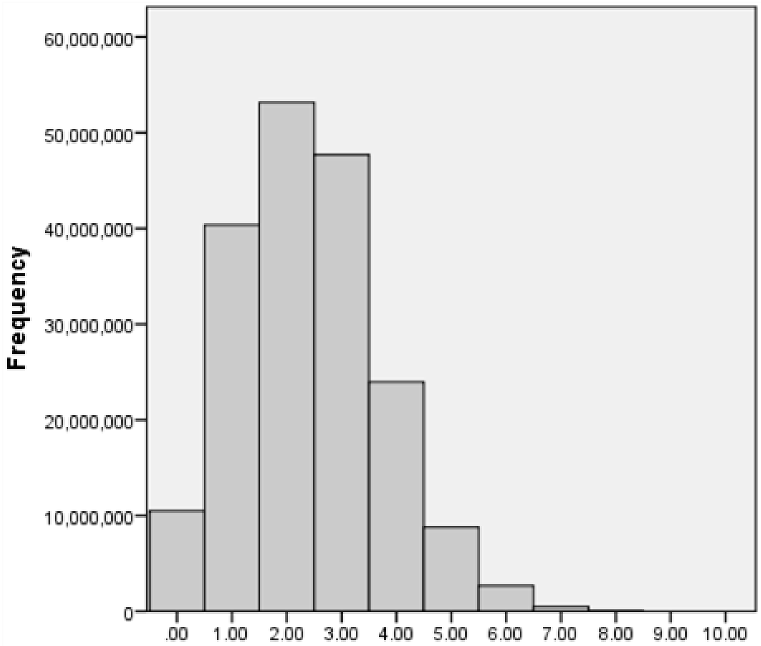
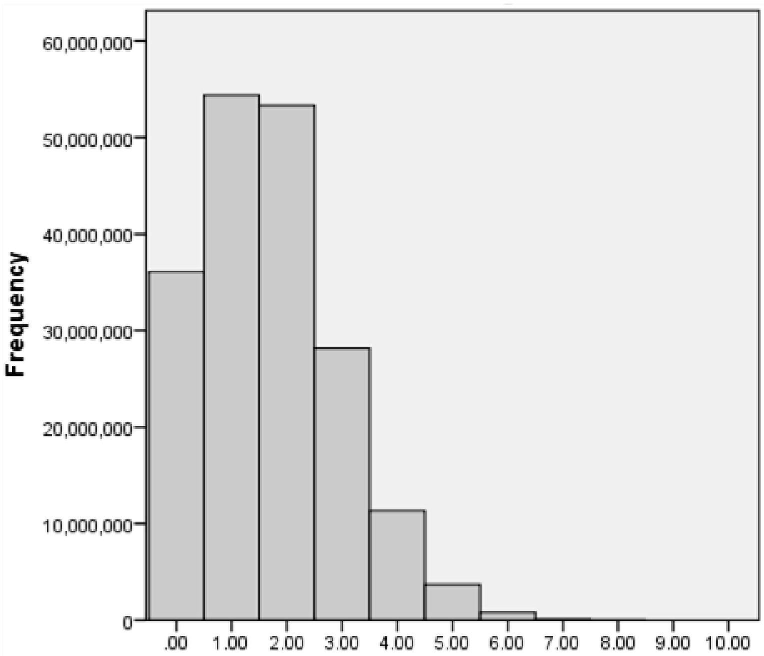


Figure 7.2 Histogram of the FPRI, with under-occupancy removed, for EU24. Data: EU-SILC 2007



Omissions and limitations

During the course of developing pan-EU measures of fuel poverty, certain elements have been excluded on the grounds of quality and practicality. In terms of the overall countries included in the indices, Croatia is absent because they joined the EU in 2013, whereas the newest EU-SILC microdata available at the time of writing was for 2011. Variables relating to summertime fuel poverty, and adequate cooling, have been excluded from the indices because they were not present in earlier studies by Healy and Clinch (2002a) and Thomson and Snell (2013), which this research replicates. However, this is an important topic for future research. Furthermore, there are a number of limitations associated with the FPRI, particularly in terms of the under-occupancy variable, which classifies the majority of EU households as under-occupying. The established method used by Eurostat (2015) was applied in the research, whereby a household is classed as under-occupying if the number of rooms available exceeds the number of people. However, in EU-SILC bedrooms, dining rooms, living rooms and habitable cellars and attics are counted as 'rooms' (Eurostat, 2010b), thus the definition of under-occupancy may be considered unrealistic as it does not solely concern bedrooms. However, to use an alternative method to the one used by Eurostat would involve making assumptions about dwelling layout, which could reduce the validity of the research.

Nevertheless, despite these omissions and limitations, the indices outlined in this chapter make an original and valid contribution to knowledge in several ways. Firstly, the FPRI makes a methodological contribution by exploring how the VCWG guidance could be operationalised. Secondly, the CIFP and EIFP offer the first ever examination of the interrelation of indicators at the household-level, thereby improving understanding of the nature of fuel poverty across the EU. Lastly, this research offers the most up to date and complete analysis of fuel poverty in Europe.

Summary

The overall objective of this chapter has been to identify a composite index that is most suitable for comparing fuel poverty rates across the EU, whilst also retaining usability for analysis at the household-level to determine factors that exacerbate fuel poverty. The key criterion were that the index should be grounded in the existing academic and policy literature, whilst taking into consideration the limitations imposed by data quality and availability. The chapter began by outlining conceptual frameworks, discussing data availability and quality, before moving on to the topic of index construction.

Overall three varying indices of fuel poverty have been created. The first index, CIFP, uses the three established proxy indicators of fuel poverty from EU-SILC, namely 'being unable to afford to heat the home adequately', 'being in arrears on utility bills', and 'living in a property that is leaking, damp or rotten'. These indicators are a common feature in the European policy and academic literature, and have been well critiqued over the past few years, yet to date the nature of households experiencing combinations of indicators has not been explored. A key finding from this index is that of the households reporting difficulties, the majority only report experiencing one of the three proxies. A little over one per cent of households in EU26 experience all three indicators.

The second index, EIFP, is an extension to the first, and uses two variables from the 2007 EU-SILC housing conditions ad-hoc module in order to replicate the earlier work by Healy and Clinch (2002a). This index helps to address some of the flaws inherent in the first index by including technical variables concerning central heating and perceived energy efficiency. This index found that a minority of households (0.1% or 180,135) reported experiencing all five of the variables comprising the EIFP. Unfortunately, the use of ad-hoc data means that this index is not available on a regular annual basis, thus restricting its usefulness in policymaking. However, this is an argument for improving data collection, rather than ignoring the available ad-hoc data.

The final index, FPRI, deviates significantly from the other indices, and draws on guidance issued by the VCWG (2013) concerning vulnerable consumers in the energy retail markets. Attempting to operationalise the VCWG guidance has been a useful exercise in considering a potential alternative measure of fuel poverty, especially as it utilises a broader range of variables than in previous indices, however, this has resulted in the index capturing general issues of poverty and vulnerability rather than specific energy deprivation problems. Furthermore, the greater input of variables has simultaneously increased potential error resulting from construction decisions and complicated the interpretability of the index. It is evident that the FPRI requires further refinement, and additional accompanying research to determine to what extent the drivers outlined by the VCWG are relevant in each Member State. As with the second index, it draws on ad-hoc data and so is not repeatable until the housing conditions module is used again in the 2012 EU-SILC microdata, which at the time of writing had not been released yet.

Overall, it is clear that the FPRI is too unstable at present, therefore only the CIFP and EIFP will be carried forward for analysis in the subsequent results chapter, with a majority focus on the CIFP as this is available across the five year analysis period. Having established the final format for the two composite indices, the next chapter will address the research questions detailed at the start of this chapter by presenting country-level results, by way of league tables and charts, before moving on to explore linkages with potential drivers via regression modelling. Chapter 8 will also attempt to correlate the indices with existing published national measures of fuel poverty in order to establish if the indexes under- or over-estimate likely levels of fuel poverty.

Chapter 8: Findings from the pan-EU fuel poverty index

Introduction

Having established the policy mandate for a pan-EU measure, and subsequently working to create suitable measures, this chapter now presents results from the two indexes chosen in the previous chapter, namely the CIFP (Core EU-SILC Index of Fuel Poverty) and the EIFP (Expanded EU-SILC Index of Fuel Poverty). Following the recommendation from the OECD that composite indices should be transparent and decomposed into their underlying indicators or values (OECD, 2008: 16), the chapter firstly presents summary statistics for the individual components of the two indices. Secondly, the country-level CIFP and EIFP results are presented, followed by the presentation of the results in ranking tables to aid interpretation. Lastly, this chapter presents a sociodemographic and geographic analysis of the most recent and complete CIFP, and examines the validity of the CIFP when compared with official statistics from the UK and European Commission.

For space purposes, two-letter country codes have been used in place of full country labels in the larger results tables presented in this chapter. The international standard has been used, as defined by the International Organization for Standardization (ISO) in ISO 3166-1 alpha-2. Table 8.1 illustrates the codes and corresponding country.

Table 8.1 Country codes from ISO 3166-1 alpha-2

Country	Code
Austria	AT
Belgium	BE
Bulgaria	BG
Cyprus	CY
Czech Republic	CZ
Denmark	DK
Estonia	EE
Finland	FI
France	FR
Germany	DE
Greece	GR
Hungary	HU
Ireland	IE
Italy	IT
Latvia	LV
Lithuania	LT
Luxembourg	LU
Malta	MT
Netherlands	NL
Poland	PL
Portugal	PT
Romania	RO
Slovakia	SK
Slovenia	SI
Spain	ES
Sweden	SE
United Kingdom	UK

Summary statistics for index components

The following section presents summary results for the main components of the CIFP and EIFP from 2007 through to 2011. The cross-sectional household weight has been applied to the EU-SILC data to produce population estimates.

Indicators used in CIFP

As outlined in the preceding chapter, the CIFP is comprised of three indicators:

- Ability to afford to keep the home adequately warm.

- Leaking roof, damp walls/floors/foundation, or rot in window frame or floor.
- Arrears on utility bills in last 12 months.

Table 8.2 outlines the results for households reporting an inability to afford to keep their home adequately warm from 2007 to 2011. In 2011 the highest incidences of self-reported inability to keep warm were found in Portugal, Lithuania and Bulgaria, ranging from 26.9 per cent to 48.7 per cent respectively, and these countries have consistently had the highest figures since 2007. By comparison, just 0.9 per cent of households reported an inability to keep warm in Luxembourg, 1.8 per cent in the Netherlands, and 1.9 per cent in Sweden. The EU26 average (excluding Ireland) in 2011 was 12.7 per cent. In longitudinal terms, the greatest aggregate decreases from 2007 to 2011 occurred in Belgium (-50.3 per cent), Romania (-53.3 per cent), and Denmark (-73.0 per cent). The largest increases over time took place in Italy (72.9 per cent), Finland (84.6 per cent) and Ireland (86.1 per cent). Overall, 13 countries have seen a decrease between 2007 and 2011, two have remained the same, and the remaining 12 countries have witnessed an increased incidence.

Table 8.2 Percentage of households reporting an inability to afford to keep their home warm. Data: EU-SILC 2007 – 2011

Country	2007	2008	2009	2010	2011
AT	2.8	4.6	3.5	3.7	3.1
BE	14.7	7.0	5.9	6.3	7.3
BG	68.5	68.4	65.9	68.2	48.7
CY	37.0	30.8	22.3	26.2	25.0
CZ	7.1	7.0	5.9	5.7	6.9
DK	11.5	1.8	1.7	2.3	3.1
EE	4.4	1.4	2.1	3.4	3.2
FI	1.3	2.4	1.8	1.6	2.4
FR	5.2	5.9	6.0	6.6	6.6
DE	6.1	6.6	6.0	5.6	6.1
GR	15.3	16.4	15.6	16.1	19.5
HU	11.7	10.8	10.0	11.6	13.1
IE	3.6	4.2	4.4	6.7	-
IT	10.7	11.2	10.6	11.5	18.5
LV	24.7	19.1	17.9	21.4	24.0
LT	25.5	24.8	25.5	26.2	37.5
LU	0.7	0.8	0.6	0.5	0.9
MT	-	-	11.3	13.9	17.7
NL	2.1	2.2	1.9	2.7	1.8
PL	24.6	22.3	18.5	16.5	15.4
PT	43.2	35.3	29.0	30.2	26.9
RO	33.6	25.5	22.2	21.1	15.7
SK	5.5	6.4	4.1	5.1	5.5
SI	5.2	6.6	5.4	6.0	6.4
ES	7.9	5.3	6.3	7.2	6.0
SE	2.3	1.7	1.7	2.1	1.9
UK	4.9	6.2	6.2	6.4	6.6
EU-wide	14.6	12.9	11.6	12.4	12.7

In 2011, the EU average for the proportion of dwellings that had a leaking roof, damp or rot was 16.6 per cent, ranging from highs of 35.0 per cent in Slovenia, 28.1 per cent in Cyprus and 26.0 per cent in Latvia, to lows of 5.5 per cent in Finland, 7.9 per cent in Sweden, and 8.2 per cent in Slovakia. Between 2007 and 2011 the incidence of leaks, damp and/or rot increased in the majority of countries (16), and reduced in 11 countries. The largest increases over time are seen in Slovenia (93.4 per cent), Belgium (50.7 per cent) and Denmark (48.5 per cent). By comparison, housing conditions improved substantially in Poland (-68.6 per cent), Romania (-38.6 per cent) and the Czech Republic (-24.7 per cent).

Table 8.3 Percentage of households reporting that they have at least one of the following housing faults: leaking roof, damp walls/floors/foundation, or rot in window frame or floor. Data: EU-SILC 2007 – 2011

Country	2007	2008	2009	2010	2011
AT	8.9	12.3	14.1	13.7	13.0
BE	14.0	18.1	14.7	18.6	21.1
BG	12.4	29.1	23.1	14.6	13.8
CY	30.4	26.8	29.5	29.0	28.1
CZ	15.0	13.6	14.0	11.7	11.3
DK	10.1	8.4	7.6	7.8	15.0
EE	22.5	18.2	20.2	18.7	19.5
FI	4.9	4.3	5.1	4.8	5.5
FR	13.4	12.7	12.2	11.7	10.6
DE	12.7	13.5	13.9	13.4	13.8
GR	19.9	18.9	17.7	17.2	15.4
HU	20.1	31.2	15.0	24.2	22.0
IE	14.9	13.0	14.2	13.4	-
IT	21.7	20.6	20.7	20.3	22.9
LV	25.8	25.9	25.5	24.5	26.0
LT	25.4	24.3	21.8	19.5	19.3
LU	14.0	15.3	16.0	15.8	14.4
MT	-	-	11.0	13.1	12.1
NL	18.0	15.7	15.0	15.2	14.3
PL	36.0	22.3	17.2	15.4	11.3
PT	20.3	19.7	20.7	22.8	21.8
RO	29.8	24.5	22.0	19.2	18.3
SK	6.2	9.4	7.2	6.4	8.2
SI	18.1	30.8	31.2	33.4	35.0
ES	18.2	16.1	17.6	21.1	15.3
SE	5.8	7.4	6.1	7.4	7.9
UK	14.0	13.7	13.6	13.8	14.8
EU-wide	17.4	17.9	16.6	16.5	16.6

In 2011 the EU-wide average for arrears on utility bills was 10.0 per cent, and the lowest incidences were found in Luxembourg (2.1 per cent), the Netherlands (2.5 per cent), Germany and the Czech Republic (both 3.7 per cent). Whereas in Latvia, Romania and Bulgaria over a fifth of households reported being in arrears (22.6, 26.0, and 26.8 per cent respectively). The results for this final indicator are among the lowest of the three indicators, however, the increases over time are more substantial, with utility bill arrears increasing in 24 of the 27 Member States between 2007 and 2011. The largest increase is seen in Romania, with a 225 per cent rise in arrears, followed by Latvia (153.9 per cent) and Estonia (134.9 per cent). Arrears decreased in France (-1.7 per cent), Germany (-5.1 per cent) and Poland (-18.8 per cent) only.

Table 8.4 Percentage of households reporting that they have been in arrears on their utility bills at least once in the last 12 months. Data: EU-SILC 2007 – 2011

Country	2007	2008	2009	2010	2011
AT	2.0	3.4	4.0	4.3	3.8
BE	3.9	4.5	5.4	5.2	5.4
BG	24.8	32.0	30.6	30.0	26.8
CY	9.2	6.7	12.2	14.5	14.1
CZ	3.5	2.4	3.5	3.7	3.7
DK	2.0	2.4	2.8	3.6	3.8
EE	4.3	6.3	8.3	9.4	10.1
FI	4.2	6.0	6.7	6.1	6.7
FR	6.0	5.1	6.5	6.3	5.9
DE	3.9	3.8	3.6	3.4	3.7
GR	16.7	15.6	18.3	18.6	22.2
HU	14.7	11.8	17.1	18.4	19.3
IE	5.4	7.7	9.6	11.4	-
IT	8.8	12.0	9.2	8.9	10.5
LV	8.9	11.5	17.3	22.0	22.6
LT	8.2	5.6	8.5	10.6	10.9
LU	1.9	1.1	2.1	1.8	2.1
MT	-	-	6.9	5.8	7.4
NL	2.2	2.0	2.1	2.1	2.5
PL	14.9	9.0	11.4	12.7	12.1
PT	4.8	3.1	5.1	5.6	5.7
RO	8.0	22.9	23.8	26.0	26.0
SK	5.0	3.4	11.2	9.2	5.9
SI	10.2	12.7	15.3	17.0	16.2
ES	3.7	3.5	4.8	5.6	4.5
SE	3.2	5.5	4.9	4.5	4.3
UK	4.3	4.1	4.5	4.9	4.4
EU-wide	7.1	7.9	9.5	10.1	10.0

Additional indicators used in EIFP

In addition to the three indicators discussed above, the EIFP also includes the following two indicators:

1. Dwelling equipped with heating facilities
2. Dwelling comfortably warm during winter time

The EIFP is only available for the 2007 survey year as these additional indicators are from the ad-hoc module on housing conditions. Table 8.5 outlines the results for both indicators, showing that on average 7.6 per cent of households across 25 EU countries did not have central heating or any other form of fixed heating. More than twice as many households across Europe (16.6 per cent) stated that they were unable to keep their home warm due to the efficiency of their dwelling. A lack of central or fixed heating was most prevalent in Portugal (88.3 per cent), followed by Spain (27.5 per cent) and Cyprus (21.7 per cent). Self-reported inability to keep warm as a consequence of dwelling efficiency, rather than affordability, was correspondingly high in Portugal (56.6 per cent) and Cyprus (29.3 per cent). Other countries with a notably high incidence of inability to keep warm include Bulgaria (38.0 per cent) and Romania (35.9). The best performing countries in terms of heating facilities were Denmark, Estonia, Poland and Sweden, where 0.0 per cent of households stated they did not have fixed heating. The lowest prevalence of inability to keep warm was found in Austria (3.1 per cent), Slovenia (3.9 per cent) and the UK (5.8 per cent).

Table 8.5 Summary of results for additional EIFP indicators. Data: EU-SILC 2007

Country	No central heating/other fixed heating	Unable to keep warm
AT	4.2	3.1
BE	9.1	6.5
BG	14.0	38.0
CY	21.7	29.3
CZ	0.4	10.4
DK	0.0	11.5
EE	0.0	16.9
FI	0.5	10.1
FR	1.9	10.8
DE	0.2	13.0
GR	10.9	17.2
HU	1.0	15.8
IE	1.7	-
IT	3.2	18.6
LV	1.1	20.6
LT	0.5	18.9
LU	0.5	8.6
MT	-	-
NL	0.5	5.9
PL	0.0	24.2
PT	88.3	56.6
RO	-	35.9
SK	0.2	13.6
SI	0.7	3.9
ES	27.5	12.9
SE	0.0	7.1
UK	0.9	5.8
EU-wide	7.6	16.6

Index results and country-level rankings

The subsequent section present results from the CIFP and EIFP. In the first instance, the raw household-level figures are displayed for the number of indicators reported, this is then followed by country-level ranking tables. As occurred in the previous section, all EU-SILC data has been weighted using the household cross-sectional weight.

CIFP results 2007

Table 8.6 presents data on the percentage of households that report zero, one, two, or all three CIFP indicators. It is evident from this data that based on this understanding of fuel poverty, issues exist across all EU countries, to varying degrees. Overall, Finland has the best results in 2007 as it has the highest proportion of households not reporting any of the three CIFP indicators (90.6 per cent), whereas Bulgaria has the lowest proportion of households reporting zero indicators (25.8 per cent). Across all countries the proportion of households affected declines with the number of indicators reported, that is to say of the households in CIFP fuel poverty, a higher proportion suffer from just one indicator rather than two or three indicators.

Table 8.6 2007 CIFP results. Data: EU-SILC 2007

Country	Number of indicators reported (% of households)			
	0	1	2	3
AT	87.8	10.8	1.2	0.1
BE	73.0	22.0	4.3	0.7
BG	25.8	47.9	20.6	5.6
CY	46.7	33.3	16.9	3.2
CZ	78.5	17.9	3.1	0.5
DK	80.8	15.4	3.5	0.4
EE	72.4	24.0	3.4	0.2
FI	90.6	8.6	0.8	0.1
FR	79.3	17.1	3.2	0.4
DE	80.7	16.1	2.8	0.3
GR	64.0	23.6	9.2	3.3
HU	65.2	24.9	8.1	1.8
IE	80.6	15.4	3.2	0.9
IT	68.8	23.0	6.5	1.7
LV	58.2	26.5	12.9	2.4
LT	55.6	31.9	10.4	2.1
LU	84.2	15.1	0.6	0.0
MT	-	-	-	-
NL	79.8	18.5	1.5	0.3
PL	48.7	31.7	14.8	4.8
PT	48.2	37.0	13.6	1.2
RO	48.5	34.1	15.0	2.4
SK	85.9	11.8	2.1	0.3
SI	72.8	21.1	5.1	0.9
ES	74.9	20.8	3.9	0.4
SE	89.6	9.6	0.7	0.1
UK	80.1	17.0	2.4	0.5
EU-wide	70.0	22.1	6.5	1.3

In the subsequent table, countries are ranked from best to worst according to the percentage of households experiencing one, two, and all three indicators concurrently. Overall rankings have also been compiled on the basis of two weighting schemes, as outlined in the box below.

Key:

a = % of households reporting 1 indicator

b = % of households reporting 2 indicators

c = % of households reporting 3 indicators

Scenario 1 - Unweighted (equal weights):

$0.3333\,a + 0.3333\,b + 0.3333\,c$

Scenario 2 - Weighted by severity

$0.1667\,a + 0.3333\,b + 0.5000\,c$

The use of an equal weighting scheme, which is the same as unweighting, can be justified on the basis that this research is exploratory in nature, with a limited evidence base to refer to. Similarly, weighting the sub-components according to their severity is intuitive as it assigns greater weight to the proportion of households experiencing all three indicators, on the basis that this represents the worst scenario.

The OECD note that "the calculation of the ranking of each country according to each individual indicator and summation of the resulting rankings…is simple and independent of outliers. However, the absolute value of information is lost" (OECD, 2008: 102). It is for this reason that the raw data is also presented, as shown in Table 8.6. The ranking tables have been colour coded for ease of tracking achievement across the various components, ranging from dark green for best, through to red for worst[8].

As can be seen in Table 8.7, most countries perform consistently across the rankings for the percentage of households reporting one, two or three indicators. The exceptions are visually discernible, and include Greece, which is ranked 17th and 19th and for households reporting 1 and 2 indicators, but for households experiencing three indicators it is in 24th place. On the other hand, Estonia is among the top five countries for the percentage of households experiencing three indicators, yet it is ranked 18th and 12th for households experiencing one and two indicators respectively. Overall, Finland, Sweden and Austria

[8] 1-6 dark green; 7-11 pale green; 12-16 yellow; 17-21 orange; 22-27 red.

are ranked in the top three positions, in both the unweighted and weighted scenarios, for having the lowest incidence of CIFP fuel poverty, whilst Poland, Portugal, Cyprus and Bulgaria have the worst rankings. There are minimal differences between the unweighted and weighted final ranks, indeed in half of the Member States there is no difference in ranked position between the two scenarios, and in a further 27 per cent of countries the change in weighting scenario only results in one position change. The greatest position changes occur in the Netherlands, which moves from 10th place in the unweighted scenario to 6th place in the weighted scenario, and in Denmark, which sees a worsening of ranks from 6th place in the unweighted scenario, to 9th place in the weighted scenario.

Table 8.7 2007 CIFP country rankings. Data: EU-SILC 2007

2007 CIFP country rankings					
Country	**Unweighted final rank**	**Weighted final rank**	**Rank for % experiencing 1 indicator**	**Rank for % experiencing 2 indicators**	**Rank for % experiencing 3 indicators**
FI	1	1	1	3	2
SE	2	2	2	2	3
AT	3	3	3	4	4
SK	4	5	4	6	6
LU	5	4	5	1	1
DK	6	9	7	13	9
DE	7	7	8	8	8
IE	8	10	6	11	15
UK	9	8	9	7	12
NL	10	6	12	5	7
FR	11	11	10	10	10
CZ	12	12	11	9	13
ES	13	13	13	14	11
BE	14	15	15	15	14
SI	15	16	14	16	16
EE	16	14	18	12	5
IT	17	17	16	17	18
HU	18	18	19	18	19
GR	19	19	17	19	24
LV	20	21	20	21	21
LT	21	20	22	20	20
PL	22	24	21	23	25
RO	23	23	24	24	22
PT	24	22	25	22	17
CY	25	25	23	25	23
BG	26	26	26	26	26
MT	-	-	-	-	-

CIFP results 2008

In 2008, Denmark had the highest proportion of households not reporting any CIFP indicators (88.9 per cent), as displayed in Table 8.8, whilst Bulgaria had the lowest proportion of households reporting zero indicators (22.6 per cent). As in 2007, the proportion of households affected declines with the number of indicators reported, indeed across the majority of countries less than one per cent of households report experiencing all three indicators concurrently.

Table 8.8 2008 CIFP results. Data: EU-SILC 2008

Country	Number of indicators reported (% of households)			
	0	1	2	3
AT	82.3	15.2	2.2	0.2
BE	75.7	19.9	3.7	0.7
BG	22.6	37.3	28.1	12.0
CY	52.4	32.6	13.2	1.8
CZ	80.3	16.8	2.6	0.4
DK	88.9	9.9	0.9	0.2
EE	76.7	20.9	2.2	0.1
FI	88.6	10.4	0.9	0.1
FR	80.5	15.7	3.4	0.4
DE	79.7	17.1	2.8	0.4
GR	63.1	25.5	8.8	2.6
HU	59.5	29.4	9.0	2.1
IE	80.0	15.7	3.7	0.6
IT	66.7	24.5	7.0	1.8
LV	58.3	29.2	10.3	2.2
LT	56.8	32.8	9.2	1.2
LU	83.3	16.1	0.5	0.0
MT	-	-	-	-
NL	81.8	16.6	1.4	0.1
PL	61.0	26.4	10.4	2.1
PT	54.9	33.5	10.9	0.7
RO	50.6	30.8	13.6	5.0
SK	83.7	13.7	2.3	0.3
SI	60.2	30.9	7.7	1.3
ES	78.7	18.0	3.1	0.3
SE	86.9	11.7	1.3	0.1
UK	79.9	16.7	2.9	0.5
EU-wide	70.5	21.8	6.2	1.4

In the overall 2008 CIFP rankings, Denmark has improved its position considerably, going from 6th/9th position respectively for the unweighted and weighted scenarios, to first place, replacing Finland. Denmark is followed by its Nordic neighbours Finland and Sweden, as shown in Table 8.9. Austria has a worsened index position compared to 2007, ranking 6th and 7th place respectively in 2008. As in the previous year, Cyprus and Bulgaria are ranked in the bottom three on the basis of fuel poverty prevalence, along with Romania which has dropped two places to 25^{th,} although Romania has improved on its rank from the previous year for the percentage of households experiencing one indicators, and Cyprus has improved its rank for the percentage of household experiencing three indicators.

Table 8.9 2008 CIFP country rankings. Data: EU-SILC 2008

2008 CIFP country rankings					
Country	Unweighted final rank	Weighted final rank	Rank for % experiencing 1 indicator	Rank for % experiencing 2 indicators	Rank for % experiencing 3 indicators
DK	1	1	1	2	6
FI	2	2	2	3	3
SE	3	3	3	4	2
SK	4	5	4	8	8
LU	5	4	8	1	1
AT	6	7	5	6	7
NL	7	6	9	5	5
FR	8	9	6	13	12
CZ	9	8	11	9	10
IE	10	12	7	14	14
UK	11	11	10	11	13
DE	12	10	12	10	11
ES	13	13	13	12	9
EE	14	14	15	7	4
BE	15	15	14	15	16
IT	16	16	16	16	19
GR	17	18	17	18	24
PL	18	19	18	22	22
SI	19	17	22	17	18
HU	20	20	20	19	21
LV	21	22	19	21	23
LT	22	21	24	20	17
PT	23	23	25	23	15
CY	24	24	23	24	20
RO	25	25	21	25	25
BG	26	26	26	26	26
MT	-		-	-	-

CIFP results 2009

The 2009 CIFP results displayed in Table 8.10 are similar to the 2008 figures, with just 24.8 per cent of Bulgarian households stating they are not affected by any of the CIFP indicators, compared to 88.9 per cent of households in Denmark. Of the households that report indicators, a greater proportion report only one, rather than a combination of two or three.

Table 8.10 2009 CIFP results. Data: EU-SILC 2009

Country	Number of indicators reported (% of households)			
	0	1	2	3
AT	80.9	16.9	2.0	0.2
BE	78.6	17.6	3.2	0.6
BG	24.8	40.1	25.9	9.3
CY	53.4	31.3	13.0	2.3
CZ	80.2	16.8	2.6	0.4
DK	88.9	10.0	1.0	0.1
EE	73.5	22.9	3.3	0.3
FI	87.6	11.4	0.9	0.1
FR	79.6	16.6	3.4	0.5
DE	80.6	16.1	2.8	0.6
GR	62.5	25.8	9.1	2.5
HU	68.0	23.6	6.6	1.7
IE	77.8	17.1	4.2	0.9
IT	69.2	22.7	6.3	1.7
LV	55.6	30.9	11.0	2.6
LT	57.1	31.4	9.9	1.6
LU	82.3	16.8	0.8	0.1
MT	75.4	20.6	3.5	0.5
NL	82.7	15.9	1.3	0.1
PL	65.9	23.5	8.5	2.2
PT	58.1	30.0	10.8	1.1
RO	53.9	28.9	12.7	4.6
SK	80.7	16.6	2.2	0.5
SI	59.6	30.4	8.6	1.4
ES	75.6	20.4	3.5	0.4
SE	88.7	10.2	1.0	0.2
UK	78.8	18.1	2.7	0.4
EU-wide	71.1	21.6	6.0	1.4

The order of countries has shifted marginally in the 2009 rankings compared to the preceding year, as shown in Table 8.11, although the top three rankings are still dominated by Nordic countries, with Denmark in first place, Sweden in second place, and Finland in third position. In terms of the bottom ranked countries, Romania, Cyprus and Bulgaria are still ranked worst. As apparent in previous years, overall most countries are ranked consistently across the severity ranks, as demonstrated by a uniform row colour. However, there are some exceptions, such as Ireland, which performs better on the basis of households experiencing just one indicator (11th place) than it does for households experiencing two or three indicators (16th place).

Table 8.11 2009 CIFP country rankings. Data: EU-SILC 2009

2009 CIFP country rankings					
Country	**Unweighted final rank**	**Weighted final rank**	**Rank for % experiencing 1 indicator**	**Rank for % experiencing 2 indicators**	**Rank for % experiencing 3 indicators**
DK	1	1	1	3	1
SE	2	2	2	4	5
FI	3	3	3	2	3
NL	4	5	4	5	4
LU	5	4	8	1	2
AT	6	6	10	6	6
SK	7	7	7	7	13
DE	8	9	5	10	14
CZ	9	8	9	8	8
FR	10	11	6	13	11
UK	11	10	13	9	10
BE	12	12	12	11	15
IE	13	13	11	16	16
ES	14	14	14	14	9
MT	15	15	15	15	12
EE	16	16	17	12	7
IT	17	17	16	17	21
HU	18	18	19	18	20
PL	19	19	18	19	22
GR	20	20	20	21	24
SI	21	21	23	20	18
PT	22	22	22	23	17
LT	23	23	26	22	19
LV	24	24	24	24	25
RO	25	26	21	25	26
CY	26	25	25	26	23
BG	27	27	27	27	27

CIFP results 2010

The results shown in Table 8.12 replicate the trends found in 2007, with Bulgaria performing worst in terms of the proportion of households reporting CIFP indicators, with only 25.5 per cent of households not experiencing any indicators, whereas in Finland the figure is 88.6 per cent.

Table 8.12 2010 CIFP results. Data: EU-SILC 2010

Country	Number of indicators reported (% of households)			
	0	1	2	3
AT	81.6	15.6	2.6	0.3
BE	75.2	20.2	4.0	0.6
BG	25.5	42.8	25.3	6.4
CY	51.4	30.4	15.2	3.0
CZ	81.8	15.5	2.4	0.3
DK	88.1	10.5	1.2	0.1
EE	73.2	22.4	3.8	0.6
FI	88.6	10.4	0.9	0.1
FR	80.2	15.8	3.4	0.7
DE	81.4	15.4	2.7	0.5
GR	61.9	26.8	8.8	2.5
HU	63.0	23.2	10.5	3.3
IE	74.9	19.4	4.8	0.8
IT	68.8	23.2	6.3	1.6
LV	51.8	31.7	13.5	3.0
LT	57.0	31.3	9.8	1.9
LU	82.8	16.4	0.8	0.0
MT	72.8	22.1	4.8	0.3
NL	81.9	16.3	1.6	0.2
PL	67.8	22.2	7.6	2.3
PT	55.1	32.6	11.2	1.2
RO	54.7	29.1	11.6	4.6
SK	82.4	15.1	2.1	0.5
SI	56.5	32.1	9.9	1.4
ES	71.3	24.0	4.2	0.5
SE	87.5	11.1	1.2	0.1
UK	79.4	16.5	3.6	0.5
EU-wide	70.2	21.9	6.4	1.4

The 2010 rankings for the CIFP, as seen in Table 8.13, show that Finland and Denmark have changed position for first place in terms of having the lowest incidence of fuel poverty related issues, whilst at the bottom of the rankings Latvia is in 25th place, followed by Cyprus and Bulgaria for 26th and 27th position respectively. This is the fourth consecutive year in which Bulgaria is ranked in last place for households experiencing one, two, and three indicators.

Table 8.13 2010 CIFP country rankings. Data: EU-SILC 2010

2010 CIFP country rankings					
Country	**Unweighted final rank**	**Weighted final rank**	**Rank for % experiencing 1 indicator**	**Rank for % experiencing 2 indicators**	**Rank for % experiencing 3 indicators**
FI	1	1	1	2	2
DK	2	2	2	3	3
SE	3	3	3	4	4
LU	4	4	10	1	1
SK	5	6	4	6	9
NL	6	5	9	5	5
CZ	7	7	6	7	6
AT	8	8	7	8	7
DE	9	9	5	9	10
FR	10	10	8	10	15
UK	11	11	11	11	11
BE	12	12	13	13	14
IE	13	13	12	16	16
EE	14	14	16	12	13
MT	15	15	14	15	8
ES	16	16	19	14	12
IT	17	17	18	17	19
PL	18	18	15	18	21
HU	19	20	17	22	25
GR	20	19	20	19	22
LT	21	22	23	20	20
SI	22	21	25	21	18
PT	23	23	26	23	17
RO	24	24	21	24	26
LV	25	25	24	25	24
CY	26	26	22	26	23
BG	27	27	27	27	27

CIFP results 2011

Table 8.14 shows the results for the 2011 edition of the CIFP. Overall Sweden has the highest proportion of households that do not report experiencing any indicator (87.5 per cent). By comparison, the lowest proportion of households not affected by any of the CIFP indicators is found in Bulgaria (40.1 per cent), although the 2011 results for Bulgaria are a significant improvement on previous years.

Table 8.14 2011 CIFP results. Data: EU-SILC 2011

Country	Number of indicators reported (% of households)			
	0	1	2	3
AT	82.7	15.0	2.1	0.3
BE	72.2	22.4	4.5	0.8
BG	40.1	36.2	18.2	5.5
CY	52.8	30.1	14.1	3.0
CZ	81.4	15.6	2.7	0.3
DK	80.7	17.4	1.5	0.4
EE	73.2	21.8	4.2	0.8
FI	87.2	11.2	1.5	0.1
FR	81.3	14.9	3.3	0.5
DE	80.2	16.4	2.8	0.5
GR	60.3	25.2	11.4	3.1
HU	63.1	23.1	10.2	3.6
IE	-	-	-	-
IT	61.8	26.9	8.8	2.4
LV	50.3	31.0	14.6	4.0
LT	47.7	38.6	11.5	2.1
LU	83.7	15.3	0.9	0.1
MT	67.0	28.9	4.0	0.1
NL	83.2	15.3	1.4	0.1
PL	71.4	20.3	6.5	1.8
PT	57.9	30.7	10.3	1.0
RO	58.6	26.8	10.6	4.0
SK	84.1	12.7	2.8	0.4
SI	55.4	33.3	9.7	1.6
ES	78.2	18.1	3.3	0.4
SE	87.5	11.1	1.2	0.1
UK	78.8	17.5	3.3	0.5
EU-wide	70.0	22.1	6.4	1.4

In the final 2011 CIFP rankings Sweden replaces Finland in 1st place overall, and Denmark drops from a top three country to 9th and 7th place respectively depending on weighting. Bulgaria remains in last place overall, but shows a marginal improvement for the percentage of households experiencing one indicator. Latvia and Lithuania are also ranked in the bottom three worst countries. The results shows more variation across the rows than in previous years, for instance, Malta is ranked 16th and 15th overall, but is ranked in 1st place for having the fewest number of households reporting all three CIFP indicators, and is in 20th position for the percentage of households experiencing one indicator.

Table 8.15 2011 CIFP country rankings. Data: EU-SILC 2011

2011 CIFP country rankings					
Country	Unweighted final rank	Weighted final rank	Rank for % experiencing 1 indicator	Rank for % experiencing 2 indicators	Rank for % experiencing 3 indicators
SE	1	1	1	2	2
FI	2	2	2	4	4
SK	3	5	3	8	9
LU	4	3	7	1	3
NL	5	4	6	3	5
AT	6	6	5	6	6
CZ	7	8	8	7	7
FR	8	9	4	12	13
DK	9	7	10	5	10
DE	10	10	9	9	12
UK	11	11	11	10	11
ES	12	12	12	11	8
EE	13	13	14	14	14
BE	14	14	15	15	15
PL	15	16	13	16	18
MT	16	15	20	13	1
HU	17	18	16	19	23
IT	18	17	19	17	20
GR	19	20	17	22	22
RO	20	22	18	21	25
PT	21	19	22	20	16
SI	22	21	24	18	17
CY	23	23	21	24	21
LV	24	25	23	25	24
LT	25	24	26	23	19
BG	26	26	25	26	26
IE	-		-	-	-

EIFP results 2007

The expanded index for 2007, as illustrated in Table 8.16, follows a slightly different pattern to the CIFP. Whilst Sweden still has the highest proportion of households that do not report experiencing any indicator (84.5 per cent), Portugal is now the worst performing country, with just 5.2 per cent of households not reporting any of the five EIFP indicators. This very low proportion of unaffected households can be explained by revisiting the results presented earlier in the chapter concerning heating facilities and dwelling efficiency, in which the majority of Portuguese households were found to lack any form of fixed heating and subsequently stated that they were unable to keep their home warm due to the efficiency of their dwelling. Furthermore, unlike the CIFP trends for a decreasing incidence of indicators reported, in Bulgaria, Denmark and Portugal a greater proportion of households report experiencing two indicators than one, or three or more. However, the incidence of households reporting all five EIFP indicators is very low, indeed the highest response is found in Cyprus, affecting 1.1 per cent of households.

Table 8.16 2007 EIFP results. Data: EU-SILC 2007

Country	Number of indicators reported (% of households)					
	0	1	2	3	4	5
AT	83.6	12.8	2.8	0.6	0.1	0.1
BE	64.4	23.1	6.7	2.4	0.6	0.2
BG	22.1	26.4	29.1	16.8	5.4	0.3
CY	38.4	24.1	17.7	12.5	6.2	1.1
CZ	73.8	18.6	5.4	1.9	0.3	0.0
DK	80.8	7.6	8.0	3.3	0.4	0.0
EE	65.5	23.2	9.1	2.1	0.2	0.0
FI	82.6	14.5	2.4	0.3	0.1	0.0
FR	72.1	20.6	5.3	1.7	0.2	0.0
DE	74.8	17.4	5.7	1.9	0.3	0.0
GR	56.7	22.4	11.0	5.5	3.4	1.0
HU	60.3	23.5	10.4	4.5	1.3	0.0
IE	-	-	-	-	-	-
IT	64.5	22.1	8.6	3.6	1.1	0.1
LV	54.2	24.6	11.9	7.7	1.7	0.0
LT	50.4	29.4	13.3	5.4	1.4	0.1
LU	78.3	18.2	3.1	0.3	0.0	0.0
MT	-	-	-	-	-	-
NL	76.8	18.9	3.4	0.7	0.2	0.0
PL	42.7	29.8	15.6	8.9	3.0	0.0
PT	5.2	26.7	30.7	26.7	9.6	1.0
RO	-	-	-	-	-	-
SK	76.5	17.8	4.3	1.1	0.2	0.0
SI	71.4	21.2	5.2	1.7	0.5	0.0
ES	56.1	27.2	9.7	4.8	2.0	0.2
SE	84.5	13.1	2.0	0.4	0.0	0.0
UK	76.8	17.9	4.0	1.1	0.3	0.0
EU-wide	63.0	20.9	9.4	4.8	1.6	0.2

The same weighting principals as before have been used to produce overall unweighted and weighting rankings for the EIFP, however, the weights have been modified to reflect the additional indicators, as outlined in the box below.

Key:

a = % of households reporting 1 indicator

b = % of households reporting 2 indicators

c = % of households reporting 3 indicators

d = % of households reporting 4 indicators

e = % of households reporting 5 indicators

Scenario 1 - Unweighted (equal weights):

$0.20\,a + 0.20\,b + 0.20\,c + 0.20\,d + 0.20\,e$

Scenario 2 - Weighted by severity

$0.0667\,a + 0.1333\,b + 0.20\,c + 0.2667\,d + 0.3333\,e$

Table 8.17 presents the results for the EIFP, showing that the overall rankings are relatively similar to the CIFP, with Sweden, Austria and Finland ranked in the top three places. Bulgaria and Cyprus are also in the bottom three ranked countries, although Portugal is in last place overall. In terms of the sub-components, nine countries do not have any households that report all five indicators, which results in some ambiguity for this sub-component as there are a high number of countries tying for first place. Thereafter the figures for households reporting five indicators remain low, as shown in Table 8.16 above. Visually there appears to be more variability across the country rows for the EIFP compared to the CIFP.

Table 8.17 2007 EIFP country rankings. Data: EU-SILC 2007

2007 EIFP country rankings							
Country	**Unweighted final rank**	**Weighted final rank**	**Rank for 1 indicator**	**Rank for 2 indicators**	**Rank for 3 indicators**	**Rank for 4 indicators**	**Rank for 5 indicators**
SE	1	1	3	1	3	1	1
AT	2	3	2	3	4	4	16
FI	3	2	4	2	1	3	1
DK	4	8	1	13	14	12	1
LU	5	4	8	4	2	2	1
UK	6	6	7	6	6	9	1
NL	7	5	10	5	5	7	1
SK	8	7	6	7	7	6	12
DE	9	9	5	11	10	11	1
CZ	10	10	9	10	11	10	13
FR	11	11	11	9	8	8	15
SI	12	12	12	8	9	13	14
BE	13	13	15	12	13	14	19
EE	14	14	16	15	12	5	1
IT	15	15	13	14	15	15	18
HU	16	16	17	17	16	16	11
GR	17	20	14	18	19	21	22
ES	18	17	22	16	17	19	20
LV	19	18	19	19	20	18	10
LT	20	19	23	20	18	17	17
PL	21	21	24	21	21	20	1
CY	22	22	18	22	22	23	24
BG	23	23	20	23	23	22	21
PT	24	24	21	24	24	24	23
IE	-		-	-	-	-	-
MT	-		-	-	-	-	-
RO	-		-	-	-	-	-

Comparison of indexes 2007 – 2011

In Table 8.18, all of the overall country rankings presented previously in the chapter are summarised, for both the expanded and core indices. The ordering of the countries in the table has been arranged in reference to the 2009 CIFP unweighted rankings as this is the first year in which the data is complete for all 27 countries. In terms of the differences between the 2007 EIFP and CIFP, for most of the countries there is minimal or no variation in scores. The main exception is Spain, which is ranked four places higher on the CIFP than EIFP. Longitudinally, there are discernible differences between the 2007 CIFP rankings and 2011 CIFP rankings, with 13 countries showing improvement to their relative position, nine countries ranked worse in 2007 than 2011, and three countries remaining the same, with respect to both unweighted and weighted scenarios.

However, comparing just the start and end data points disguises the significant movement that occurred from 2007 to 2011. For instance, Denmark fluctuates significantly from 9th place (weighted) in 2007 to 1st and 2nd place from 2008 to 2010, before dropping several places to 7th position in 2011. As the OECD stated, a key flaw of the ranking design is that absolute values are lost, which is why the raw data has been presented too. An examination of the earlier data tables (8.6, 8.8, 8.10, 8.12 and 8.14) suggests that Denmark's fluctuations are due to large changes within the Danish statistics rather than it being a consequence of other countries changing substantially, with a higher proportion of households reporting CIFP indicators in 2007 and 2011 than between 2008 to 2010.

Overall, the top five performing countries with the lowest incidence of fuel poverty are predominantly Northern and Western European countries, such as Finland, Denmark and Luxembourg. At the opposite end of the scale, the bottom five ranked countries are consistently Eastern and Southern European countries, such as Bulgaria, Cyprus and Romania.

Table 8.18 Comparison of CIFP and EIFP overall country rankings. Data: EU-SILC 2007-2011

	EIFP		CIFP									
	2007 U	2007 W	2007 U	2007 W	2008 U	2008 W	2009 U	2009 W	2010 U	2010 W	2011 U	2011 W
DK	4	8	6	9	1	1	1	1	2	2	9	7
SE	1	1	2	2	3	3	2	2	3	3	1	1
FI	3	2	1	1	2	2	3	3	1	1	2	2
NL	7	5	10	6	7	6	4	5	6	5	5	4
LU	5	4	5	4	5	4	5	4	4	4	4	3
AT	2	3	3	3	6	7	6	6	8	8	6	6
SK	8	7	4	5	4	5	7	7	5	6	3	5
DE	9	9	7	7	12	10	8	9	9	9	10	10
CZ	10	10	12	12	9	8	9	8	7	7	7	8
FR	11	11	11	11	8	9	10	11	10	10	8	9
UK	6	6	9	8	11	11	11	10	11	11	11	11
BE	13	13	14	15	15	15	12	12	12	12	14	14
IE	-	-	8	10	10	12	13	13	13	13	-	-
ES	18	17	13	13	13	13	14	14	16	16	12	12
MT	-	-	-	-	-	-	15	15	15	15	16	15
EE	14	14	16	14	14	14	16	16	14	14	13	13
IT	15	15	17	17	16	16	17	17	17	17	18	17
HU	16	16	18	18	20	20	18	18	19	20	17	18
PL	21	21	22	24	18	19	19	19	18	18	15	16
GR	17	20	19	19	17	18	20	20	20	19	19	20
SI	12	12	15	16	19	17	21	21	22	21	22	21
PT	24	24	24	22	23	23	22	22	23	23	21	19
LT	20	19	21	20	22	21	23	23	21	22	25	24
LV	19	18	20	21	21	22	24	24	25	25	24	25
RO	-	-	23	23	25	25	25	26	24	24	20	22
CY	22	22	25	25	24	24	26	25	26	26	23	23
BG	23	23	26	26	26	26	27	27	27	27	26	26

Post-hoc index adjustment

Given the diversity of countries comprising the European Union - particularly in terms of heating demand - the comparability of the EU-SILC data in its current form may be questioned by key stakeholders. The purpose of this section is to consider one potential post-hoc index adjustment, climate correction, with an overall aim of enabling discussions around comparability of data, and potential remediation measures in the form of post-hoc adjustments. The author could find no examples of survey data adjustments of this nature, and so the key methods are borrowed from energy consumption and energy efficiency statistics, in which it is standard practice to apply temperature corrections to data, particularly for pan-European comparisons (Lapillonne *et al*., 2015).

Climate correction factors have been calculated for each country to apply to the national-level aggregate index rankings. Due to time and space limitations, the post-hoc adjustments have been made to one survey year only, 2010, as this is the newest complete dataset available. Consequently, only the CIFP has been used in the analysis. The core component of the correction factors is heating degree days (HDD) data from Eurostat. HDD express the severity of the cold in a specific time period, taking into consideration the amount of time when the outside temperature falls below a pre-specified base temperature. The base temperature is a balance point temperature, that is, the outdoor temperature at which supplementary heating is not required in order to maintain a comfortable internal environment. The base temperature is usually 15°C or 15.5°C. Heating degree days are the sum of the differences between the outside and base temperature whenever the outside temperature falls below the base temperature. The calculation method used by Eurostat is as follows:

(18°C - Tm) x d if Tm is lower than or equal to 15°C (heating threshold) and are nil if Tm is greater than 15°C

Where Tm is the mean ((Tmin + Tmax)/ 2) outdoor temperature over a period of d days.

(Eurostat, 2014b)

These calculations are computed on a daily basis, and subsequently added up to calendar months and years. The Eurostat degree days utilise two thresholds, 15°C and 18°C. Degree days are unidirectional with regard to the base temperature, which means that when the daily mean temperature is 15°C or less, there is a positive contribution to the degree days measure of 18°C minus the average temperature. But if the temperature is higher than the 15°C baseline, then there is zero contribution to the degree days measure. This means that any single day's degree day measure will be zero, or a number that is greater than or equal to three. The calculation method used for heating degree days can result in there being more heating degree days than the number of days in a year, thus the metric should be interpreted as a measure of severity, rather than in reference to Gregorian calendar days and years.

The climate correction factors have been calculated by dividing the average annual HDD score for each Member State by the EU-27 average annual HDD. The national figures for the proportion of households reporting one, two and three indicators is then multiplied by the corresponding correction factor. In the box below is a worked example for Austria in 2010, whilst Table 8.19 displays the full list of HDD and correction factors for each country.

Correction factor: 3703.619 ÷ 3472.792 = 1.066.

Adjusting % of households reporting one indicator: 15.576 × 1.066 = 16.6%

Table 8.19 Average annual heating degree days and climate correction factors for 2010

Country	HDD	Correction factor	Country	HDD	Correction factor
EU-27	**3472.792**	**N/A**	IE	3125.334	0.900
AT	3703.619	1.066	IT	1992.313	0.574
BE	3173.996	0.914	LT	4409.380	1.270
BG	2595.686	0.747	LU	3357.740	0.967
CY	442.229	0.127	LV	4622.254	1.331
CZ	3832.471	1.104	MT	384.716	0.111
DE	3610.812	1.040	NL	3299.819	0.950
DK	3971.335	1.144	PL	3880.592	1.117
EE	4817.635	1.387	PT	1289.750	0.371
ES	1913.043	0.551	RO	2988.331	0.860
FI	6058.319	1.745	SE	5873.873	1.691
FR	2707.421	0.780	SI	3040.878	0.876
GR	1342.537	0.387	SK	3467.444	0.998
HU	2936.471	0.846	UK	3403.313	0.980

The underlying principal of the climate correction factors means that such adjustments could be made on the basis of alternative factors, such as energy efficiency standards, income inequality, the extent of energy market liberalisation, and energy pricing.

The unadjusted CIFP index results (both unweighted and weighted) for 2010 have been compared with the adjusted index results in Table 8.20 below. As can be seen, adjusting the index results for climate, based on deviation from the EU27 HDD average, significantly changes the ranking order. Countries located in Southern Europe see a substantial improvement in rankings, particularly Malta, which goes from 15th place to 1st, and Cyprus, which climbs from 26th place to 2nd. This is due to the very low heating demand found in these countries, for instance Malta's annual HDD is almost one tenth of the EU27 average, with the CIFP results reduced accordingly. Member States that have annual HDD close to the EU27 average see some changes to rank position but these are not particularly significant changes, for instance Slovakia, Germany and Luxembourg. Similarly, Denmark remains in the top three best countries after adjustment. At the opposite end of the table, the worst ranked countries remain relatively similar, with Bulgaria and Latvia featuring in the bottom three before and after climate adjustment, despite a reduction in the Bulgarian CIFP fuel poverty rates.

Table 8.20 Climate adjusted 2010 CIFP country rankings. Data: EU-SILC 2010

	Unadjusted		Adjusted	
Country	Unweighted final rank	Weighted final rank	Unweighted final rank	Weighted final rank
FI	1	1	14	11
DK	2	2	3	3
SE	3	3	17	16
LU	4	4	7	4
SK	5	6	10	9
NL	6	5	9	6
CZ	7	7	15	14
AT	8	8	13	12
DE	9	9	12	13
FR	10	10	5	7
UK	11	11	16	17
BE	12	12	19	18
IE	13	13	18	19
EE	14	14	22	20
MT	15	15	1	1
ES	16	16	6	5
IT	17	17	11	15
PL	18	18	21	23
HU	19	20	20	21
GR	20	19	4	8
LT	21	22	25	25
SI	22	21	23	22
PT	23	23	8	10
RO	24	24	24	24
LV	25	25	27	27
CY	26	26	2	2
BG	27	27	26	26

Sociodemographic and geographic characteristics of the fuel poor

Having established that fuel poverty exists across the EU, on the basis of the indicators used, the subsequent analysis examines the sociodemographic and geographic characteristics of the fuel poor. In addition to preliminary relationship testing using cross-tabulation and chi square tests, multinomial logistic regression models have also been constructed to examine the factors that influence the likelihood of being fuel poor. Logistic regression is the most appropriate form of statistical test as it requires categorical outcome variables, and continuous or categorical predictor variables (Field, 2009: 265). Furthermore, as many of the household characteristics associated with fuel poverty also tend to be correlated with each other, regression analysis is useful for isolating specific affects and assessing relative importance (Scott *et al*., 2008: 18).

For variables with more than two categories, for example household type and highest educational achievement, reference categories have been selected in order to produce odds ratios (Exp(B)) within each of the regression models. As Scott *et al.* explain, a reference category is “essentially a baseline against which households with different characteristics may be compared” (2008: 19), whilst odds ratios reflect the likelihood that a household with a specific characteristic will be fuel poor, relative to households in the reference group. An odds ratio score greater than one indicates a higher risk of fuel poverty, an odds ratio equal to one signifies an equal likelihood of being fuel poor, whilst an odds ratio below one indicates a lower risk. It should be noted that in the regression models a minority of predictor variables have very large Exp(B) values and are not statistically significant (NS). This is likely to have been caused by the small cell sizes resulting from analysis of sub-groups; further details are provided in Appendix 4.

The choice of predictors was informed by the literature review in Chapter 2, and by the studies profiled in Chapter 5. In total, ten predictors were utilised: highest education level; unemployment; retirement; chronic illness and disability; income poverty; household type; dwelling type; central heating; tenure; and urban/rural location. In addition, the association between fuel poverty and climate has been analysed using national-level data. With the exception of the central heating analysis, which uses data from 2007, data from the 2010 EU-SILC has been used as this is the newest complete dataset available. Consequently, only the CIFP has been used in the analysis. The full results tables can be found in Appendix 3 and 4.

Education

This predictor variable is aggregated from individual-level data and refers to the highest educational attainment by anyone in the household. The educational classification used is the International Standard Classification of Education (ISCED) (Eurostat, 2010b), which has six levels of completed education, ranging from pre-primary, through to the first and second stage of tertiary education. The latter category is the reference category in the regression models.

Reporting a higher number of CIFP indicators is generally associated with lower educational attainment, and across all countries the chi-square tests were significant at the p <.001 level. For instance in Belgium the modal category of education for households reporting zero and one indicators is first and second stage tertiary, whereas the modal category for households experiencing two and three indicators is upper secondary. The same pattern is repeated in Cyprus, Lithuania, and the Netherlands. However, it should be noted that across 12 countries (CZ, DK, FI, FR, HU, LU, PL, PT, RO, SE, SI, SK) the modal category of education is the same irrespective of CIFP status, although overall a higher proportion of households not reporting CIFP indicators are educated to the first and second stage of tertiary education compared to CIFP fuel poor households.

The regression models indicate that generally the risk of fuel poverty is higher for households with lower levels of education, and that this risk increases in line with the number of CIFP indicators. Table 8.21 summarises the highest risk categories by CIFP level and country. For example, households in Cyprus, Greece and Poland that are only educated to pre-primary level are between three to four times more likely to report one CIFP indicator compared to households in the reference category (first and second stage tertiary). Households with pre-primary education are around 49 times more likely to report two indicators in Estonia, almost 22 times more likely in the Netherlands, and 10 times more likely in Bulgaria. Similarly, being educated to pre-primary level is associated with increased odds of 24.5 in France and 58.7 in Bulgaria for reporting all three CIFP indicators. This trend is not always evident for households educated to a higher level, with upper secondary educated households sometimes at a lower risk of fuel poverty, or in the region of between one and three times more likely to be in fuel poverty. Appendix 3 and 4 contain the full details of analysis for each country.

Table 8.21 Summary of highest odds ratio for education

Country	Highest odds ratio category for education		
	One indicator	Two indicators	Three indicators
AT	2.90 pre-primary	3.37 pre-primary	10.90 lower secondary
BE	1.39 post-secondary non-tertiary	2.99 pre-primary	3.12 post-secondary non-tertiary
BG	2.71 pre-primary	10.05 pre-primary	58.72 pre-primary
CY	3.77 pre-primary	5.28 pre-primary	9.53 lower secondary
CZ	1.59 lower secondary	1.43 lower secondary	33.38 lower secondary
DK	1.53 lower secondary	0.79 upper secondary	-
EE	2.15 primary	49.40 pre-primary	12.04 primary
FI	1.94 lower secondary	2.38 lower secondary	10.88 upper secondary
FR	1.72 lower secondary	9.67 pre-primary	24.53 pre-primary
DE	1.17 lower secondary	3.10 primary	4.55 lower secondary
GR	4.05 pre-primary	7.62 pre-primary	18.17 lower secondary
HU	2.25 lower secondary	3.71 lower secondary	10.20 lower secondary
IE	1.30 primary	1.97 lower secondary	4.09 post-secondary non-tertiary
IT	1.60 pre-primary	4.06 pre-primary	16.23 pre-primary
LV	1.85 lower secondary	2.94 lower secondary	3.38 pre-primary
LT	1.84 pre-primary	11.44 pre-primary	6.57 upper secondary
LU	0.99 primary (NS)	1.54 lower secondary	2.39 post-secondary non-tertiary (NS)
MT	1.84 primary	2.22 primary	5.66 primary
NL	2.38 pre-primary	21.99 pre-primary	10.65 lower secondary
PL	3.03 pre-primary	6.63 lower secondary	10.18 pre-primary
PT	2.66 primary	3.98 primary	4.68 primary
RO	2.63 lower secondary	8.06 primary	7.19 primary
SK	2.44 primary	2.44 lower secondary	7.19 lower secondary
SI	1.93 primary	9.14 primary	2.51 lower secondary
ES	1.48 primary	3.13 primary	2.02 lower secondary
SE	1.43 lower secondary	1.79 lower secondary	1.41 lower secondary
UK	0.94 upper secondary	1.67 upper secondary	2.21 upper secondary

Unemployment

Unemployment status has been derived from the current activity status, and refers to people who are presently out of work but are seeking re-employment. Chi-square tests indicate a statistically significant association between unemployment status and fuel poverty across all countries, significant at the $p < .001$ level. In 20 of the Member States, a greater proportion of households reporting all three indicators are unemployed compared to households that report zero, one or two indicators. In some of the 20 countries the prevalence of unemployment is very high in fuel poor households, for instance, in Slovakia 69.8 per cent of households that report all three indicators are unemployed, with regression analysis demonstrating that unemployed households are 11 times more likely to be fuel poor on this basis compared to employed households, as summarised below in Table 8.22. Similarly, in the Czech Republic 68.1 per cent of households that report all three indicators are unemployed, and are 7.5 times more likely to be fuel poor. This trend is repeated to a marginally lesser extent in Latvia and Lithuania.

In all but three cases, the logistic regression models show that unemployed households have a higher likelihood of being fuel poor than employed household, at all levels of the CIFP. The first exception is households that report all three indicators in Finland, as in this scenario unemployed households have lower odds of being fuel poor. The other two exceptions occur in Luxembourg and the Netherlands, where households that are unemployed have an equal risk of reporting all three indicators as employed households, however, these results are not statistically significant.

Table 8.22 Summary of odds ratio for unemployment status

Country	Odds ratio for unemployment		
	One indicator	Two indicators	Three indicators
AT	1.30	2.30	1.97
BE	1.35	1.79	3.63
BG	1.93	2.94	3.87
CY	2.03	3.37	2.47
CZ	1.57	2.69	7.51
DK	2.18	3.28	-
EE	1.67	1.93	1.80
FI	1.68	2.32	0.14
FR	1.33	2.13	4.54
DE	1.54	2.53	3.43
GR	1.53	2.29	4.31
HU	1.74	3.26	2.82
IE	1.63	1.77	3.40
IT	1.66	2.16	2.36
LV	1.85	3.19	6.05
LT	1.62	2.97	4.92
LU	1.39	2.34	0.00 (NS)
MT	1.67	1.90	4.48
NL	1.46	5.70	0.00 (NS)
PL	1.58	2.16	4.01
PT	1.52	1.66	8.29
RO	1.50	2.39	2.68
SK	2.04	3.22	11.08
SI	1.84	2.22	4.11
ES	1.57	3.22	5.22
SE	1.69	3.98	1.92
UK	1.35	2.24	3.40

Retirement

As with unemployment status, retirement status has been derived from the current activity status, and refers to people who have retired from employment. Chi-square tests indicate a statistically significant association between being retired and fuel poverty across all countries, significant at the $p < .001$ level, however, in general it appears that retired households are more likely to be non-fuel poor. Across 18 countries, a lower proportion of households that report one, two or all three CIFP indicators are retired compared to households that report zero indicators. Furthermore, in those 18 countries there is a negative relationship between the severity of fuel poverty and the proportion of retired households affected.

The nine countries that are exceptions to the trend are all Eastern and Southern European states, with Bulgaria and Romania being the main exceptions. In Bulgaria over half of households reporting one and two indicators are retired, although the associated odds ratios are relatively small at 1.17 respectively, and are only 0.87 in relation to reporting three indicators, meaning that retired households are at less risk than non-retired households. Romania has very similar results for households reporting one and two indicators, with the logistic regression model finding that retired households are 1.02 times more likely to report one indicator, but less likely to report two indicators (0.89) or three indicators (0.76) compared to non-retired households. In all, the logistic regression models indicate that retired households are only at greater risk of experiencing one indicator in Latvia, Romania and Slovenia, and are at greater risk of experiencing one and two indicators in Bulgaria and Lithuania, as shown below in Table 8.23. There is no country in which retired households are more likely to report all three indicators.

Table 8.23 Summary of odds ratio for retirement status

Country	Odds ratio for retirement		
	One indicator	Two indicators	Three indicators
AT	0.82	0.85	0.25
BE	0.76	0.59	0.53
BG	1.17	1.17	0.87
CY	0.69	0.63	0.27
CZ	0.80	0.81	0.08
DK	0.51	0.41	-
EE	0.67	0.41	0.11
FI	0.43	0.14	0.67
FR	0.66	0.65	0.55
DE	0.58	0.58	0.36
GR	0.77	0.99	0.87
HU	0.89	0.80	0.53
IE	0.72	0.39	0.93
IT	0.84	0.68	0.52
LV	1.09	0.88	0.55
LT	1.10	1.06	0.28
LU	0.98	0.23	0.00 (NS)
MT	0.83	0.74	0.53
NL	0.58	0.30	0.00 (NS)
PL	0.87	0.82	0.41
PT	0.98	0.68	0.33
RO	1.02	0.89	0.76
SK	0.79	0.53	0.57
SI	1.06	0.66	0.60
ES	0.79	0.80	0.23
SE	0.68	0.73	0.40
UK	0.64	0.34	0.17

Chronic illness and disability

To identify households that contain at least one person with a self-reported chronic illness and disability, individual responses have been aggregated to the household-level. This predictor variable determines whether people have a chronic condition, which Eurostat define as a condition that is “permanent and may be expected to require a long period of supervision, observation or care; temporary problems are not of interest” (Eurostat, 2010b: 265).

In households reporting CIFP indicators, the levels of self-reported illness and disability are very high. Indeed, in the majority of countries over 50 per cent of households reporting CIFP indicators contain at least one person with an illness. The highest incidence is found in Estonia, where 68.4 per cent of households reporting one indicator contain at least one chronically ill person, in Austria where 75.6 per cent of households reporting two indicators have an ill household member, and in the Netherlands where 86.9 per cent of households reporting all three indicators contain at least one person with illness. Across all 27 countries, and at all levels of CIFP, the regression models demonstrate that households containing at least one person with a chronic illness or disability are significantly more likely to be fuel poor, compared to healthy households, as can be seen in Table 8.24. For example, the odds ratios for reporting all three CIFP indicators are 17.38 in the Netherlands, 14.90 in Luxembourg, and 8.19 in Estonia.

Table 8.24 Summary of odds ratio for chronic illness and disability

Country	Odds ratio for chronic illness and disability		
	One indicator	Two indicators	Three indicators
AT	1.36	3.51	1.95
BE	1.59	1.88	1.89
BG	1.63	1.96	2.61
CY	1.40	1.99	2.38
CZ	1.65	2.97	1.52
DK	1.59	3.22	-
EE	1.91	2.17	8.19
FI	1.36	2.07	5.03
FR	1.46	1.69	2.17
DE	1.42	1.71	1.61
GR	1.21	1.77	3.13
HU	1.51	2.28	1.97
IE	1.86	1.98	4.03
IT	1.80	2.20	2.44
LV	1.51	2.29	3.08
LT	1.64	1.55	3.51
LU	1.65	2.75	14.90
MT	1.43	2.54	1.53
NL	1.30	2.60	17.38
PL	1.44	1.71	2.67
PT	1.68	2.87	3.04
RO	1.25	1.80	2.10
SK	1.52	3.50	5.54
SI	1.32	1.79	1.73
ES	1.47	1.82	2.84
SE	1.53	1.59	4.94
UK	1.49	2.02	2.40

Income poverty

Across Europe a standard measure of income poverty is where the household’s equivalised disposable income is below the national 60% threshold (Eurostat, 2010b). Analysis finds a positive association between income poverty and fuel poverty, indeed across all 27 countries the proportion of households that are income poor increases in line with the number of CIFP indicators reported. The highest incidence of income poverty within fuel poor households is found in Denmark, where all households that report experiencing three CIFP indicators are income poor, followed by Luxembourg, where 81 per cent of households that report all three CIFP indicators are income poor. Finland and Sweden are the slight exception to the rule, with the highest levels of income poverty found in households that report two indicators, rather than three. The multinomial logistic regression models show that living below the relative poverty line increases the likelihood of reporting one, two and three CIFP indicators across all countries, without exception, as shown in Table 8.25. The highest risk of fuel poverty for income poor households is found in the Netherlands, with an odds ratio of 14.70 for reporting all three indicators, in Luxembourg where income poor households are 9.68 times more likely to report two indicators, and in Estonia where income poverty increases the likelihood of reporting all three indicators by a factor of 7.23.

Table 8.25 Summary of odds ratio for income poverty

Country	Odds ratio for households below the poverty line		
	One indicator	Two indicators	Three indicators
AT	1.73	4.93	5.42
BE	1.69	3.08	5.23
BG	1.90	2.58	4.40
CY	1.32	1.55	3.22
CZ	1.60	2.89	3.17
DK	1.31	2.85	-
EE	1.64	4.08	7.23
FI	1.43	6.07	3.73
FR	1.99	3.44	2.99
DE	1.64	2.55	2.98
GR	2.86	4.78	4.55
HU	2.14	2.72	4.99
IE	1.49	1.78	1.57
IT	1.54	3.07	3.76
LV	1.81	2.55	5.69
LT	1.64	1.81	4.38
LU	1.01	9.68	101.08
MT	1.40	1.69	6.20
NL	1.56	2.45	14.70
PL	1.92	3.47	6.62
PT	1.73	2.32	3.64
RO	1.63	2.16	2.61
SK	1.51	3.42	3.86
SI	1.53	1.70	5.29
ES	1.52	2.34	5.15
SE	1.44	2.02	1.42
UK	1.54	2.29	2.20

Table 8.26 below displays the median disposable household income for EU27 households at each level of the CIFP. As can be seen, households that are not fuel poor have the highest median income, whereas households reporting one, two or all three indicators comprising the CIFP have significantly lower incomes. Indeed, the median income for households in the most severe fuel poverty group is two-thirds less than the median income for non-fuel poor households. This pattern is repeated individually across country, with the slight exception of eight countries (AT, CY, DE, FI, NL, SE, SK, UK) in which the median income of households reporting all three indicators is higher than households reporting two indicators, but is lower than the other two categories.

Table 8.26 EU27 median disposable household income by CIFP. Data: EU-SILC 2010

CIFP number of indicators	Median income
0	€24,245.00
1	€17,000.00
2	€10,800.00
3	€8,073.00

Household type

This predictor variable has nine categories covering a variety of household arrangements. The reference category in the regression models is households containing two adults who are both aged under 65 years, with no dependent children. As can be seen from the cross-tabulations, within households reporting one, two and three CIFP indicators, the modal household arrangement is single households across nearly all countries, often followed closely by couples aged under 65 years with no children. Within Denmark, all households that report all three indicators are single adult households. Similarly, in Sweden 79.8 per cent of households reporting three indicators are single adults. However, the logistic regression results are very variable within and across countries, as summarised in Table 8.27. For instance, within Bulgaria couples with three or more dependent children are consistently more likely to report one, two and three indicators compared to other household arrangements, whereas in Austria single parent households are most likely to report one indicator, couples with three or more children are most likely to report two indicators, and other household types without children have the highest odds ratio for reporting three indicators.

Given the variability of household types most affected by fuel poverty across the EU, it is not possible to identify a single family arrangement that is most likely to experience different CIFP indicators. However, generally speaking single parent households, and couples with three or more dependent children are regularly the household types that have the highest odds ratio for reporting one, two or three CIFP indicators. For example, single parent households are 8.74 times more likely to report all three indicators in Finland compared to a couple below retirement age without children, whilst in Bulgaria couples with three or more dependent children are 9.14 times more likely to report three indicators.

Table 8.27 Summary of highest odds ratio for household type

Country	Highest odds ratio category for household type		
	One indicator	Two indicators	Three indicators
AT	2.02 single parent	2.70 two adults with 3+ children	4.19 other household without children
BE	4.09 other household	3.83 single parent	1.63 other household with children
BG	1.77 two adults with 3+ children	3.42 two adults with 3+ children	9.14 two adults with 3+ children
CY	1.91 other household with children	2.06 single parent	4.74 single parent
CZ	1.79 single parent	1.95 two adults with 3+ children	4.66 single parent
DK	2.35 other household	2.10 other household with children	-
EE	1.63 two adults with 3+ children	1.91 two adults with 3+ children	NS
FI	1.54 two adults with 3+ children/other household with children	6.69 other household without children	8.74 single parent
FR	4.10 other household	4.99 other household	3.85 single parent
DE	1.78 other household	1.55 single parent	5.43 other household with children
GR	1.70 other household with children	3.81 two adults with 3+ children	10.23 two adults with 3+ children
HU	1.72 single parent/ two adults with 3+ children	3.40 single parent	3.10 single parent
IE	2.36 single parent	3.50 single parent	12.36 single parent
IT	1.48 two adults with 3+ children	1.47 two adults with 3+ children	3.95 single parent
LV	1.87 other household	5.39 other household	3.00 single parent
LT	1.66 single parent	1.34 single parent	1.56 two adults with 3+ children
LU	1.49 single parent	0.03 other household with children	NS
MT	1.49 other household with children	3.82 single parent	4.52 single parent
NL	1.38 single parent	9.28 single parent	NS
PL	1.74 single parent	2.59 single parent	2.78
PT	2.50 other household	3.46 other household	15.85 single parent
RO	1.94 single parent	1.94 two adults with 3+ children	5.45 two adults with 3+ children
SK	1.82 single parent	3.93 single parent	1.03 one person household
SI	1.41 single parent	2.66 single parent	3.34 single parent
ES	5.74 other household	2.06 two adults with 3+ children	1.49 two adults with 3+ children
SE	2.18 other household	4.53 single parent	8.83 one person household
UK	1.48 single parent	2.14 single parent	3.70 other household with children

Dwelling type

There are four categories of dwelling, covering apartments in small and large developments, semi-detached houses, and detached houses. The latter category is the reference category in regression models. Across ten countries, detached housing is the modal, and often majority, dwelling type for households that report CIFP indicators. With the exception of France, these countries are located in Southern and Eastern Europe. Apartments are the modal housing arrangement for households reporting CIFP indicators in a further six countries, followed by semi-detached housing in five predominantly Western European countries. The final six countries have a mixture of modal housing arrangements depending on the number of CIFP indicators reported. The logistic regression models in Austria, Finland, Italy, Luxembourg and Sweden demonstrate that households in apartments and semi-detached houses have a lower likelihood of reporting CIFP indicators than households in the reference category of detached housing. In the remaining countries the odds ratios are relatively low overall, as summarised in Table 8.28, with no clear trend emerging regarding the dwelling type that places households in most risk of fuel poverty.

Table 8.28 Summary of highest odds ratio for dwelling type

Country	Highest odds ratio category for dwelling type		
	One indicator	Two indicators	Three indicators
AT	0.78 apartment in building with <10 units	0.77 apartment in building with >=10 units	0.17 apartment in building with >=10 units
BE	1.42 semi-detached house	1.81 semi-detached house	0.74 semi-detached house
BG	1.45 apartment in building with >=10 units	1.59 apartment in building with >=10 units	1.24 semi-detached house
CY	1.07 semi-detached house	0.80 semi-detached house	0.87 apartment in building with <10 units
CZ	0.95 semi-detached house	0.98 semi-detached house (NS)	1.17 semi-detached house
DK	1.14 apartment in building with <10 units	0.86 apartment in building with >=10 units	-
EE	1.56 apartment in building with <10 units	1.81 apartment in building with >=10 units	3.62 apartment in building with <10 units
FI	0.81 semi-detached house	0.54 semi-detached house	NS
FR	1.32 semi-detached house	1.62 semi-detached house	0.65 semi-detached house
DE	1.08 apartment in building with <10 units	0.76 semi-detached house	0.49 apartment in building with <10 units

GR	1.10 semi-detached house	0.91 semi-detached house	1.10 semi-detached house
HU	1.20 semi-detached house	1.36 semi-detached house	1.56 semi-detached house
IE	1.76 apartment in building with <10 units	0.81 semi-detached house	4.56 apartment in building with <10 units
IT	0.72 apartment in building with <10 units/semi-detached house	0.68 semi-detached house	0.83 apartment in building with <10 units
LV	2.11 apartment in building with <10 units	3.20 apartment in building with <10 units	4.65 apartment in building with <10 units
LT	2.09 apartment in building with <10 units	3.19 apartment in building with <10 units	2.04 apartment in building with <10 units
LU	0.98 semi-detached house	0.97 apartment in building with <10 units	16.35 semi-detached house
MT	1.49 semi-detached house	1.53 semi-detached house	NS
NL	0.83 apartment in building with <10 units	2.95 apartment in building with <10 units	0.68 apartment in building with <10 units
PL	1.46 apartment in building with <10 units	1.54 apartment in building with <10 units	1.35 semi-detached house
PT	1.31 semi-detached house	1.13 semi-detached house	0.92 semi-detached house
RO	1.89 semi-detached house	1.10 apartment in building with <10 units	3.89 semi-detached house
SK	0.72 apartment in building with <10 units	0.43 apartment in building with <10 units	1.31 apartment in building with <10 units
SI	1.29 apartment in building with <10 units	1.64 apartment in building with <10 units	0.91 apartment in building with <10 units
ES	1.08 semi-detached house	1.35 semi-detached house	1.75 semi-detached house
SE	0.79 apartment in building with <10 units	0.19 apartment in building with <10 units/semi-detached house	0.62 semi-detached house
UK	1.52 apartment in building with <10 units	1.29 apartment in building with <10 units	NS

Central heating

As seen in earlier chapters, the ad-hoc variable concerning central heating determines whether households have central heating, an alternative form of fixed heating, or no fixed heating. The data is from 2007, and is missing Malta and Romania. All of the chi-square tests were statistically significant at the $p < .001$ level, and demonstrate that the incidence of having no fixed heating is higher within households reporting all three CIFP indicators, compared to households reporting zero, one, or two indicators. Having full central heating is generally higher in households reporting fewer fuel poverty indicators. The exceptions are Finland, Luxembourg and Sweden, where 100 per cent of households reporting all three indicators have central heating, which is higher than in households reporting zero, one and two indicators. This could be a consequence of targeted energy efficiency schemes, or due to measurement errors resulting from small sample sizes.

A number of countries have a high prevalence of other forms of fixed heating, particularly in Bulgaria, where the majority of households have other fixed heating, irrespective of the number of CIFP indicators reported. Lacking any form of fixed heating is highest in Portugal, Spain and Austria. Within Portugal just over 90 per cent of households reporting one, two and three indicators lack fixed heating, which is around 5 percentage points higher than in households reporting zero indicators. In Spain over 60 per cent of households reporting two and three indicators do not have fixed heating, which is nearly three times higher than for households not reporting any CIFP indicators. By comparison a lack of heating is an isolated issue in Austria for households reporting all three indicators, with 52.2 per cent of such households lacking fixed heating compared to only 14.0 per cent of households reporting two indicators, and 9.4 per cent of households reporting one indicator. This differs substantially from Germany, Estonia, Finland, Hungary, Latvia, Poland and Sweden, where less than two per cent of all households lack fixed heating. Indeed, within Estonia and Sweden, zero per cent of households are affected.

Tenure

The tenure status variable asks whether households are owner-occupiers, living in free accommodation (perhaps as part of employment), renting their property at the prevailing market rate, or renting their property at a reduced rate, which includes social housing and accommodation where the actual rent is fixed by law (Eurostat, 2010b). For the purposes of producing odds ratios, the owner category is used as the reference.

In just over half of the Member States (14), the majority of households reporting CIFP indicators are homeowners. With the exception of Finland, all of these countries are located within Eastern and Southern Europe. Within these 14 countries there is a marginal gradient, whereby homeownership rates decrease in line with an increasing number of CIFP indicators, although in some countries the difference is very small, for instance in Bulgaria 88.4 per cent of households reporting zero indicators are owners, compared to 79.9 per cent of households reporting all three indicators. The tenure profile is less obvious in a further ten countries, which are predominantly located in Western Europe, with variations between CIFP levels. For example, within Ireland, Malta and the UK, the majority of households that report one indicator are homeowners, whereas the majority of households that state they experience all three CIFP indicators are renting their property at reduced market rate. Market rate rented housing prevails among the majority of households reporting CIFP indicators in just three countries, Germany, Denmark and the Netherlands. Rented housing is particularly common for households reporting all three indicators in Denmark (100 per cent) and the Netherlands (96.1 per cent).

The logistic regression models show substantial variation in the likelihood of fuel poverty occurring for different tenures, by both CIFP level and country, as demonstrated in Table 8.29. In Austria, tenants paying market rate are 15.61 times more likely to report all three indicators than homeowners, whilst in Lithuania the odds ratio is 12.02 for three indicators, and 6.56 in Slovakia for two indicators. Accommodation provided free has high odds ratio in many countries, despite the relatively low prevalence of this tenure type. This is especially so in Germany, where households occupying free accommodation are 10.49 times more likely to report three indicators, in Ireland where the odds ratio is 6.75 for reporting two indicators, and in Belgium where it has an odds ratio of 5.15 for two indicators. Reduced rate tenancy has an odds ratio of 10.45 in Portugal for three indicators, 8.65 in Austria for reporting all three indicators, and 6.39 in Latvia for three indicators.

Table 8.29 Summary of highest odds ratio for tenure type

Country	Highest odds ratio category for tenure		
	One indicator	Two indicators	Three indicators
AT	1.60 tenant market rate	2.95 tenant market rate	15.61 tenant market rate
BE	2.62 tenant market rate	5.15 free accommodation	4.91 tenant market rate
BG	1.21 tenant market rate	2.03 tenant below market rate	2.47 tenant below market rate
CY	1.62 tenant market rate	1.78 tenant market rate	2.47 free accommodation
CZ	2.27 tenant below market rate	4.69 tenant below market rate	3.93 tenant market rate
DK	2.20 tenant market rate	3.49 tenant market rate	-
EE	1.89 tenant below market rate	1.25 free accommodation	1.92 tenant market rate
FI	2.07 tenant below market rate	3.62 tenant below market rate	19.15 tenant market rate
FR	2.27 tenant below market rate	3.87 tenant market rate	6.94 tenant market rate
DE	2.42 tenant below market rate	4.67 tenant below market rate	10.49 free accommodation
GR	1.44 tenant market rate	2.74 tenant market rate	3.21 tenant market rate
HU	2.65 tenant below market rate	4.31 tenant below market rate	5.39 tenant below market rate
IE	2.84 free accommodation	6.75 free accommodation	5.84 tenant below market rate
IT	2.11 tenant below market rate	4.14 tenant below market rate	6.03 tenant below market rate
LV	1.85 tenant below market rate	3.57 tenant below market rate	6.39 tenant below market rate
LT	1.25 tenant market rate	4.12 tenant market rate	12.02 tenant market rate
LU	2.15 tenant below market rate	1.48 tenant below market rate	NS
MT	1.73 tenant below market rate	2.31 tenant below market rate	21.88 free accommodation
NL	2.29 tenant market rate	2.30 tenant market rate	56.43 tenant market rate
PL	2.03 tenant below market rate	2.96 tenant below market rate	4.77 tenant below market rate
PT	2.15 tenant market rate	5.11 tenant below market rate	10.45 tenant below market rate
RO	2.85 free accommodation	3.70 free accommodation	10.23 tenant below market rate
SK	2.59 tenant market rate	6.56 tenant market rate	4.93 tenant market rate
SI	1.50 tenant below market rate	1.84 tenant market rate	3.78 tenant market rate
ES	2.66 tenant below market rate	3.60 tenant below market rate	3.94 tenant below market rate
SE	1.98 tenant market rate	2.29 tenant market rate	5.46 tenant market rate
UK	2.51 tenant market rate	5.94 tenant market rate	55.83 free accommodation

Urban/rural location

The degree of urbanisation variable is automatically completed for respondents on the basis of a standardised classification system. Households are assigned to one of the following three groups:

1. Densely populated area, which has a density of more than 500 inhabitants per square kilometre.

2. Intermediate area, which has a density of more than 100 inhabitants per square kilometre.

3. Thinly-populated area, which belongs to neither the densely populated or intermediate area (Eurostat, 2010b).

Densely populated has been set as the reference category in the regression models, however, this variable is missing for the Netherlands and Slovenia. Furthermore, a minority of countries have merged the area groups, as outlined in Appendix 2.

The degree of urbanisation for fuel poor households across the EU is diverse. Within seven of the twenty-five countries, the majority of households that report CIFP indicators are located in a rural thinly-populated area. The highest figures are found in Lithuania and Finland, where of the households that report all three indicators, 85.3 and 81.5 per cent respectively are located in a rural area. Rural location is the modal, but not majority, category for households reporting CIFP indicators in an additional three countries, the Czech Republic, Hungary, and Poland. In a further six countries, the majority of households reporting CIFP indicators are located in densely populated areas. For instance, 87.5 per cent of households that report one indicator in Malta live in a densely populated area, as do 83.0 per cent of households that report all three indicators in the UK. Similarly, the modal location group in Portugal for households reporting CIFP indicators is urban. The remaining eight countries have a mixed urban/rural profile.

In terms of increased likelihood of experiencing fuel poverty, the regression models indicate that across many countries, such as Bulgaria, Finland, Portugal, and the UK, households located in rural and intermediate sized areas are less likely to report any CIFP indicators, suggesting that fuel poverty, as measured by the CIFP, is a predominantly urban issue. Overall, degree of urbanisation does not produce high odds ratios. For instance, households in thinly populated or intermediate areas of Malta are 2.66 times more likely to report three indicators, whilst households in thinly populated areas of Estonia are 2.28 times more likely to report three indicators.

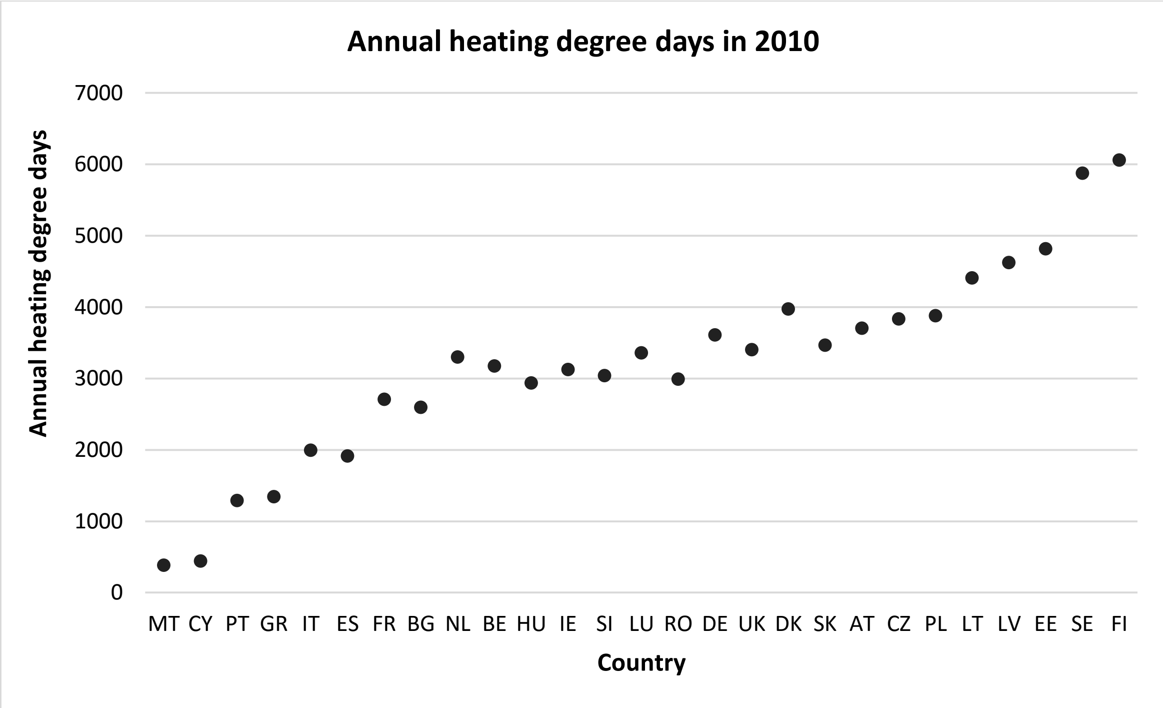
Table 8.30 Summary of highest odds ratio for degree of urbanisation

Country	Highest odds ratio category for degree of urbanisation		
	One indicator	**Two indicators**	**Three indicators**
AT	1.04 intermediate	0.69 intermediate	1.53 thinly populated
BE	1.81 thinly populated	1.90 thinly populated	0.82 thinly populated
BG	0.87 intermediate	0.59 thinly populated	0.44 intermediate
CY	1.01 thinly populated	0.87 intermediate	1.24 intermediate
CZ	1.17 intermediate	1.63 thinly populated	0.82 thinly populated
DK	0.98 intermediate	1.76 intermediate	-
EE	1.24 thinly populated	2.09 thinly populated	2.28 thinly populated
FI	0.91 intermediate	0.95 intermediate	NS
FR	1.24 thinly populated	1.84 thinly populated	1.16 intermediate
DE	1.25 thinly populated	1.26 thinly populated	1.05 thinly populated
GR	1.12 thinly populated	1.27 thinly populated	1.57 thinly populated
HU	1.16 intermediate	1.28 intermediate	1.56 intermediate
IE	0.98 thinly populated	0.95 intermediate	0.92 intermediate
IT	1.22 intermediate	1.42 thinly populated	0.95 intermediate
LV	0.89 thinly populated	0.96 thinly populated	1.47 thinly populated
LT	0.52 thinly populated	0.58 thinly populated	1.94 thinly populated
LU	1.22 thinly populated	0.72 intermediate	NS
MT	1.50 thinly populated or intermediate	2.23 thinly populated or intermediate	2.66 thinly populated or intermediate
NL	-	-	-
PL	1.06 thinly populated	0.95 thinly populated	0.78 intermediate
PT	0.84 intermediate	0.97 intermediate	0.41 thinly populated
RO	0.78 intermediate	0.55 intermediate	0.35 thinly populated
SK	1.15 intermediate	1.45 intermediate	1.33 thinly populated
SI	-	-	-
ES	1.19 thinly populated	1.69 intermediate	1.46 intermediate
SE	0.89 thinly populated	0.60 intermediate	NS
UK	0.98 thinly populated	0.97 thinly populated	0.57 intermediate

Climate

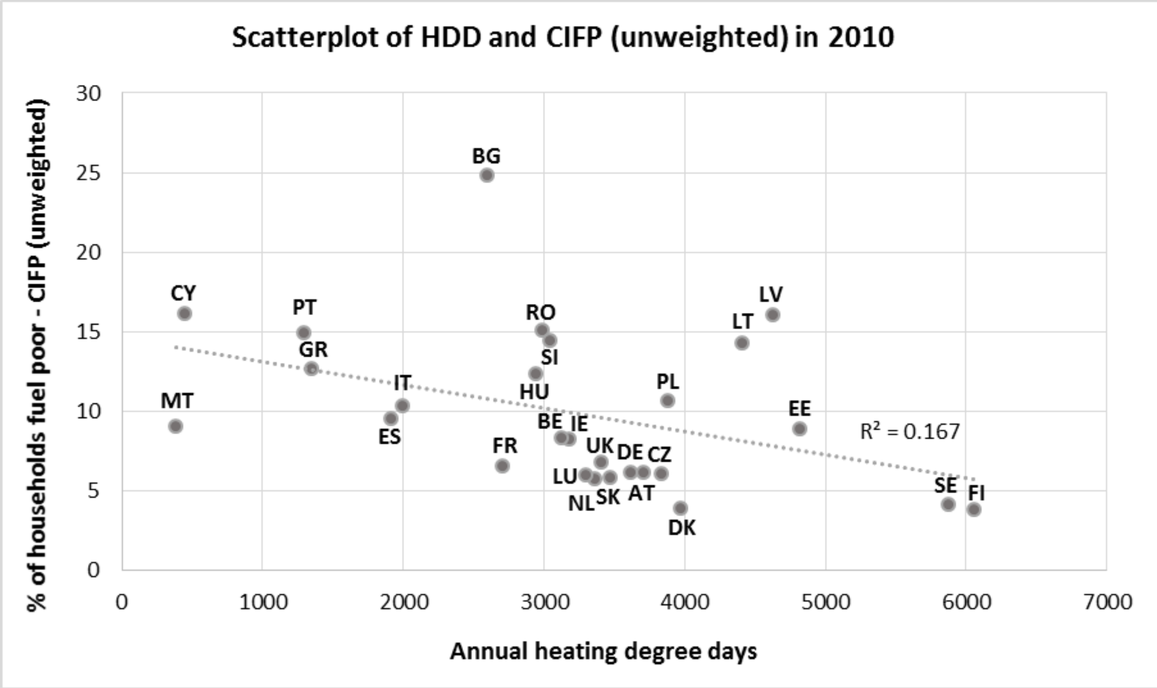
This final section of analysis uses national annual HDD data from Eurostat for 2010. As discussed earlier in the chapter, HDD express the severity of the cold in a specific time period, taking into consideration the amount of time when the outside temperature falls below a pre-specified base temperature. Figure 8.1 below depicts the annual heating degree day scores across the EU in 2010, showing as expected that more temperate Southern European countries have the lowest number of heating degree days, whilst Nordic countries have the highest.

Figure 8.1 National annual heating degree days in 2010. Data source: Eurostat



Initially, regional heating degree day data were going to be incorporated into the EU-SILC microdata by matching the regional heating degree days to the region identifier contained within EU-SILC, however, as shown in Table A2-2 in Appendix 2, two serious data issues prevent this. Firstly, Eurostat stopped producing heating degree day data at the regional level after 2009, and secondly, the region variable is missing for several countries across the series. As an alternative, the national HDD data for 2010 has been plotted against the corresponding CIFP results for each country. The scatterplot of national HDD and the percentage of households classified as fuel poor under the CIFP (unweighted) indicator, as shown in Figure 8.2, indicates that there is a small association between climate and fuel poverty, R^2= .17. This means that countries with milder climates generally experienced higher rates of fuel poverty than cold countries in 2010. However, the association with climate was not as strong for households classified as fuel poor in the weighted CIFP index, R^2= .15.

Figure 8.2 Scatterplot of heating degree days and CIFP results in 2010. Date source: Eurostat and EU-SILC 2010



Summary

This chapter started by presenting figures for the individual components of the CIFP and EIFP. In terms of the CIFP, the results showed that Southern and Eastern European countries are worst affected by the three constituent indicators, especially Latvia, Cyprus and Bulgaria. Furthermore, there have been substantial changes in prevalence between 2007 and 2011, particularly in terms of utility bill arrears, with multiple countries witnessing increases in excess of 100 per cent. The EIFP disaggregated results followed a broadly similar pattern, with countries such as Portugal, Cyprus and Bulgaria worst affected by a lack of fixed heating, and widespread inability to keep warm due to dwelling efficiency.

Subsequently, the country-level CIFP and EIFP results and corresponding ranking tables were presented. The CIFP results consistently showed that within households reporting CIFP indicators, a higher proportion reported just one indicator, rather than two or three indicators. This suggests that whilst fuel poverty issues are likely to be widespread across Europe, there is little overlap between the indicators and they may be capturing different aspects of energy deprivation, although this does vary by country. Overall, it was found that the countries with the lowest incidence of fuel poverty from 2007 to 2011 were Northern and Western European states, including Finland, Sweden and Luxembourg. The countries with the worst incidence of fuel poverty, and thus the lowest rankings, were Bulgaria, Cyprus and Latvia, which are countries located in Eastern and Southern Europe. Only three countries maintained their relative position between 2007 and 2011, whilst 13 countries improved their position, and a further nine countries were ranked worse in 2011. Denmark demonstrated the largest fluctuations in rankings, going from 6th place in 2007 to 1st and 2nd place from 2008 to 2010, before dropping several places to 9th position in 2011. This was found to be the result of significant fluctuations within the individual Danish data.

The penultimate section considered and applied one form of post-hoc index adjustment, to correct for the substantial variations in heating demand found across the EU. Borrowing key methods from the field of energy consumption and energy efficiency statistics, the index results were adjusted on the basis of deviation from the EU27 HDD average. It was found that making climate adjustments significantly altered the ranking order, with countries located in Southern Europe seeing a substantial improvement in rankings as a consequence of the lower heating demand found in these countries. Although, at the opposite end of the table, the worst ranked countries remained relatively similar, with Bulgaria and Latvia featuring in the bottom three before and after climate adjustment, despite a reduction in the Bulgarian CIFP fuel poverty rates. The subsequent discussion chapter debates the potential validity of this post-hoc adjustment.

The final element of this chapter was a sociodemographic and geographic analysis of the 2010 CIFP, which is the newest complete index for EU27 due to the absence of Ireland from the 2011 EU-SILC dataset. This analysis aimed to examine what factors increase household propensity to experience fuel poverty, as conceptualised in the CIFP, and how this differs between countries. In the first instance, the relationship between education and fuel poverty was examined and found to be statistically significant, with households that report all three indicators demonstrating lower levels of educational attainment compared to other households. Multinomial logistic regression models showed that generally the risk of fuel poverty is higher for households with lower levels of education, and that this risk increases in line with the number of CIFP indicators concerned.

A high proportion of fuel poor households were found to be unemployed, for instance in Slovakia and the Czech Republic nearly 70 per cent of households reporting all three indicators were unemployed. In the majority of cases, the logistic regression models showed that unemployed households have a much higher likelihood of being fuel poor than employed households, at all levels of the CIFP. By comparison, there was a weak relationship between retirement and the CIFP across most countries, and in general retired households were more likely to be non-fuel poor, with the exception of Bulgaria and Romania. There is no country in which retired households were more likely to report all three indicators, compared to non-retired households.

Chronic illness and disability is widespread in fuel poor households across the EU, with the regression models demonstrating that across all countries, and at all levels of the CIFP, households containing at least one person with a chronic illness or disability are significantly more likely to be fuel poor compared to healthy households. A strong relationship was also found between income poverty, as measured using a 60 per cent income threshold, and CIFP fuel poverty, with increasing proportions of income poverty in line with the number of CIFP indicators reported. Being income poor increased the likelihood of reporting one, two and three CIFP indicators across all countries without exception. Furthermore, a strong income gradient was found, with households that report zero indicators possessing the highest levels of median disposable income, and households that report three indicators possessing the lowest levels of median disposable income.

In terms of household type, the modal and often majority arrangement was single households, often followed by couples aged under 65 years old, with no children. However, the cross-tabulation and logistic regression results are variable within and across countries, thus it is not possible to identify a single family arrangement that is more likely to experience fuel poverty. Although, broadly speaking, single parent households and couples with three or more dependent children regularly had the highest odds ratios, at all levels of the CIFP. As with household type, the prevailing dwelling type of fuel poor households also varies significantly, with some regions of Eastern and Southern Europe demonstrating high rates of detached housing among fuel poor households, whilst apartments are the modal dwelling arrangement elsewhere. However, in a number of countries the odds ratios were relatively low, with no clear trends concerning dwelling type and fuel poverty risk.

A statistically significant relationship was found between heating type and fuel poverty, with households that report all three indicators particularly affected by a lack of fixed heating, whilst households reporting zero indicators generally had high levels of central heating. In terms of tenure, in just over half of the EU Member States, located predominantly in Eastern and Southern Europe, the majority of fuel poor households were homeowners. Elsewhere, the tenure profile was less obvious, with high proportions of fuel poor households occupying market rate and subsidised rental accommodation, as well as owning their property. The logistic regression models showed substantial variation in the likelihood of fuel poverty occurring for different tenure groups, by both CIFP level and country.

A diverse degree of urbanisation profile was found for fuel poor households across Europe. A rural location was the modal, and often majority, group for ten of the 25 countries present in the analysis, whilst urban location was the modal group for seven countries. The remaining eight countries had a mixed urban/rural profile. In the final analysis of climate using HDD data, a fuel poverty paradox was revealed, whereby fuel poverty rates are negatively associated with climate and thus countries with lower heating demands have higher rates of fuel poverty.

Chapter 9: Discussion

Introduction

This thesis has presented a comprehensive multi-methods assessment of fuel poverty in the EU, finding that it is a policy issue that is growing in both recognition and prevalence across Europe, with acknowledgment from several EU institutions, including the European Commission, European Parliament, and the EESC. However, there remains a significant gap in knowledge concerning the incidence and intensity of fuel poverty related issues at the household-level across the EU, in conjunction with a limited understanding of historical policy processes and the nature of discourse across the different institutions of the EU. The literature review in Chapter 2 focused on defining, understanding, and measuring fuel poverty. This set out a basic context for situating the thesis research, finding that at present only three countries in the EU have an official definition of fuel poverty, and at the EU-level there is no recognised definition, which is compounded by a significant level of terminological confusion. Chapter 2 examined the main determinants of fuel poverty, including energy efficiency and energy prices, and a range of secondary determinants, such as tenure and climate. The significant negative consequences that can arise from living in fuel poverty were also documented, including poorer physical and mental health, and social exclusion. Finally, the prevailing methods for measuring the incidence of fuel poverty were outlined, finding several methodological limitations to measuring pan-EU fuel poverty. Although this chapter was quite broad, it helped to identify some of the research gaps in the literature.

The overarching purpose of this thesis was to address the identified analytical gaps in policy and statistical understandings of fuel poverty, and contribute to an improved understanding of fuel poverty in the EU. It aimed to disentangle the messy policy context and understand the current mandates from various EU institutions, and move towards a practical use of available data for measuring the incidence and intensity of fuel poverty across the EU, in order to orientate policy action. The purpose of this chapter is to discuss and interpret the main research findings of the thesis, with consideration for the pre-existing state of the art in fuel poverty research, and to reflect on the policy implications and key recommendations.

Policy Analysis

Background

Chapter 3 established the European policy context to situate the subsequent analyses, with a focus on the distribution of power in the decision-making process, the role of different institutions in setting policy, and the relationship the EU has to fuel poverty policy. This chapter highlighted how in power play terms, the European Commission is a very important actor given its monopoly over introducing new legislative proposals. The chapter outlined some of the existing European Directives that have some bearing on fuel poverty alleviation, from improved energy efficiency of equipment and buildings, to enhanced consumer protection in the gas and electricity markets. Chapter 3 also provided insight into existing empirical analyses of EU fuel poverty policy, finding only three previous studies, which mainly focused on policy and events from the point of the 2009 internal gas and electricity market Directives. This chapter established that previous research has not examined the early origins of fuel poverty concerns in European policy literature, nor has it looked in detail at the position taken by various EU institutions on topics pertaining to defining, measuring and alleviating fuel poverty. Given these gaps in policy knowledge, Chapter 4 detailed the methods for analysing a selection of official policy documents from a range of legislative and consultative EU institutions, spanning 2003 to 2014. It emphasised the importance of examining the role of institutions in policymaking, and of taking a historical perspective in order to identify path dependencies and enduring concepts.

Key results

The bulk of Chapter 4 was dedicated to presenting the results of the qualitative policy analysis. This analysis demonstrated that concerns about fuel poverty were first raised at the EU-level in 2001, which predates the documents examined in earlier policy analyses by approximately eight years (see Thomson, 2011; Bouzarovski *et al*., 2012; Bouzarovski and Petrova, 2015), thus offering new insights into the origins of fuel poverty as an EU policy concern. Since this time, three distinct phases in policy development were identified, namely: fragmented discussions on fuel and energy poverty between 2001 and 2006; efforts to legally recognise energy poverty between 2007 and 2010; and an enhanced focus on energy poverty and vulnerable consumers from 2011 to 2014.

Across all three phases it is clear that fuel and energy poverty is recognised as a valid policy concern by the majority of EU institutions, including the European Commission. However, whilst it is evident that formal protection for vulnerable consumers and energy poor households has increased significantly over the 2001 to 2014 timeframe, the loose wording of current Directives allows Member States to absolve themselves of responsibility, and fails to provide comprehensive protection for all households at risk of fuel poverty. Applying key concepts from the historical institutionalism framework, this chapter found evidence of several critical junctures in the 2001 to 2014 policy timeline, at which points key legislation could have been amended and/or introduced to enhance the alleviation of fuel poverty. However, due to opposition from the European Commission, which is a powerful player, and the European Council, there have been numerous missed opportunities. This is in spite of the clear support implicit in many European policy and opinion pieces for the EU to go much further in addressing fuel and energy poverty at the European scale.

Defining and measuring fuel poverty

A key characteristic of the discourse on fuel and energy poverty over time has been the multiplicity of both *concepts* and *definitions of concepts*, and an absence of authoritative clarification from the EU. Yet, the EESC note that obfuscation could be resolved by adopting a harmonised broad definition at the European-level, which could then be adapted to national contexts. Since 2008, the European Parliament, EESC and CoR have been unanimous in repeatedly calling for a pan-EU definition of fuel poverty to be established. However, the European Commission has remained opposed and has rejected several key proposals, arguing that the national contexts are too diverse. However, a common pan-EU definition of fuel poverty need not be detailed, for instance, the working definition for this thesis is relatively broad and is relevant to all national contexts:

> Households, groups, and individuals can be said to be in fuel poverty when they lack the resources to obtain adequate levels of energy services which are customary, or at least widely encouraged or approved in the societies to which they belong.

Examining the existing literature offers some explanation as to why the European Commission and the European Council have been opposed to adopting a harmonised definition, with evidence suggesting that some Member States have played a powerful role in blocking policy developments at the EU-level. For example findings from qualitative interviews by Bouzarovski and Petrova (2015) indicate that Germany has been particularly unwilling to recognise a new group of vulnerable people because it could cause significant domestic political difficulties (Bouzarovski and Petrova, 2015: 15). Germany is currently undergoing a substantial restructuring of the energy sector as part of a low carbon energy transition (*energiewende*), which is creating a specific form of fuel poverty, whereby current policies do not adequately compensate for the negative effects of energy bill levies used to fund renewable energy schemes (Tews, 2013). However, this situation demonstrates precisely why a definition is essential, namely for facilitating the recognition of the social and distributional impacts of policy and subsequently enabling policy synergies. For instance, one example of a policy synergy is targeted energy efficiency investments, which have the potential to reduce fuel poverty whilst also contributing to climate change goals (Ürge-Vorsatz and Tirado Herrero, 2012; Snell and Thomson, 2013).

Additional benefits of adopting even a general description of fuel or energy poverty at the EU-level include increased political recognition (Bouzarovski *et al*., 2012), and clarification of what constitutes a fuel poor household, which has the potential to prevent additional researchers from inaccurately measuring fuel poverty by misapplying the UK's definition (Liddell *et al*., 2012). This corresponds with the sentiments of academic and advocacy groups that support a broad EU definition of fuel poverty (Morgan, 2008; EPEE, 2009a;

European Anti-Poverty Network, 2010; Boardman, 2010a; Bouzarovski *et al.*, 2012; Thomson and Snell, 2013). A key recommendation from this thesis, therefore, is for a common pan-EU definition of fuel poverty to be developed in order to give prominence to the issue in national and EU-level policymaking.

Boardman (2010a) has suggested fuel poverty in Europe could be defined using a twice-median expenditure threshold, which it is argued has a universality that is independent of country-specific conditions (Boardman, 2010a: 193). However, based on the review of data in Chapter 6, which found substantial variation in the HBS methods and quality, and given the lack of detailed understandings of energy consumption patterns in fuel poor households in many countries, this thesis initially advises against the common definition being overly prescriptive. Instead, Eurostat should be consulted on ways to improve and expand data collection, as recommended later in this chapter, and Member States should be encouraged to review fuel poverty in their country, and subsequently develop a detailed definition that builds on the common EU definition and is appropriate to local contexts.

In terms of measuring the incidence of EU fuel poverty, the European Parliament, CoR and EESC have all given firm policy mandates for the production of harmonised statistics on fuel poverty, stating the importance of understanding the extent of the issue. Despite overall resistance to defining and measuring fuel and energy poverty, the European Commission, in a staff working document, has suggested that fuel poverty could be measured using the consensual indicators from EU-SILC or using a twice-mean expenditure threshold based on HBS data. Revealing these policy mandates has been an important process for reinforcing the key aim of this thesis, which was to quantify the proportion of households likely to be experiencing fuel poverty in the UK. However, it should also act as a call to action for key stakeholders to advance fuel poverty measurement methods and techniques.

Fragmented policy protection and opportunities for policy synergies

The policy analysis established that the current legislative requirements for Member States to recognise energy poverty is restricted to natural gas and electricity only, with no broader legislation governing other energy sources, such as heating oil, coal, and liquid petroleum gas. This is a key gap in policy, from which it is evident that at the EU-level protection for fuel poor households needs to be expanded. Generally, there is consensus across the EU institutions that addressing fuel and energy poverty does fall within the remit of energy policy. Indeed, the EESC has been especially vocal in stating that the European Commission does have legal competence to go further in establishing comprehensive policy frameworks, and along with the CoR it has been opposed to the use of soft law in addressing fuel and energy poverty.

A key recommendation that emerges as a consequence of this analysis is for fuel poverty alleviation to be incorporated within all energy policy, as well as other relevant policy areas such as housing and health, as identified in Chapter 3 and by the VCWG (2013). This could be enhanced with a requirement for fuel poverty to be included in all impact analyses conducting during the drafting of new legislation, at both the national and European scale, in relevant policy domains. This would enable an assessment of how different consumers could be affected, and the impact on fuel poverty. Furthermore, the Commission should explicitly list fuel poverty reduction as an objective in EU policy, accompanied by targets where appropriate. A key potential outcome of this would be the promotion of policy synergies, such as between climate change mitigation and fuel poverty alleviation, as detailed in an earlier section. Indeed, there is substantial scope for fuel poverty levels to be reduced as part of efforts to meet the Europe 2020 goals, which were outlined in Chapter 3, particularly around climate change and poverty and social exclusion. Furthermore, a strong synergy exists between fuel poverty alleviation and reducing the use of health services, given the recognised health implications of living in fuel poverty (Free *et al*., 2010; Liddell and Morris, 2010; Somerville *et al*., 2000; Deugen *et al*., 2012).

Path dependency of the term 'vulnerable customers' and potential new entry points

By examining policy statements over the longue durée, Chapter 4 provided important insights into the institutional legacy of the term 'vulnerable customer'. Formally introduced in the 2003 internal energy market Directives, the phrase has received *de facto* usage by the Commission as an alternative to fuel or energy poverty and has exhibited signs of strong path dependency and reproduction and reinforcement of existing paths, culminating in the formation of the VCWG in 2012. Identifying this path dependency is an important contribution made by the thesis, particularly for those seeking to affect policy change as enduring concepts are more likely to provide veto points in the future than concepts which have struggled to gain policy acceptance. This comes at a strategically important time as several new entry points into policy are offered by the newly launched Energy Union strategy (European Commission, 2015), which aims at ensuring "Europe has secure, affordable and climate-friendly energy". Additional associated entry points in 2015 and 2016 include full implementation of the third Internal Energy Market Package at the Member State level, and reviews of the 2012 Energy Efficiency Directive and the 2010 Energy Performance of Buildings Directive.

The creation of the VCWG is a positive development since Member States on the whole seem – to date – unwilling to perform their obligations to define vulnerable groups. Bouzarovski and Petrova (2015), who looked at the role of policy actors in shaping policy agendas in the latter part of the policy timeline, suggest the activities of the VCWG are path breaking, and to some extent the findings from the analysis confirm this. For instance, the VCWG guidance represents the first determined attempt by the European Commission at defining vulnerable consumers, with significant involvement from external stakeholders such as academics, advocacy organisations and industry representatives. However, the focus on vulnerable customers is not path breaking, as the process of policy tracing revealed, but rather hitherto it had not been examined in great detail.

During Chapter 4, the implications of the divergent nomenclature were discussed, and whilst it was recognised that the VCWG guidance (2013) is beneficial for acknowledging the diverse contexts and capabilities of households, several concerns were expressed. In particular, it was argued that the wide-ranging list of drivers identified by the VCWG (2013) has the potential to further cloud the debate surrounding measuring and identifying affected households. Furthermore, the UK experience has shown it can be a blunt policy tool, with 80% of households defined as vulnerable in 2009, of which only one in five were fuel poor (Boardman, 2012).

Statistical index of fuel poverty: development and key results

Background

Chapter 5 provided an overview of the state of the art in fuel poverty measurement across the EU, finding that the recognition and analysis of fuel poverty is growly rapidly across Europe, with single country studies of fuel poverty emanating from twelve different Member States. However, knowledge about fuel poverty is still lacking at the European-scale (Bouzarovski *et al*., 2012), and the quality of existing research is highly variable across Europe. Many national-level analyses have incorrectly partially transferred the UK's fuel poverty methodology (Liddell *et al*., 2012); by using a ten per cent actual expenditure threshold that is not grounded in the specific context of the country under study, researchers risk producing invalid results. There is a need for guidance on how best to utilise actual expenditure data, given the known limitations, perhaps via a pan-European collaboration of key stakeholders. Furthermore, many of the comparative and single country studies reviewed had used older data that is at risk of becoming obsolete due to rapid societal changes in response to the global financial recession, and efforts to transition to a low carbon economy. For instance, the last pan-EU analysis of microdata was conducted using data from 2007, and the main source of data in France is from 2006. This indicates an urgent need for new sources of data at the national and European-level.

A further concern is that a high number of single country studies were found to have used macrodata, which is of poorer quality to microdata and cannot be used for detailed analysis at the household-level. This is perhaps due to access issues, lack of training in data analysis, or simply a lack of knowledge about the limitations associated with aggregated macrodata. The range of previously unutilised datasets outlined in Chapter 6 should go some way towards addressing this concern, particularly as the EQLS and Eurobarometer microdata are easily obtainable. Concern was also raised about the lack of rigorous examination of the relationship between key EU indicators of fuel poverty, which means that to date the degree of correlation between indicators is unknown, as is the nature of fuel poverty issues at the household-level across the EU. However, this latter issue is addressed by the composite indices developed in the thesis.

In Chapter 6, all available pan-EU sources of data were assessed to establish the most viable source of data for quantifying EU fuel poverty. This analysis found that there is a paucity of data, with no dedicated survey of fuel poverty in Europe, and no standardised household microdata on energy expenditure, energy consumption, or energy efficiency. As a consequence it is essential that comparative European fuel poverty researchers are pragmatic about the substantial gap in available data, both qualitative and quantitative. The index presented in this thesis is pragmatically driven by available data, which has resulted in an emphasis on subjective data concerning the *consequences* of fuel poverty, such as arrears on utility bills and the presence of damp in the home. However, this trade-off is considered essential for producing a practical interim measure of fuel poverty that contributes to an improved understanding of fuel poverty as a policy problem in the EU, and that ultimately helps to highlight the necessity of tackling fuel poverty. Moving forward this thesis advocates the collection of new purpose-built data that captures the *causes* of fuel poverty, namely specific energy needs and energy efficiency, among others, as will be elaborated on later in the chapter.

Constructing a composite index of fuel poverty

Chapter 7 outlined in detail the methods used for constructing composite indices of EU fuel poverty. This chapter addressed issues such as conceptual frameworks, correlations and underlying factor structures, and aggregation techniques. Overall, the chapter culminated in the production of three composite indices, one of which was derived from the VCWG's (2013) list of drivers and exacerbators. However, the VCWG's list of drivers and exacerbators was not easy to operationalise, and the index was deemed too unreliable for further analysis, which suggests the need to create a simpler policy tool for monitoring purposes. Given this, only two indices were chosen. These two indices are the CIFP, which makes use of the three prevailing indicators from EU-SILC from 2007 to 2011, and the EIFP, which is an expanded version that uses additional variables from the 2007 and 2012 ad-hoc housing condition modules. Overall, the indices are: grounded in the existing academic and policy literature; take into consideration the limitations imposed by data quality and availability; and can be used to make household-level comparisons of fuel poverty across Europe. The indices address the calls made by the EESC for a pan-EU measurement tool. In particular, the CIFP is a robust measure that provides annual statistics on fuel poverty prevalence, and can be used an interim measure until better quality expenditure data becomes available.

In Chapter 8, two weighting structures were also introduced; one that assigned equal weight to the proportion of households reporting one, two, and three indicators (unweighted scheme), and a second that weighted the indicators by severity (weighted). Both schemes are considered valid, particularly as they produce relatively similar results and index rankings. However, the weighted scheme is preferable overall because it places emphasis on households likely to be in the worst situations, that is, living in a cold and damp home with accumulated energy debts.

Key results

Chapter 8 detailed the headline results from the two indices, by way of household-level results tables, and overall country ranking tables. The indices provided important insights into the existence of fuel poverty across Europe, finding that fuel poverty does exist, to varying extents, in all countries of the EU. Across EU27, approximately 30 per cent of households reported one or more of the CIFP indicators in 2010. This figure equates to 52,109,083 households, which appears to confirm (2009c) earlier estimate that between 50 million and 125 million *people* are likely to be fuel poor across Europe, indeed the upper limit estimate is likely to be closest to the CIFP estimate given that there are more people than households in each country. The index results also provided important insights into the nature of the intensity of issues at the household-level. Of the 30 per cent of households reporting one or more indicator across EU27, a higher proportion reported just one indicator (21.9%, 39.9 million), rather than two indicators (6.4%, 10 million), or all three indicators (1.4%, 2.3 million). This suggests that there may be little overlap between the indicators, and as such they may be capturing different aspects of energy deprivation, although this does vary by country.

In terms of changes to the rates of fuel poverty across the EU over time, it was found that only three countries maintained their relative position between 2007 and 2011, 13 countries improved their position, and a further nine countries were ranked worse in 2011. Denmark demonstrated the largest fluctuations in rankings, going from 6th place in 2007 to 1st and 2nd place from 2008 to 2010, before dropping several places to 9th position in 2011. This was found to be the result of significant fluctuations within the individual Danish data, and also highlighted the importance of reporting the country ranking tables alongside the corresponding data tables in order to identify the cause of changes in ranking. In all, the findings presented in Chapter 8 add to the weight of evidence concerning the prevalence of fuel poverty across Europe, and highlight the necessity of tackling fuel poverty at the EU-level. However, the CIFP and EIFP may not gain widespread policy acceptance, particularly at the Member State level, precisely because it reveals the enduring and pervasive nature of fuel poverty issues in many countries.

Regional variations in fuel poverty prevalence

Based on the proportion of households reporting one, two, and all three indicators, all EU countries were ranked from 1st (best) to 27th (worst). Overall, it was found that with the exception of Slovakia, all of the top ranked countries, with the lowest incidence of fuel poverty from 2007 to 2011, were located in Northern and Western Europe. The bottom ranking countries were Southern, Eastern and Central European states, which is consistent with earlier research by Healy (2004), Buzar (2007a), and Thomson and Snell (2013). Part of the divergence in CIFP scores can be explained by examining the macroeconomic indicators for income inequality, national economic systems and energy markets, which reveal existing regional structural differences between the Member States. Indeed, as Table 9.1 below shows, there is a medium strength correlation between the CIFP scores (both unweighted and weighted) and the Gini coefficient of equivalised disposable income, which is a measure of income inequality. This relationship exhibits a positive trend line, meaning that as inequality increases so does the CIFP.

National Gross Domestic Product (GDP), which broadly speaking is a measure of the size of an economy, also has a medium strength correlation with CIFP scores, and demonstrates that countries with larger economies ((€ per inhabitant) perform better on the CIFP indices. It is likely that similar results would be produced using other indicators of national economic systems due to the strong role that household income and income inequality plays in determining fuel poverty, as will be expanded on later in this chapter.

National domestic electricity pricing also emerges as a determinant of fuel poverty, for instance, there is a small correlation between CIFP scores and domestic electricity pricing in Euros, exclusive of taxes and levies, which increases to a moderate correlation when taxes and levies are included. However, it is important to note the role of currency in altering the direction and strength of this association. When examining electricity pricing in Euros it appears that lower prices are associated with higher rates of fuel poverty, as measured using CIFP. Yet when Purchasing Power Standard (PPS) is applied, which reflects the relative purchasing power of households in terms of household income, this relationship is reversed, with lower pricing associated with lower CIFP scores. Indeed there is negligible correlation between CIFP and full electricity prices in PPS (including taxes and levies).

Table 9.1 Correlations between CIFP and key economic indicators. Data: EU-SILC 2010 and Eurostat data explorer.

Indicator (in 2010)	**Correlation**	
	CIFP U	CIFP W
Gini coefficient of equivalised disposable income	.30	.28
Gross Domestic Product (€ per inhabitant)	.38	.38
Electricity prices in Purchasing Power Standard (exc. taxes and levies)	.15	.15
Electricity prices in Euros (exc. taxes and levies)	.16	.17
Electricity prices in Purchasing Power Standard (inc. taxes and levies)	.06	.06
Electricity prices in Euros (inc. taxes and levies)	.29	.28

In addition to the aforementioned factors, there are a range of features unique to specific regions that mean fuel poverty is likely to be more pronounced. For instance, the demise of communism in the Eastern and Central European (ECE) region in the late 1980s and early 1990s initiated rapid and substantial restructuring processes (Sailer-Fliege, 1999), with the overall stated objective of moving towards a market-based economy. Early neoliberal grounded policy measures included the deregulation of the economy, widespread privatization, and the introduction of private property rights, in conjunction with fiscal austerity and the downsizing of state intervention in all aspects of society (Grubbauer, 2012). Among the key outcomes of the post-communist transformations are increasingly polarised urban neighbourhoods, growing income inequalities, decaying housing stocks, and rising energy affordability issues (Sailer-Fliege, 1999; Lampietti and Meyer, 2002; Buzar, 2007a).

Examining the results for the individual components of the CIFP in ECE countries reveals some interesting trends. For instance, in Romania the percentage of households reporting an inability to keep warm declined year on year from a high of 33.6 per cent in 2007 to 15.7 per cent in 2011. This was mirrored by similar decreases in the proportion of Romanian households reporting leaks, damp and/or rot, from 29.8 per cent in 2007 to 18.3 per cent in 2011. Conversely, the percentage of households stating they have been in arrears on their utility bills increased substantially from 8.0 per cent in 2007 to 26.0 per cent in 2011. These trends could be the result of a growing cultural preference for a warm and dry home, at the expense of energy debts. However, it is also likely that post-communist transformations have contributed to the rising prevalence of utility bill arrears in Romania, specifically in terms of ongoing energy market liberalisation and associated issues of non-payment of utility bills in ECE states (Buzar, 2007a; EBRD, 2003). Indeed, Hungary and Slovenia have also seen a growing proportion of households reporting arrears on utility bills between 2007 and 2011.

Southern Europe is a region that also suffers from a high prevalence of fuel poverty, but which has a unique context. As will be detailed later in the chapter, the CIFP analysis has established a fuel poverty paradox, whereby fuel poverty rates are negatively associated with climate and thus countries with lower heating demands have higher rates of fuel poverty. At first this result may seem anomalous, however, the Member States in Southern Europe have been exposed to particularly challenging macroeconomic circumstances necessitating prolonged fiscal austerity. This has caused a real loss of income for many households, and has resulted in finance for energy-related infrastructure projects becoming increasing scarce (Institute for European Environmental Policy, 2014). Furthermore, energy efficiency standards are among the worst in Southern Europe (Healy, 2004), which is compounded by high levels of dependence on imported energy. Indeed, the latest statistics from Eurostat's data explorer show that in 2013 the island states of Cyprus and Malta were between 96 and 104 per cent dependent on imported energy, meaning that these countries are particularly vulnerable to global price shocks.

Locating fuel poverty: socioeconomic and geographic drivers

Using multinomial logistic regression and cross-tabulation, Chapter 8 also explored the specific sociodemographic and geographic factors that increase household propensity to be fuel poor, and whether these differ between countries. A number of commonalities were found across the EU. For instance, the likelihood of being fuel poor is generally highest for households with lower levels of education, and those that contain at least one person who is unemployed, which is consistent with analysis by Tirado Herrero *et al*. (2014) and Healy and Clinch (2002a; 2002b). Chronic illness and disability was found to be widespread in fuel poor households across the EU, with households containing at least one person with a chronic illness or disability significantly more likely to be fuel poor, on the basis of consensual indicators, compared to healthy households. The relationship between living in fuel poverty and negative health implications has been well documented in several countries, including France (Jusot and Lacroix, 2014), the UK (Somerville *et al*., 2000; Liddell and Guiney, 2014; Liddell and Morris, 2010; Snell and Bevan, 2014), and New Zealand (Free *et al*., 2010), as detailed in Chapter 2.

A strong relationship was also found between fuel poverty and household income, both in terms of living below the national poverty line, and median disposable income. A discernible income gradient was observed in relation to the number of indicators reported, with households that report zero indicators possessing the highest levels of median disposable income, and households that report all three indicators possessing the lowest levels of disposable income. This result is perhaps unsurprising given that income plays an important role in shaping the affordability of energy bills, and determines whether a household needs to employ additional practices in order to maintain the affordability of domestic energy services. Additional practices include reducing expenditure on other essentials such as food, decreasing energy consumption, or accruing energy debts (Gibbons and Singler, 2008; Brunner *et al*., 2012; Lambie-Mumford *et al*., 2015). Raising household incomes is therefore an important short-term policy measure (Boardman, 2012), however, in the long-term targeted energy efficiency retrofits are the most sustainable and enduring method of alleviating fuel poverty.

By comparison, a weak relationship was found between retirement and the CIFP across the majority of EU countries, and in general retired households were more likely to be non-fuel poor, with the exception of Bulgaria and Romania. The results for household type were variable within and across countries, and thus it was not possible to identify a single family arrangement that is most likely to experience fuel poverty. Although, broadly speaking, single parent households and couples with three or more dependent children regularly had the highest odds ratios, at all levels of the CIFP, which is consistent with findings from numerous earlier studies (e.g. Hills, 2012; Healy and Clinch, 2002a; Benke and Varga, 2012). As with household type, the prevailing dwelling type of fuel poor households also varied significantly, with some regions of Eastern and Southern Europe demonstrating high rates of detached housing among fuel poor households.

Tenure played a critical role in shaping fuel poverty. The majority of fuel poor households in many ECE and Southern European countries were homeowners, which corresponds with existing research that shows home ownership has experienced strong growth in most European countries in recent decades. Indeed by 2003 home ownership was the majority tenure in every EU25 country, except Germany (Quilgars and Jones, 2010). The dominance of owner-occupation in ECE specifically is a consequence of widespread privatisation of housing in post-communist countries (Grubbauer, 2012). Among the key implications of high owner-occupation rates are limited state intervention in housing refurbishment, and housing policy more generally (Petrova *et al*., 2013; Edgar *et al*., 2007), housing affordability problems (Sailer-Fliege, 1999), and constraints on co-ordinated urban regeneration resulting from ownership fragmentation (Sýkora and Bouzarovski, 2012).

Elsewhere in Europe the tenure profile was slightly more varied, although there were high proportions of fuel poor households occupying market rate and subsidised rental accommodation. Rented accommodation is a particular risk factor in the UK, where it has been observed that living in rented accommodation limits the opportunities to improve the dwelling (Boardman, 2010a), with landlords unlikely to see the need for energy efficiency improvements (Brunner et al., 2012), which is contributing to very poor levels of energy efficiency in the private rented sector (Stockton and Campbell, 2011).

The analysis of central heating data demonstrated the importance of heating systems in shaping and driving fuel poverty in Europe. This is consistent with the established literature on the drivers of fuel poverty, which stresses the central role that energy efficiency plays in causing fuel poverty (Boardman, 1991; 2010a). In terms of geographic factors, a diverse degree of urbanisation profile was found for fuel poor households across Europe. A rural location was the modal, and often majority, group for fuel poor households in ten of the 25 countries present in the analysis, whilst urban location was the modal group for seven countries. The remaining eight countries had a mixed urban/rural profile.

Lastly, the analysis of climate using HDD data established a fuel poverty paradox, whereby fuel poverty rates are negatively associated with climate and thus countries with lower heating demands have higher rates of fuel poverty, which compares favourably with earlier work by Healy and Clinch (2002a). As Healy (2003) first posited in relation to excess winter mortality, this paradox may be due to poor energy efficiency standards and a lack of preparedness for cold weather. Whereas Northern European countries have extreme cold climates for most of the year and subsequently require high thermal standards, Southern European countries are relatively warm all year round and thus are not as prepared for cold snaps. For instance, Liddell *et al.* (2011) note that in Greece and Spain: "more attention has commonly been paid to protecting residents from heat rather than cold in these countries e.g. through high ceilings, tiled floors, and large window expanses. These contribute to short but acute periods of cold exposure during winter" (Liddell *et al*., 2011: 20). This analysis suggests that improving energy efficiency standards should be assigned a higher policy priority in Southern European countries.

Overall, the individual country results indicate a number of groups that would benefit from targeted fuel poverty alleviation schemes. Consensus already exists at the EU-level on the importance of Member States implementing energy efficiency schemes to alleviate energy poverty, thus a key recommendation is for Member States to target energy efficiency financing at households that suffer from the worst incidences of fuel poverty. In the absence of data on required energy expenditure, there is potential for EU-SILC data, and in particular the CIFP, to initially guide policy design. However, more sophisticated area-based methods are required to identify individual households for targeting purposes, such as those introduced by Walker *et al*. (2012), Fahmy *et al.* (2011); Morrison and Shortt (2008), and Baker *et al*. (2003).

Validity of the index and areas for future development

Post-hoc index adjustments

The last chapter considered and applied one form of post-hoc index adjustment that amended the CIFP results on the basis of climate. The rationale for making post-hoc adjustments is that the diversity of contexts found across the Member States of the EU, particularly in terms of heating demand, may reduce the comparability of the CIFP indicators, which in turn may reduce its acceptance by key stakeholders. However, to the author's knowledge survey data adjustments of this nature have not been made before, and so the key methods were borrowed from the field of energy consumption and energy efficiency statistics (see Lapillonne *et al*., 2015).

It was found that making climate adjustments significantly altered the ranking order, with countries located in Southern Europe seeing a substantial improvement in rankings as a consequence of the lower heating demand found in these countries. For instance, Malta was previously in 15th place but was ranked 1st in the climate adjusted index, and similarly, Cyprus went from 26th place to 2nd. These significant improvements occurred because the percentage of households reporting one CIFP indicator was reduced by 27 percentage points in Cyprus, and 20 percentage points in Malta - however, this raises the question of how meaningful it is to alter survey data in this manner.

Overall, this post-hoc adjustment is not considered valid for various reasons. Firstly, it contributes to the assumption that more temperate countries cannot suffer from energy deprivation, and yet Figure 8.1 shows HDD values for the six countries commonly classified as Southern Europe (Cyprus, Greece, Italy, Malta, Portugal and Spain) ranging from 385 through to 1,992 HDD. This indicates that indoor heating is required at various points throughout the year. Indeed, the use of a single HDD value for each country obscures the significant regional variations that are present in many countries, as reflected by the 2011 heating subsidies available in Italy, which varied from €70 in the warmest regions through to €183 in the coldest regions (Liddell *et al*., 2016). Secondly, the post-hoc climate adjustments place the emphasis on heating demand, when fuel poverty should concern all energy demands in the home, including cooking, use of appliances, and air conditioning. Thirdly, as the efficiency of heating systems improves and associated heat loss decreases - via equipment replacement and the gradual replacement of housing stocks with more efficient dwellings - the role of heating within overall energy demand is declining, with correspondingly increasing importance attached to lighting and the powering of appliances (Wright, 2008). Lastly, Wallenborn and Wilhite (2014: 63) posit that "Energy consumption is experienced by bodies in cultural settings and shaped by material environments", thus the culturally embedded nature of energy, and the societal role played by energy uses such as television viewing and internet communication, may be more important for energy consumption than climatic conditions.

However, there is an opportunity for the climate correction factors, in their present form, to serve as a discussion point on whether survey data, particularly related to fuel poverty, could and should be adjusted. Alternative factors could be used, such as income inequality, energy efficiency standards, and energy prices.

Comparisons with official statistics and other studies of fuel poverty

Determining the accuracy of the CIFP results is an inherently difficult process due to the problematic nature of measuring a multi-dimensional phenomenon. However, one method of ground truthing the results is to compare them with existing official statistics and statistical studies of fuel poverty. To that end, several comparisons are made below between the CIFP results and: European Commission pan-EU expenditure estimates of fuel poverty; official UK government statistics; and studies from France, Germany, and Spain. Whilst a broader range of studies are available than those outlined below, many were not considered to provide rigorous analyses of fuel poverty, for the reasons detailed in Chapter 5.

Pan-EU: European Commission estimates

In Table 9.2 below, the CIFP results have been matched by year, or closest available year, to statistics reported in a European Commission staff working paper (2010a). The working paper used HBS data to estimate the percentage of households across EU27 that spent twice the national mean on domestic energy (European Commission, 2010a). The calculations from the European Commission are the only expenditure based statistics available at the EU-scale, however, there are a number of associated limitations. For instance, as noted in Chapter 6, the HBS survey is not harmonised, thus the data reference year varies from 2005 to 2008 depending on the country. Furthermore, the estimates of fuel poverty are derived from a twice national mean expenditure threshold, rather than twice median expenditure, and on the basis of actual expenditure rather than theoretical required expenditure.

Two statistics from the CIFP are reported, firstly the *unweighted* index results (CIFP U), and secondly the *weighted* index results (CIFP W). Across most of the Member States the European Commission's HBS statistics are moderately matched to the CIFP U and CIFP W results, with differences of less than 10 percentage points found in 22 countries. In a minority of countries there is only a relatively small difference in values between the percentage of households spending twice the national mean and the CIFP index results, with differences of less than two percentage points found in 9 countries. The smallest difference in values for the HBS and CIFP U is found in Romania (0.6 percentage points), whilst the smallest difference between the HBS and the CIFP W index is found in Hungary (0.7 percentage points). In other countries, however, the results are significantly divergent. For instance, in Bulgaria, Slovakia and the United Kingdom, there is more than 15 percentage points in difference between the twice mean expenditure measure and the CIFP index results. The largest difference in values for the HBS and CIFP U is found in Bulgaria (19.4 percentage points), whilst the largest difference between the HBS and the CIFP W index is found in Slovakia (16.2 percentage points). Overall the HBS results are more closely matched to CIFP U, with the exception of Bulgaria, Cyprus, Greece, Hungary, Italy, Latvia, and Portugal.

The divergence in results could be caused by several factors, such as the use of the mean rather than median value for calculating energy affordability, which has the potential to artificially increase estimated prevalence by giving weight to atypically high values (Moore, 2012; Fahmy, 2011). Similarly, actual expenditure data is considered a poor indication of fuel poverty as it is affected by the priorities and decisions that households actually make (Hirsch *et al*., 2011; Moore, 2012; Liddell *et al*., 2012). Alternatively, there may be significant underlying material deprivation issues relating to the quality of housing that the twice-mean measure is incapable of capturing. On the other hand, the discrepancies could be the result of the flaws associated with consensual measures, namely potential error of exclusion (Dubois, 2012, Boardman, 2011), cultural embeddedness (Bouzarovski, 2013), and the inclusion of all utility bills in the arrears variable, which may include water and refuse collection (Thomson and Snell, 2013).

Table 9.2 Comparison of CIFP results and HBS statistics for the share of households spending twice the national mean on energy. Source: EU-SILC 2007-2008 and European Commission (2010a)

Country	% of households			Year (HBS/SILC)
	2 x national mean (HBS)	CIFP U	CIFP W	
Austria	11.9	4.1	2.3	2005/2007
Belgium	8.9	8.1	4.9	2008
Bulgaria	6.4	25.8	21.6	2008
Cyprus	6.4	17.8	12.8	2005/2007
Czech Republic	14.5	7.2	4.3	2005/2007
Denmark	12.4	6.4	3.9	2005/2007
Estonia	19.7	9.2	5.2	2007
Finland	13.0	3.1	1.7	2005/2007
France	16.2	6.9	4.1	2005/2007
Germany	12.6	6.4	3.8	2005/2007
Greece	7.6	12.0	8.6	2005/2007
Hungary	8.2	13.5	8.9	2008
Ireland	13.5	6.5	4.1	2005/2007
Italy	8.6	11.1	7.3	2008
Latvia	6.1	13.9	9.4	2008
Lithuania	16.0	14.4	9.1	2008
Luxembourg	13.6	5.3	2.8	2007
Malta	-	-	-	-
Netherlands	8.1	6.7	3.7	2005/2007
Poland	14.1	13.0	8.9	2008
Portugal	10.0	17.3	11.3	2007
Romania	16.6	17.2	11.9	2005/2007
Slovakia	19.0	4.7	2.8	2005/2007
Slovenia	12.0	9.1	5.7	2005/2007
Spain	11.2	7.1	4.1	2008
Sweden	11.2	3.5	1.9	2005/2007
United Kingdom	19.2	6.7	4.0	2008

United Kingdom

As noted previously, fuel poverty has been a policy concern in the UK for almost two decades, and the UK is widely regarded for producing rigorous estimates of prevalence using complex energy modelling. To compare values, the CIFP results have been matched to official fuel poverty estimates calculated by DECC for the UK from 2007 to 2011. However, only the 10 per cent measure is used in Table 9.3 below, as the LIHC measure has not been adopted beyond England. As before, two statistics are presented from the CIFP results for the UK, namely CIFP U and CIFP W.

Examining the overall percentage of households that are fuel poor under the official 10 per cent measure compared to the unweighted and weighted CIFP index results reveals that there is only a small amount of deviation between scores. In addition, the CIFP scores observe the same trend as the 10 per cent measure for the first three years, increasing year on year from 2007 to 2009. Overall, the proportion of household classified as fuel poor in the unweighted CIFP is closest to the official UK indicator. Indeed, across 2009 and 2010 the difference between the 10 per cent measure and CIFP U is just -0.1 and 0.5 percentage points respectively. The largest difference in scores is found between CIFP W and the 10 per cent measure in 2009, with a difference of -3.1 percentage points. Overall this indicates that the CIFP, in both unweighted and weighted format, has relatively high face validity, in the British context. However, the overlap between the CIFP and the official UK indicators requires further exploration to determine if the same households are classified as fuel poor under different measures.

Table 9.3 Fuel poverty estimates for the UK 2007 – 2011. Source: EU-SILC 2007-2010, DECC (2015a) and E Vincent (DECC), pers. comm., 7th October

Year	% of households		
	10%	CIFP U	CIFP W
2007	5.3	6.6	3.9
2008	6.1	6.7	4.0
2009	7.2	7.1	4.1
2010	6.4	6.9	4.2
2011	6.3	7.1	4.2

The subsequent table, 9.4, was created to explore whether the types of households identified as fuel poor under different measures are similar. However, there are a number of disclaimers that require consideration before interpreting the results. Firstly, it should be noted that the official statistics shown for the LIHC and 10 per cent measure refer to England, rather than the UK, as this is the spatial level used by DECC in their detailed tables of fuel poverty (DECC, 2015b). Secondly, due to sampling design and the absence of the region identifier variable for the UK, it was not possible to produce CIFP statistics for England only, thus the CIFP results refer to households across the UK. Consequently, only the overall trends should be examined. Third, the raw CIFP results have been used in the cross tabulations rather than the weighted index results as the latter is an aggregated score produced at the national- rather than household-level. In total three CIFP statistics are presented, namely the percentage of household reporting *only one* indicator (CIFP 1), the proportion of households reporting *two* indicators (CIFP 2), and the proportion of households reporting all *three* indicators (CIFP 3). Fourth, it should be further noted that the household categories used by DECC and EU-SILC are not a perfect match, with DECC using a threshold of 60 years and EU-SILC a threshold of 65 years for identifying older households. Lastly, EU-SILC does not distinguish between younger and older single households, and so the DECC results for single households have been collapsed into one category.

Overall, there are some similarities between the composition of households in CIFP 1 and the LIHC definition, particularly in terms of couples with dependent children and single households, which both have a difference of just 0.5 percentage points respectively. Similarities can also be observed between the LIHC, CIFP 2 and CIFP 3 scores for the proportion of other multi-person households classed as fuel poor, with differences of 0.8 and 0.7 percentage points. Under the LIHC, 10 per cent, CIFP 1 and CIFP 2 measures, single household is the modal fuel poor category. However, both CIFP measures tend to underestimate fuel poverty in couples with no dependent children who are aged over 65, and to overestimate incidence in couples with no children aged under 65 years. This may be due to the nature of self-reported data, especially as older people have been found to underreport difficulties relating to energy bills (Liddell *et al*., 2011; Palmer *et al*., 2008), in part due to a sense of stigmatisation of old age (Day and Hitchings, 2011).

Table 9.4 Comparison of household composition under the CIFP measure (UK), and the LIHC and 10% fuel poverty measures (England) in 2010. Source: EU-SILC 2010 and DECC (2015b)

Household type	**% of households**				
	LIHC	**10%**	**CIFP 1**	**CIFP 2**	**CIFP 3**
Couple, no children, under 60/65 years	9.0	6.4	18.3	13.2	10.6
Couple, no children, over 60/65 years	16.1	18.9	8.7	1.3	0.0
Couple with dependent children	23.3	8.5	23.8	18.1	33.8
Lone parent with dependent children	14.7	8.9	9.9	17.9	23.2
Other multi-person households	9.1	6.6	12.1	8.3	9.8
Single household	27.8	50.7	27.3	41.1	22.6

France

Of the limited analyses of fuel poverty in France that exist, the majority use data from the 2006 National Housing Survey. The most recent and comprehensive analysis of this data was conducted by Legendre and Ricci (2015), and their various scenarios have been matched to CIFP results from 2007 in Table 9.5 below. As can be seen, the unweighted and weighted CIFP results are the lowest estimates of fuel poverty, especially compared to the 10 per cent actual spend measure, and the after fuel costs poverty approach. The two CIFP indicators are closest in value to the LIHC-type measure (2.3 and 5.1 percentage points difference respectively). However, as noted in Chapter 5, a key limitation of the French research is that is relies heavily on income poverty concepts, indeed, the authors acknowledge that the second measure is identifying income poverty, rather than fuel poverty specifically (Legendre and Ricci, 2015: 2). In addition, their analyses are based on actual expenditure data, thus it is difficult to assess which measure offers the most accurate picture of the phenomenon.

Table 9.5 Comparison of CIFP and analyses by Legendre and Ricci (2015). Data: EU-SILC 2007 and French National Housing Survey 2006

Indicator	% of households
10% (actual spend)	16.6
After fuel costs poverty approach	20.9
LIHC	9.2
CIFP unweighted	6.9
CIFP weighted	4.1

Germany

In Germany, the best source of statistics is Heindl (2013), who used 2011 microdata from the German socio-economic panel (SOEP) to examine a variety of expenditure based fuel poverty indicators. Whilst there are a number of limitations associated with Heindl's research, namely the use of actual expenditure data, and the significantly reduced sample which decreases the representativeness of the analysis, it is nevertheless interesting to compare and contrast the CIFP results with Heindl's analysis. Compared with the eight varying expenditures measures shown in Table 9.6, the CIFP unweighted result is most similar to the twice mean share of expenditure indicator (with a difference of 1.2

percentage points), whilst the weighted CIFP result is closest in value to the twice median expenditure indicator (0.2 percentage points).

Table 9.6 Comparison of CIFP and analyses by Heindl (2013). Data: EU-SILC 2011 and SOEP 2011.

Indicator	% of households
10%	29.8
2x median expenditure	4.1
2x median share of expenditure	12.0
2x mean expenditure	2.4
2x mean share of expenditure	5.4
Minimum Income Standard	9.9
LIHC before housing costs	11.1
LIHC after housing costs	13.7
CIFP unweighted	6.6
CIFP weighted	3.9

Spain

The work by Tirado Herrero *et al*. (2014) provided an assessment of fuel poverty in Spain using microdata from the Spanish HBS and EU-SILC surveys. A key finding from this study was that 16.6 per cent of Spanish households had disproportionate energy costs (approximately twice-mean expenditure) and so were classified as fuel poor in 2012. As can be seen from Table 9.7 below, this figure is significantly higher than the unweighted and weighted CIFP results, although it is likely this can be partly attributed to their use of the mean rather than median, which as discussed previously is influenced by extreme values.

Table 9.7 Comparison of CIFP and analyses by Tirado Herrero et al. (2014). Data: EU-SILC 2011 and Spanish HBS 2012

Indicator	% of households
Approximately twice-mean	16.6
CIFP unweighted	7.3
CIFP weighted	4.3

Summary of comparisons

Overall the CIFP results are relatively close in value to the majority of existing statistics, especially the European Commission’s estimates, Heindl’s (2013) twice-average expenditure measures for Germany, and the UK’s 10 per cent measure. The latter measure is still regarded as one of the most robust measures of fuel poverty, thus it can be tentatively stated that the CIFP represents a good interim measure of EU fuel poverty. However, further research into the overlap between consensual and expenditure measures is necessary. Indeed, the comparisons do raise a number of questions about the validity of consensual and quantitative fuel poverty measures more generally, namely:

- Are consensual measures better at capturing the lived experience of fuel poverty compared to quantitative measures?
- Are the same households classified as fuel poor by consensual and expenditure measures, and how does this vary across Europe?
- Do either measure go far enough in capturing the multiplicity of experiences that result from differences in culture, energy needs, and socioeconomic characteristics?

These questions are beyond the scope of the thesis, mainly due a lack of appropriate data or resources to conduct in-depth qualitative research with fuel poor households, however, they are critical points to consider in order to advance fuel poverty measurement at the European-scale.

Improving data collection in Europe

At present, consensual measures of fuel poverty offer the best opportunity for gaining insight into the likely prevalence of fuel poverty across Europe. This is because, as noted earlier in the chapter, there is a paucity of data, with no dedicated survey of fuel poverty in Europe, and no standardised household microdata on energy expenditure, energy consumption, or energy efficiency. Among the key advantages of using a consensual measure are the relative simplicity of data collection when compared to expenditure data (Thomson and Snell, 2013), and the ability to capture wider elements of fuel poverty (Healy and Clinch, 2002a). However, the associated flaws include the potential error of exclusion (Dubois, 2012, Boardman, 2011), and the broad coverage of the utility bill arrears variable, which may include water and refuse collection (Thomson and Snell, 2013). Furthermore, thermal comfort and energy use is culturally embedded (Bouzarovski, 2013; Wallenborn and Wilhite, 2014), which adds some complexity to survey implementation and interpretation. Indeed, Slovakia’s statistical office reported implementation problems with the 2007 ad-hoc variables relating to comfortably warm and cool dwellings, stating that some respondents found it difficult to define 'comfortable' (Eurostat, 2009b: 29). However, in the same Eurostat (2009b) report, a further 12 European countries did not report any difficulties with implementing these variables.

In view of the weaknesses associated with the EU-SILC indicators, the CIFP should be treated as an interim measure of fuel poverty in the EU, rather than a final product. Where robust measurement frameworks already exist at the individual country-level, such as in the UK, the CIFP should have secondary status. At the European-level it is essential that data collection receives a radical overhaul in the succeeding years. This is most likely to be achieved in an incremental manner, via modifications to existing survey instruments. With this in mind, Table 9.8 outlines selected recommendations for improving data collection in EU-SILC. Many of these recommendations are drawn from an earlier Eaga Charitable Trust commissioned review co-produced by the author (Thomson and Snell, 2014), however, a number of additional recommendations resulting from the thesis are included too.

Amending EU-SILC is the most appropriate action to take initially for the reasons outlined in Chapter 6, namely that it is the largest and most frequently conducted pan-EU social survey. When considering how EU-SILC could be adapted to be fit for purpose, a key criteria was that the proposed amendments should not deviate too substantially from the existing formats, in order to maintain comparability across survey years for longitudinal analysis and to avoid complex and costly changes. However, it is important to note that changes to EU-SILC would need to be considered by the Indicators Sub-Group of the Social Protection Committee, in consultation with national statistical agencies, which is a process that could take several years, especially if met with resistance at the Member State-level.

Table 9.8 Selected recommendations for improved data collection in EU-SILC. Partially adapted from Thomson and Snell (2014: 30-34).

Proposed changes	Detail
New variable(s)	Create a dedicated actual energy expenditure variable, perhaps using a disaggregated HH070 (Total housing cost) which includes energy costs.
New variable(s)	Create a new variable that asks about payment methods for household energy bills, including information about tariffs where feasible.
Modification of existing variable	The established method used by Eurostat (2015) for identifying under-occupancy does not solely concern bedrooms. Disaggregate HH030 (Number of rooms available to the household) by room type to enable new calculations.
Separation of existing variable(s)	Disaggregate variable HH040 (Leaking roof, damp walls/floors/foundation, or rot in window frames or floor) to distinguish between problems, as occurred in the ECHP.
Modification of response format	Amend HH050 (Ability to afford to keep home adequately warm), and MH050 (Dwelling comfortably warm) variables so instead of a binary variable format, they use a Likert type scale response format to detect frequency of the problems.
Review subjective variable wording	Review the subjective wording of HH050 (Ability to afford to keep home adequately warm), MH050 (Dwelling comfortably warm) and MH070 (Dwelling comfortably cool) to ensure validity.
New variable(s)	The 2002 EU Directive on the Energy Performance of Buildings requires an energy performance certificate to be produced whenever a building is constructed, rented, or sold. Create a new variable for energy performance ratings.

Additional options for improving pan-EU data collection include harmonising national HBS, and launching a new household-level survey of fuel poverty. Harmonising national HBS to create a pan-EU dataset of actual fuel expenditure would be useful for exploring seasonal and annual variations in expenditure, and for investigating differences in expenditure between different household groups. However, as noted throughout the thesis, actual fuel expenditure can be a poor indication of fuel poverty, particularly if the limitations are not acknowledged during analysis. Furthermore, harmonising HBS would be a challenging undertaking due to the variations that currently exist in sampling methods and variable design, requiring either a shared political will across all countries to standardise their measurement approach or the production of a statistical algorithm to standardise the data. The creation of a new dedicated pan-EU household survey of fuel poverty could be even more challenging to undertake, with significant financial and resource costs. The types of indicators contained in a dedicated survey would be relatively diverse, ranging from sociodemographic and self-assessed health and wellbeing questions, through to technical energy efficiency and housing quality data. However, it would also allow stakeholders to develop an evidence based dataset that is relevant and appropriate for monitoring fuel poverty trends, with significant opportunities for policy transfer from countries which have expertise in collecting complex fuel poverty data.

Chapter 10: Conclusions

Introduction

As outlined in Chapter 1 the main purpose of this thesis was to contribute to an improved understanding of fuel poverty in the EU by addressing the analytical gaps in policy and statistical understandings of fuel poverty. It aimed to connect historical policy processes and policy discourses concerning fuel poverty measurement on the one hand, and the development of a new measurement tool that could be used for policy monitoring, on the other hand, recognising that the two are intertwined. In other words, this thesis aimed to establish what policy mandates exist for advancing fuel poverty measurement, in order to move towards a practical use of available data for monitoring the incidence of fuel poverty across the Member States of the EU.

Overall this thesis has made two key original contribution to knowledge. Firstly, it has established the central role of institutions in shaping fuel poverty policy over time since the term first emerged in a policy document over a decade earlier, with the European Commission playing an important role in impeding policy development. This analysis revealed that there is substantial desire among many EU institutions for quantitative assessments of fuel poverty, which has not been addressed thus far. The second key contribution to knowledge has been the demonstration of the pervasive and enduring nature of fuel poverty in Europe via a new household-level composite index. The index has shown that significant regional variations in fuel poverty prevalence exist, with countries in ECE and Southern Europe worst affected. The purpose of the following chapter is to assess the contributions to knowledge made by the study, in the context of its main strengths and limitations. Furthermore, this chapter will also summarise the key recommendations made in the previous chapter, which are aimed at addressing the gaps in research, policy provision, and data availability identified by the thesis. The chapter concludes with a number of suggested directions for future research on fuel poverty across Europe.

Strengths and limitations of the study

This thesis makes an original methodological contribution to the comparative literature on fuel poverty by using a summative index derived at the household-level to determine the intensity of fuel poverty issues. Previous pan-EU indexes by Healy and Clinch (2002a), Thomson and Snell (2013) and Bouzarovski (2013) have produced composite scores at the country-level by averaging national results for individual components, which offers no insight into the number of indicators concurrently reported by households. Furthermore, this is the first time that the correlations between the prevailing consensual indicators of fuel poverty have been explored, which has been determined using Phi and Tetrachoric correlation coefficients. The Tetrachoric coefficient is an underutilised correlation test in fuel poverty research, yet it may be more appropriate than the Phi coefficient as it assumes a continuous underlying distribution, which is important when dealing with latent traits that may not be truly discrete, such as ability to afford to heat the home. The research also offers methodological insight into the process of operationalising the VCWG's recent guidance on vulnerable consumers.

A general contribution of this thesis is its coverage of EU27 countries using the latest available microdata, whereas the last microdata analysis by Thomson and Snell (2013) used 2007 EU-SILC data for 25 Member States, and Healy and Clinch's (2002a) work focused on EU14 using significantly older ECHP data. This advances and expands understandings of fuel poverty in the EU. In terms of the qualitative analysis, this research has applied aspects of a theoretical framework that has hitherto not been used in fuel poverty research, namely historical institutionalism. This framework has been useful for identifying how institutions have shaped fuel poverty policy between 2001 and 2014, and in particular for locating the critical junctures in policymaking, as well as recognising the most powerful players in the policy game. The qualitative analysis offers the most comprehensive coverage of EU fuel poverty policy developments to date, broadening the focus of discussions beyond the 2009 internal energy market Directives. This has helped with identifying the policy mandates for defining, measuring and addressing fuel poverty across Europe, as well as recognising the path dependent nature of the vulnerable consumer terminology.

However, there are a number of associated methodological and conceptual limitations that must be noted. Firstly, the credibility of the qualitative policy analysis has not been confirmed using member checks, although this is minimised somewhat by the use of a diverse selection of official policy documents spanning over a decade. Secondly, whilst official EU policy documents provide insight into the formal emergence of fuel and energy poverty related concerns, they are not necessarily reflective of the informal policymaking process, especially in terms of informal lobbying of political representatives located at veto points in the policy chain. Policy documents may provide an incomplete or distorted account of events, and do not reflect the implementation of policy at the Member State level.

In terms of the quantitative analysis, many of the limitations relate to the quality and availability of secondary data. For instance, as detailed in Chapters 2 and 6, there is currently no dedicated EU survey of fuel poverty, nor is standardised energy expenditure data available at the household-level. This necessitates the use of a consensual measurement approach only, and prevents meaningful comparison between expenditure and consensual based measures. The main limitations of the consensual approach have been stated earlier in the thesis, and relate to the self-reported and subjective nature of the indicators used. A number of omissions and limitations were outlined in Chapter 7 relating to the EU-SILC survey and the indices. It was noted that the analysis of fuel poverty focuses on EU27, which excludes Croatia who joined the EU in 2013, as the newest EU-SILC data available at the time of analysis was for 2011. A number of inherent data issues were discussed, as summarised in Appendix 2, such as the absence of Malta for the 2007 and 2008 survey years, and Ireland in 2011. In addition to this, none of the indices have incorporated variables relating to summertime fuel poverty, and adequate cooling, mainly because they were not present in earlier studies by Healy and Clinch (2002a) and Thomson and Snell (2013), which this research replicates. However, this is an important topic for future research.

There are a number of limitations associated with the FPRI, which is why it was not selected for further analysis. For example, in creating an under-occupancy variable, it was found that the established Eurostat methodology results in the majority of EU households being classified as under-occupying, whereby the number of rooms available exceeds the number of people. However, in EU-SILC bedrooms, dining rooms, living rooms and habitable cellars and attics are counted as ‘rooms’ (Eurostat, 2010b), thus the definition of under-occupancy may be considered unrealistic as it does not solely concern bedrooms. However, to have used an alternative method to the one employed by Eurostat would have involved making assumptions about dwelling layout, which could reduce the validity of the research.

The statistical analysis focussed on generating results at the household-level, given that policy interventions are generally delivered at this level, and thus the research has not produced estimates for the number of individuals affected. On a related point, the analysis utilised cross-sectional data files rather than longitudinal data. However, one of the main limitations of the research is that it has not been possible to entirely follow the methodology for consensual poverty measurement established by Mack and Lansley (1985) and Gordon *et al*. (2000) in terms of socially perceived necessities. Certainly the Eurobarometer survey results in Chapter 6 offered insights into the perceived necessity of adequate warmth and access to utilities, finding consensus across the majority of countries. However, earlier British consensual poverty research used focus groups to determine what items and services citizens consider to be necessary.

Key recommendations

In the previous discussion chapter a number of recommendations were made for improving policy provision, research, and data availability. These recommendations have arisen from the empirical analyses conducted during the thesis, and are summarised in Table 10.1. Of the recommendations detailed below, the two most important proposals are: the significant overhaul of data collection across Europe; and the development and adoption of a basic pan-EU definition of fuel poverty. The first recommendation is considered essential because the paucity of suitable data at the EU-level is a major impediment to scientific research and policy design. Whilst the composite index developed in this thesis advances knowledge, there are a number of inherent limitations that mean new data is required. In terms of the second recommendation, the analysis in Chapter 4 indicated that whilst fuel poverty has been recognised as a policy issue by all

EU institutions, a substantial level of terminological confusion has persisted at the EU-scale. Creating a basic definition of fuel poverty is essential for clarifying what is meant by fuel and energy poverty, and has the additional benefit of giving increased prominence to the issue of fuel poverty. These are not insurmountable tasks, although they will require input from all relevant stakeholders.

The additional recommendations in Table 10.1 concern policy design and other aspects of statistical data. In terms of policy, it is recommended that legal protection and obligations to reduce fuel poverty are extended beyond mains gas and electricity to cover all energy carriers, including heating oil and coal. It is recommended that fuel poverty be included in impact analyses conducted by EU and national administrations during the drafting of all new legislation in relevant policy areas, such as energy and housing. This would determine the distributional impacts of new policy on different household groups, and it might encourage greater collaborative working across departments if potential policy synergies and conflicts are recognised. It was also suggested that energy poverty reduction should be set an objective in EU policy, and where feasible, targets should be established, however, to some extent it is contingent on the availability of suitable data, and advances made in data collection. A number of forthcoming policy entry points have been outlined, including the new Energy Union strategy, enforcement of full implementation of the third Internal Energy Market Package at the Member State level, and reviews of the 2012 Energy Efficiency Directive and 2010 Energy Performance of Buildings Directive. It is recommended that key stakeholders target these entry points, with a specific focus on the concept of 'vulnerable customers', given that this is the preferred terminology used by the European Commission. A final policy recommendation was for Member States to target fuel poverty alleviation schemes, especially those based on energy efficiency improvements, at households that are most likely to be suffering from fuel poverty. Initially this could be determined using the CIFP and other indicators from the EU-SILC survey, however, in the medium and long term, effective targeting of fuel poverty measures requires area-based methods.

The additional data recommendations concern the need for guidance on how best to utilise actual expenditure data, given the known limitations of this data type. As stated previously, this guidance could be developed via a pan-European collaboration of key stakeholders, and would be particularly pertinent if conducted in conjunction with a partial harmonisation of HBS data. In terms of the concept of vulnerable customers, the work in Chapter 7 established that the drivers and exacerbators from the VCWG guidance are not easy to operationalise, thus if Member States are to focus on vulnerable customers in place of fuel poor households, there is a need to develop a simpler measurement tool for monitoring the incidence of issues. A monitoring tool would help to identify areas of improvement and subsequent best practice, and would determine the effectiveness of measures. This is particularly pertinent because as discussed in Chapter 4, there is a danger that Member States will focus only on softer consumer regulation, at the expense of addressing structural issues such as energy efficiency and access to a range of energy carriers.

Table 10.1 Summary of key recommendations

Recommendation	Potential impact
Improve and expand data collection, in consultation with Eurostat, national statistical agencies and other key stakeholders. Use Table 9.8 and the full review by Thomson and Snell (2014) as the starting point for discussions.	Better quality data provision that enables more accurate assessments of fuel poverty in the EU, and evidence based policy design.
Develop a basic common pan-EU definition of fuel poverty.	Increased recognition and prominence of the issue, and clarification around what is meant by fuel and energy poverty.
Encourage Member States to review fuel poverty in their country, and subsequently develop a detailed definition that builds on the common EU definition and is appropriate to local contexts.	Increased recognition and prominence of the issue, and clarification around what is meant by fuel and energy poverty.
Incorporate fuel poverty alleviation within all energy policies, as well as other relevant policy areas such as housing and health.	Increased recognition and prominence of the issue, potential for policy synergies.
Explicitly list fuel poverty reduction as an objective in EU policy, accompanied by targets where appropriate.	Increased recognition and prominence of the issue, potential for policy synergies.
Include fuel poverty in impact analyses conducting during the drafting of new legislation in relevant policy domains.	Increased recognition and prominence of the issue, potential for policy synergies.
Expand fuel poverty related legislation to all energy carriers.	At present only consumers of mains gas and electricity are protected by EU law, despite the significant numbers of households using solid and liquid fuels. This would extend protection to all households.
Target new policy entry points offered by the new Energy Union strategy (European Commission, 2015), enforcement of full implementation of the third Internal Energy Market Package at the Member State level, and reviews of the 2012 Energy Efficiency Directive and 2010 Energy Performance of Buildings Directive. This should specifically focus on the concept of 'vulnerable customers'.	Improved policy design, with the potential to incorporate fuel poverty alleviation targets in legislation. This is likely to be more successful it enduring concepts (vulnerable customers) are targeted.
Pan-European collaboration of key stakeholders to produce guidance on how best to utilise actual expenditure data, given the known limitations.	Avoidance of misapplication of the UK's methodology, and improved research design.
Target energy efficiency financing at households that are at the greatest risk of fuel poverty.	Long term alleviation of fuel poverty.
Develop a tool for monitoring the vulnerability of customers in the energy markets.	This would help to identify areas of improvement and subsequent best practice, and would determine the effectiveness of measures.

Directions for future research

Although this thesis presents the most comprehensive assessment of fuel poverty in the EU to date, there are several ways in which the research could be expanded and improved. From the review of policy, it is evident that the term vulnerable customer will continue to have *de facto* usage in place of fuel and energy poverty at the EU-level, especially as a consequence of the VCWG guidance document. Future research could examine use of the term vulnerable customer across all EU policy, and at the Member State level to assess how it is conceptualised, and what the implications of this are for fuel poverty alleviation. This is particularly pertinent in the context of efforts to meet the EU target of transitioning to a low carbon economy by 2050, which will require significant investment in energy efficiency and renewable energy and restructuring of existing economic systems (Xiao-jing, 2012) - financing that could be regressive if the social and distributional impacts of policy are not recognised. Related to this is the possibility to explore how a measurement tool could be derived from the VCWG's list of drivers and exacerbators. As highlighted above, these were not easy to operationalise, thus whilst the guidance provides comprehensive information for Member States on different ways of alleviating various aspects of consumer vulnerability, it steers policy away from monitoring the prevalence of energy deprivation.

The review of data in Chapter 6 provided information on all presently available datasets that could be utilised in fuel poverty research. For instance, HBS could be partially harmonised to provide pan-EU data on actual energy expenditure. The Eurobarometer data could be explored further to examine opinion on the necessity of adequate warmth and access to gas and electricity, especially as the concepts underpinning consensual fuel poverty work have not been tested at the European-scale. A connected point is that additional research is needed on socially perceived necessities. At present, the majority of evidence is produced in, and relates to, the UK, particularly as a result of the ongoing Poverty and Social Exclusion project, and the Minimum Income Standard project. The focus group methodology used by both projects could be replicated elsewhere, and would produce valuable information on cross-national differences in perceived necessities.

The EU-SILC survey is an exceedingly rich source of data. Subsequent analysis could look at the individual-level data files to determine the number of people affected. Issues relating to summertime fuel poverty and adequate cooling could be assessed using the ad-hoc housing condition modules. There is potential to use the longitudinal EU-SILC data to follow groups over a four year rotation period to track transitions in and out of fuel poverty, which could provide a more nuanced understanding of the determinants of fuel poverty. However, it should be noted that at present there is no way of linking individuals and households in the cross-sectional data files with the longitudinal data files. Furthermore, Iacovou *et al*. (2012) highlight the difficulties in using EU-SILC for analysing the transitions of young adults and separating couples. Finally, additional research could focus on the worst affected regions, by using statistical techniques such as cluster analysis to group countries by their characteristics on the different disaggregated indicators of fuel poverty. This analysis could also be conducted at the regional level for a finer grained analysis of the issues, although this might preclude the use of a summative index due to sample restrictions.

Appendix 1: Policy document selection

Table A1-1 Coverage of search terms in selected policy documents

Year	Document title	Coverage of term "fuel poverty" % and number of references (#)[9]	Coverage of term "energy poverty" % and number of references (#)
	European Commission		
2007	Communication from the Commission to the Council and the European Parliament - Prospects for the internal gas and electricity market COM(2006) 841 final	0.02% (2)	0.01% (1)
2007	Commission staff working document - Accompanying the legislative package on the internal market for electricity and gas - Impact Assessment {COM(2007) 528 final} {COM(2007) 529 final} {COM(2007) 530 final} {COM(2007) 531 final} {COM(2007) 532 final} {SEC(2007) 1180} /* SEC/2007/1179 final */ [NOT IN DOWNLOADABLE FORMAT]	0.00% (0)	0.31% (4)
2007	Communication from the Commission to the European Council and the European Parliament: An Energy Policy for Europe COM(2007) 1 final	0.00% (0)	0.01% (1)
2007	Communication from the Commission: Towards a European Charter on the Rights of Energy Consumers COM(2007)386 final	0.03% (2)	0.04% (2)
2008	Communication from the Commission to the European Parliament pursuant to the second subparagraph of Article 251(2) of the EC Treaty concerning the common position of the Council on the adoption of a Directive of the European Parliament and of the Council concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC COM(2008)906 final	0.00% (0)	0.41% (10)
2008	Communication from the Commission to the European Parliament pursuant to the second subparagraph of Article 251 (2) of the EC Treaty concerning the common position of the Council on the adoption of a directive of the European Parliament and of the Council repealing Directive 2003/55/EC concerning common rules for the internal market in natural	0.00% (0)	0.41% (10)

[9] Calculated using the Text Search function in NVivo 10

	gas COM(2008) 907 final		
2010	Commission Staff Working Paper: An Energy Policy for Consumers	0.09% (8)	0.16% (13)
2011	European Commission Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on energy efficiency and repealing Directives 2004/8/EC and 2006/32/EC COM(2011)	0.01% (2)	0.01% (2)
2011	Commission Staff Working Document: Impact Assessment Accompanying document to the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Commission Staff Working Document Energy Efficiency Plan 2011 COM(2011) 109	0.01% (1)	0.01% (3)
2012	Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Making the internal energy market work COM(2012) 663 final	0.00% (0)	0.01% (1)
European Parliament			
2008	European Parliament resolution of 19 June 2008 on Towards a European Charter on the Rights of Energy Consumers. Official Journal of the European Union, C 286 E/24	0.03% (1)	0.10% (3)
2008	Position of the European Parliament adopted at first reading on 9 July 2008 with a view to the adoption of Directive 2008/…/EC of the European Parliament and of the Council amending Directive 2003/55/EC concerning common rules for the internal market in natural gas. Official Journal of the European Union, C 294 E/142	0.00% (0)	0.04% (8)
2008	Position of the European Parliament adopted at first reading on 18 June 2008 with a view to the adoption of Directive 2008/…/EC of the European Parliament and of the Council amending Directive 2003/54/EC concerning common rules for the internal market in electricity. Official Journal of the European Union, C 286 E/106	0.00% (0)	0.05% (8)
2009	European Parliament legislative resolution of 23 April 2009 on the proposal for a directive of the European Parliament and of the Council on the energy performance of buildings (recast). Official Journal of the European Union, C 184 E/263	0.00% (0)	0.01% (1)
2010	European Parliament resolution of 15 December 2010 on Revision of the Energy Efficiency Action Plan. Official Journal of the European Union, C 169 E/66	0.01% (1)	0.09% (8)
2010	European Parliament resolution of 25 November 2010 on Towards a new Energy Strategy for Europe 2011-2020. Official Journal of the European Union, C 99 E/64	0.00% (0)	0.03% (2)

Directives			
2009	Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC	0.00% (0)	0.01% (4)
2009	Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC	0.00% (0)	0.01% (4)
2010	Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast)	0.00% (0)	0.01% (1)
2012	Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC	0.01% (1)	0.01% (2)
Committee of the Regions documents			
2007	Opinion of the Committee of the Regions on The energy package. Official Journal of the European Union, C 305/1	0.03% (1)	0.00% (0)
2008	Opinion of the Committee of the Regions on the ‘Third legislative package on European electricity and gas markets’. Official Journal of the European Union, C 172/55	0.00% (0)	0.04% (1)
2013	Opinion of the Committee of the Regions on ‘Making the internal energy market work’	0.00% (0)	0.07% (3)
2014	Opinion of the Committee of the Regions - Affordable Energy for All	0.04% (1)	1.31% (30)
European Economic and Social Committee documents			
2008	Opinion of the European Economic and Social Committee on the — ‘Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/54/EC concerning common rules for the internal market in electricity’ — ‘Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/55/EC concerning common rules for the internal market in natural gas’ — ‘Proposal for a Regulation of the European Parliament and of the Council establishing an Agency for the cooperation of energy regulators’ — ‘Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EC) No 1228/2003 on conditions for access to the network for cross-border exchanges in electricity’	0.02% (1)	0.02% (1)

	— 'Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EC) No 1775/2005 on conditions for access to the network for cross-border exchanges in natural gas'. Official Journal of the European Union, C 211/23		
2008	Opinion of the European Economic and Social Committee on the Communication from the Commission: Towards a European Charter on the Rights of Energy Consumers. Official Journal of the European Union, C 151/27	0.03% (2)	0.00% (0)
2011	Opinion of the European Economic and Social Committee on 'Energy poverty in the context of liberalisation and the economic crisis' (exploratory opinion). Official Journal of the European Union, C 44/53	0.12% (4)	1.20% (33)
2011	Opinion of the European Economic and Social Committee on the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions — Energy Efficiency Plan 2011. Official Journal of the European Union, C 318/155	0.02% (1)	0.02% (1)
2013	Opinion of the European Economic and Social Committee on 'For coordinated European measures to prevent and combat energy poverty' (own-initiative opinion)	0.08% (4)	1.12% (51)
2014	Opinion of the European Economic and Social Committee on the communication from the Commission on 'Delivering the internal electricity market and making the most of public intervention'	0.00% (0)	0.23% (9)
MEP questions to the European Commission			
2003	Written question by Claude Moraes (United Kingdom, Labour) to the Commission (28 May 2003). Answer given by Mrs de Palacio on behalf of the Commission (2 July 2003).	1.23% (2)	0.00% (0)
2008	Written question by Anni Podimata (Greece, Panellinio Socialistiko Kinima) to the Commission (10th September 2008). Answer given by Mr Piebalgs on behalf of the Commission (24 October 2008).	0.33% (1)	1.56% (4)
2010	Written question by Alan Kelly (Ireland, Labour) to the Commission (12th October 2010). Joint answer given by Mr Oettinger on behalf of the Commission (23rd November 2010).	0.82% (1)	0.96% (1)
2010	Written question by Proinsias De Rossa (Ireland, Labour) to the Commission (14th October 2010). Joint answer given by Mr Oettinger on behalf of the Commission (23rd November	1.73% (2)	1.01% (1)

	2010).		
2012	Written question by Marisa Matias (Portugal, Bloco de Esquerda) to the Commission (7th February 2012). Answer given by Mrs Georgieva on behalf of the Commission (12th April 2012).	0.00% (0)	1.54% (3)
2012	Written question by Konstantinos Poupakis (Greece, Nea Demokratia) to the Commission (29th June 2012). Answer given by Mr Oettinger on behalf of the Commission (13 August 2012).	0.00% (0)	0.39% (1)
2012	Written question by Konstantinos Poupakis (Greece, Nea Demokratia) to the Commission (20th November 2012). Answer given by Mr Oettinger on behalf of the Commission (28th January 2013).	0.00% (0)	0.73% (2)
2013	Written question by Nikos Chrysogelos (Greece, Ecologist Greens) to the Commission (8th January 2013). Answer given by Mr Rehn on behalf of the Commission (12th March 2013).	0.00% (0)	0.69% (2)
2013	Written question by Niki Tzavela (Greece, Popular Orthodox Rally) to the Commission (22nd March 2013). Answer given by Mr Oettinger on behalf of the Commission (30th April 2013).	0.00% (0)	3.98% (7)
2013	Written question by Diane Dodds (Northern Ireland, Democratic Unionist Party) to the Commission (29th April 2013). Answer given by Mr Oettinger on behalf of the Commission (21st June 2013).	4.08% (6)	2.38% (3)
2013	Written question by Raül Romeva i Rueda (Spain, Iniciativa per Catalunya Verds) to the Commission (14th October 2013). Answer given by Mr Oettinger on behalf of the Commission (6th December 2013).	0.37% (1)	4.30% (10)
2013	Written question by Gaston Franco (France, Union pour un Mouvement Populaire) to the Commission (19th November 2013). Answer given by Mr Oettinger on behalf of the Commission (17th December 2013).	4.16% (10)	0.49% (1)
2014	Written question by Claudette Abela Baldacchino (Malta, Partit Laburista) to the Commission (6th January 2014). Answer given by Mr Oettinger on behalf of the Commission (27 February 2014).	0.00% (0)	3.89% (7)
Vulnerable Consumer Working Group			
2013	Vulnerable Consumer Working Group Guidance Document on Vulnerable Consumers	0.10% (29)	0.24% (60)

Appendix 2: Supplementary material for Chapter 7

Table A 2-1 EU-SILC dataset versions

EU-SILC 2007 cross-sectional rev 5 from 01/08/2011
EU-SILC 2008 cross-sectional rev 4 from 01/03/2012
EU-SILC 2009 cross-sectional rev 4 from 01/03/2013
EU-SILC 2010 cross-sectional rev 2 from 01/03/2013
EU-SILC 2011 cross-sectional from 01/03/2013

EU-SILC Sample Individual Confidentiality Declaration

Regulation (EC) No 223/2009 of the European Parliament and of the Council of 11 March 2009 on European Statistics provides the basic legal framework for the development, production and dissemination of European statistics. That Regulation foresees an additional possibility to give access to confidential data to researchers in the interest of scientific progress in Europe, subject to the strict obligation to respect the statistical confidentiality of the data.

I will be bound by all the terms and conditions of the confidentiality undertaking signed by the duly designated representative of my research entity and will use the dataset indicated in the research proposal in accordance with the terms of use attached to the confidentiality undertaking.

I will:

(a) use the dataset only for the purposes specified in the research proposal;

(b) safeguard the dataset and any usernames and passwords associated with it;

(c) ensure that any results of analyses will not be disclosive or potentially disclosive in conjunction with other publicly available information;

(d) acknowledge the dataset and its source in any research report or publication and also state that the results and conclusions are mine and not those of Eurostat, the European Commission or any of the national statistical authorities whose data have been used;

(e) provide Eurostat with references to publications and other research reports based on this dataset;

(f) preserve the confidentiality of information pertaining to identifiable individuals, households and/or organisations that are recorded in the dataset;

(g) submit the final complete output of my work for the confidentiality check to the competent Eurostat staff (in case of access to secure use files);

(h) destroy the dataset and any data or variables derived from it at the end of the research period specified in the research proposal and sign a declaration to the effect that it has been ensured that all data have been destroyed;

(i) abide by any other conditions notified to me by Eurostat (e.g. guidelines for publication).

I will not:

(a) make copies of the data;

(b) allow others to access the dataset;

(c) use the data for research purposes before it is checked for confidentiality by Eurostat (in case of access to secure use files)

(d) remove the data or any part of it (in case of access to secure use files);

(e) attempt to link the data to other (including public) datasets, whether or not provided by Eurostat, if not expressly agreed;

(f) attempt to identify any individual record (individual, household, business, etc.) in the dataset, or claim to have done so;

(g) release or publish any information or results which identify any individual record or may lead to the identification of any individual record.

I certify that I have read all of the above clauses, that I understand that I am accountable for correct and responsible use of the data and data access system, and that I understand that if I fail to comply with these clauses, my access to the dataset will be withdrawn and I will be liable to any other sanctions that may be determined by my research entity or are specified in the applicable civil or penal law.

Name: ……………………………………………

Signature: ……………………………………………… Date: …………………………….

Table A 2-2 Data issues in EU-SILC and Eurostat heating degree day data 2007 - 2011

Issues	Survey year				
	2007	2008	2009	2010	2011
Country missing from EU-SILC	MT	MT	-	-	IE
DB040 (Region NUTS 1 OR 2)	DE, MT, NL, PT, SI, UK missing. A further 13 countries are at NUTS 1/other instead of 2.	DE, MT, NL, PT, SI, UK missing. A further 12 countries are at NUTS 1/other instead of 2.	DE, NL, PT, SI, UK missing. A further 13 countries are at NUTS 1/other instead of 2.	N/A as heating degree days data missing	N/A as heating degree days data missing
Heating degree days NUTS 1 or 2	-	-	-	No data below national level	No data below national level
DB100 (Degree of urbanisation)	MT, NL and SI missing. EE, LT and LV have merged intermediate area in densely populated area.	DE, MT, NL, SI missing. EE, LT, LV have merged intermediate area in densely populated area.	NL and SI missing. EE, LT, LV have merged intermediate area in densely populated area. MT have merged thinly populated area in intermediate area.	NL and SI missing. EE, LT, LV have merged intermediate area in densely populated area. MT have merged thinly populated area in intermediate area.	IE, NL and SI missing. EE, LT, LV have merged intermediate area in densely populated area. MT have merged thinly populated area in intermediate area.
MH040 (Dwelling equipped with heating facilities)	MT and RO missing	N/A - 2007 only	N/A - 2007 only	N/A - 2007 only	N/A - 2007 only
MH050 (Dwelling comfortably warm during winter)	IE and MT missing	N/A - 2007 only	N/A - 2007 only	N/A - 2007 only	N/A - 2007 only
MH060 (Dwelling equipped with air conditioning)	MT missing. FI has high levels of missing values (42.9%)	N/A - 2007 only	N/A - 2007 only	N/A - 2007 only	N/A - 2007 only
MH070 (Dwelling comfortably cool	MT and RO missing BG has very high levels of	N/A - 2007 only	N/A - 2007 only	N/A - 2007 only	N/A - 2007 only

during summer)	missing values (93.3%)				
HS020/HS021 (Arrears on utility bills)	-	HS021 introduced alongside HS020. This has an extra response category, but 5 countries continue to use HS020	HS020 and HS021 still in simultaneous use, with some counties only using HS020.	HS020 and HS021 still in simultaneous use, with some counties only using HS020.	HS021 is now used by all countries. HS020 exists but is empty.
HH020/HH021 (Tenure)	-	-	-	HH021 introduced, has slightly different coding to HH020. Some countries continue to use HH020.	HH021 is now used by all countries, but the coding has changed since 2010. HH020 exists but is empty.
PL030/PL031 (Current economic status)	-	-	PL031 introduced. Some countries continue to use PL030.	PL031 is now used by all countries. PL030 exists but is empty.	PL031 is now used by all countries. PL030 exists but is empty.

Appendix 3: Descriptive statistics

Table 3-1 Highest ISCED level attained by households reporting CIFP indicators. Data: EU-SILC 2010

Country	Number of CIFP indicators	Highest ISCED level					
		Pre-primary	Primary	Lower secondary	Upper secondary	Post-secondary non-tertiary	1st & 2nd stage tertiary
AT	0	0.5%	0.0%	13.1%	48.3%	11.8%	26.2%
	1	1.7%	0.2%	16.0%	46.9%	10.2%	25.0%
	2	3.1%	0.0%	20.7%	51.2%	10.8%	14.1%
	3	0.0%	0.0%	46.8%	32.1%	14.5%	6.6%
BE	0	1.9%	9.1%	14.5%	29.9%	2.5%	42.1%
	1	2.6%	9.1%	18.2%	30.4%	3.5%	36.2%
	2	7.3%	10.6%	26.1%	34.2%	3.0%	18.8%
	3	7.1%	1.8%	18.5%	40.1%	9.3%	23.2%
BG	0	0.1%	2.8%	10.6%	42.6%	1.1%	42.8%
	1	0.3%	4.3%	16.5%	49.1%	0.9%	29.0%
	2	1.2%	5.1%	21.5%	47.4%	1.2%	23.8%
	3	5.4%	11.2%	31.7%	39.7%	0.9%	11.0%
CY	0	2.7%	9.8%	4.6%	28.0%	2.9%	52.0%
	1	6.0%	14.4%	8.4%	33.3%	3.6%	34.2%
	2	6.5%	16.6%	9.8%	37.6%	2.6%	26.9%
	3	3.1%	12.5%	18.3%	41.8%	1.6%	22.6%
CZ	0		0.1%	6.6%	68.0%	1.8%	23.5%
	1		0.2%	10.7%	72.4%	1.3%	15.4%
	2		0.0%	17.2%	68.2%	1.3%	13.3%
	3		0.0%	31.7%	67.3%	0.0%	1.0%
DE	0		0.3%	6.4%	38.3%	6.8%	48.1%
	1		0.6%	9.3%	41.1%	8.2%	40.8%
	2		2.6%	19.9%	44.6%	7.0%	25.9%
	3		0.0%	21.4%	53.1%	8.9%	16.6%
DK	0		0.0%	25.5%	42.4%		32.1%
	1		1.1%	32.3%	41.1%		25.5%
	2		0.0%	32.0%	38.4%		29.6%
EE	0	0.2%	1.8%	8.0%	40.8%	3.4%	45.8%
	1	0.0%	3.0%	13.4%	49.2%	3.6%	30.9%
	2	1.9%	2.3%	18.5%	49.6%	7.2%	20.6%
	3	0.0%	2.3%	18.5%	74.0%	0.0%	5.2%
ES	0		15.7%	17.6%	21.6%	0.6%	44.5%
	1		20.8%	23.7%	21.5%	0.3%	33.7%
	2		24.3%	33.4%	20.8%	0.5%	21.0%
	3		12.3%	45.0%	19.9%	0.0%	22.8%
FI	0			20.4%	39.9%	0.6%	39.1%
	1			21.7%	50.0%	0.1%	28.2%
	2			27.3%	53.2%	0.0%	19.5%
	3			22.4%	72.7%	0.0%	4.9%
FR	0	0.5%	19.3%	6.4%	40.1%		33.8%
	1	0.6%	20.1%	10.8%	40.1%		28.4%
	2	3.0%	24.7%	11.4%	45.3%		15.7%
	3	2.2%	17.6%	25.3%	50.2%		4.7%
GR	0	2.3%	13.1%	5.5%	31.3%	6.7%	41.0%
	1	6.6%	17.0%	10.5%	35.7%	6.9%	23.2%
	2	6.6%	30.4%	8.3%	37.6%	5.8%	11.3%
	3	4.2%	34.0%	18.6%	32.3%	6.3%	4.5%
HU	0		3.0%	9.4%	48.5%	6.7%	32.5%
	1		4.3%	17.0%	51.5%	6.3%	20.8%
	2		3.8%	21.2%	56.7%	5.6%	12.7%
	3		2.7%	29.1%	57.8%	4.6%	5.8%
IE	0		13.5%	11.6%	21.2%	8.7%	45.0%
	1		18.8%	13.5%	22.5%	8.1%	37.1%

Country	Number of CIFP indicators	Highest ISCED level					
		Pre-primary	Primary	Lower secondary	Upper secondary	Post-secondary non-tertiary	1st & 2nd stage tertiary
	2		18.9%	20.7%	20.5%	13.2%	26.7%
	3		14.4%	23.3%	21.5%	26.0%	14.8%
IT	0	2.0%	14.9%	19.3%	38.6%	4.3%	20.9%
	1	2.9%	17.4%	24.2%	35.0%	5.2%	15.3%
	2	4.9%	18.8%	32.8%	30.2%	4.5%	8.7%
	3	5.7%	16.2%	38.8%	32.8%	3.0%	3.6%
LT	0	0.8%	6.9%	7.6%	16.6%	23.5%	44.6%
	1	1.3%	9.4%	10.4%	21.4%	24.5%	33.0%
	2	3.0%	8.6%	13.2%	31.0%	22.3%	21.8%
	3	0.0%	1.3%	11.6%	52.5%	25.5%	9.1%
LU	0		18.8%	8.8%	37.8%	3.9%	30.8%
	1		17.8%	9.8%	38.0%	2.6%	31.7%
	2		4.3%	32.5%	37.2%	0.8%	25.2%
	3		9.5%	0.0%	90.5%	0.0%	0.0%
LV	0	0.4%	1.2%	9.0%	39.3%	7.7%	42.4%
	1	0.2%	1.6%	14.5%	44.9%	8.6%	30.2%
	2	0.7%	1.7%	18.7%	49.6%	9.2%	20.0%
	3	0.7%	3.1%	20.3%	54.0%	9.4%	12.5%
MT	0	0.4%	14.0%	33.5%	23.1%	3.1%	25.9%
	1	0.2%	19.6%	41.0%	20.9%	1.6%	16.6%
	2	0.0%	25.2%	47.6%	14.5%	1.4%	11.3%
	3	0.0%	41.3%	28.7%	25.5%	0.0%	4.5%
NL	0	0.2%	7.2%	13.8%	34.6%	4.1%	40.1%
	1	0.4%	5.0%	16.3%	36.1%	4.3%	37.9%
	2	2.2%	3.1%	31.0%	42.1%	1.5%	20.2%
	3	0.0%	0.0%	35.5%	55.8%	3.2%	5.5%
PL	0	0.8%	8.7%	0.3%	49.9%	6.2%	34.1%
	1	1.7%	14.7%	0.6%	58.8%	5.6%	18.5%
	2	2.4%	19.6%	1.8%	61.6%	5.9%	8.8%
	3	2.5%	24.3%	2.3%	59.4%	5.0%	6.5%
PT	0		29.4%	18.4%	24.7%	0.8%	26.7%
	1		40.7%	24.2%	21.9%	0.6%	12.7%
	2		51.4%	24.7%	14.1%	0.9%	9.0%
	3		62.9%	21.9%	6.9%	0.0%	8.4%
RO	0		6.3%	13.0%	49.7%	8.0%	23.0%
	1		9.6%	20.0%	51.8%	5.3%	13.3%
	2		12.7%	24.7%	51.9%	4.2%	6.5%
	3		13.0%	24.8%	52.0%	2.0%	8.2%
SE	0		8.7%	4.9%	41.6%	6.4%	38.4%
	1		5.4%	8.0%	44.9%	6.6%	35.2%
	2		6.3%	11.0%	46.1%	7.1%	29.5%
	3		0.0%	22.5%	47.3%	0.0%	30.2%
SI	0		1.7%	7.9%	53.4%		37.0%
	1		3.0%	11.7%	60.8%		24.6%
	2		7.7%	16.5%	63.5%		12.4%
	3		0.0%	24.5%	62.8%		12.7%
SK	0	0.0%	0.4%	6.5%	59.5%	2.6%	30.9%
	1	0.0%	1.3%	13.6%	61.0%	1.9%	22.3%
	2	0.0%	1.7%	19.2%	66.9%	0.7%	11.5%
	3	0.0%	0.0%	34.4%	59.3%	0.0%	6.3%
UK	0			20.0%	38.0%	0.1%	41.9%
	1			18.9%	41.8%	0.0%	39.4%
	2			19.8%	57.8%	0.0%	22.4%
	3			22.5%	63.2%	0.0%	14.3%

Note: All chi-square tests were significant at p <.001 level

Table 3-2 Prevalence of unemployment in households reporting CIFP indicators. Data: EU-SILC 2010

Country	% of unemployed households by number of CIFP indicators reported			
	0	1	2	3
AT	6.7%	11.1%	28.2%	28.9%
BE	8.7%	15.4%	29.7%	42.8%
BG	11.4%	17.8%	25.1%	38.1%
CY	6.0%	12.1%	18.0%	17.1%
CZ	9.7%	17.5%	32.0%	68.1%
DE	6.7%	16.6%	32.4%	43.1%
DK	6.3%	18.9%	29.0%	0.0%
EE	14.5%	23.6%	34.1%	33.1%
ES	19.3%	29.3%	50.6%	66.4%
FI	9.7%	20.1%	37.8%	10.9%
FR	8.5%	15.2%	26.5%	44.0%
GR	10.9%	16.1%	23.1%	30.8%
HU	8.5%	15.9%	28.8%	34.4%
IE	15.6%	25.0%	29.8%	42.3%
IT	7.6%	13.9%	21.4%	28.1%
LT	15.6%	21.7%	36.6%	62.5%
LU	6.5%	10.8%	35.1%	0.0%
LV	17.3%	27.7%	38.8%	60.0%
MT	5.7%	11.6%	13.5%	30.0%
NL	3.2%	6.3%	22.2%	3.2%
PL	8.6%	14.7%	21.3%	36.5%
PT	13.2%	21.3%	23.1%	56.3%
RO	4.6%	6.8%	10.5%	14.0%
SE	5.6%	11.4%	19.5%	9.2%
SI	10.7%	19.4%	25.9%	45.1%
SK	13.9%	26.2%	40.9%	69.8%
UK	4.7%	9.1%	18.2%	33.9%

Note: All chi-square tests were significant at $p < .001$ level

Table 3-3 Prevalence of retirement in households reporting CIFP indicators. Data: EU-SILC 2010

Country	**% of retired households by number of CIFP indicators reported**			
	0	**1**	**2**	**3**
AT	41.3%	36.0%	29.8%	20.1%
BE	36.9%	26.6%	18.4%	11.5%
BG	41.6%	52.4%	51.2%	47.6%
CY	29.5%	32.6%	33.7%	18.9%
CZ	37.9%	35.7%	34.3%	3.0%
DE	36.2%	22.4%	18.1%	8.5%
DK	29.7%	15.9%	12.8%	0.0%
EE	35.2%	34.2%	23.4%	12.7%
ES	28.8%	27.5%	22.6%	7.5%
FI	33.1%	17.7%	8.6%	31.9%
FR	40.2%	29.1%	24.9%	18.1%
GR	38.0%	37.6%	42.9%	45.3%
HU	45.9%	44.1%	36.3%	28.2%
IE	20.3%	13.8%	5.8%	11.4%
IT	35.8%	32.4%	27.7%	17.3%
LT	34.5%	41.6%	36.7%	8.5%
LU	28.3%	22.2%	2.3%	0.0%
LV	41.0%	41.6%	39.3%	24.0%
MT	30.5%	31.0%	30.1%	29.4%
NL	22.1%	11.2%	5.8%	0.0%
PL	37.6%	37.1%	35.4%	24.0%
PT	39.3%	44.0%	46.1%	21.9%
RO	46.8%	51.2%	52.2%	46.3%
SE	31.3%	20.1%	21.1%	17.9%
SI	45.9%	48.3%	41.8%	34.8%
SK	41.2%	40.5%	38.2%	26.8%
UK	34.4%	22.0%	11.0%	2.8%

Note: All chi-square tests were significant at $p < .001$ level, except for Malta which is not significant

Table 3-4 Prevalence of chronic illness or disability in households reporting CIFP indicators. Data: EU-SILC 2010

Country	**% of households containing at least one person with a chronic illness or disability, by number of CIFP indicators reported**			
	0	**1**	**2**	**3**
AT	50.3%	56.0%	75.6%	63.5%
BE	36.5%	45.0%	52.7%	58.4%
BG	26.2%	38.7%	41.7%	47.9%
CY	50.1%	60.3%	67.7%	69.2%
CZ	37.9%	49.0%	62.7%	41.5%
DE	48.5%	51.9%	58.1%	53.6%
DK	27.6%	37.9%	60.1%	0.0%
EE	55.9%	68.4%	67.8%	85.4%
ES	45.3%	54.4%	57.6%	59.5%
FI	46.1%	48.1%	56.0%	83.3%
FR	51.4%	57.1%	60.8%	65.4%
GR	33.4%	40.1%	52.7%	62.7%
HU	53.8%	60.8%	65.2%	61.4%
IE	42.1%	55.7%	56.6%	77.2%
IT	32.7%	44.5%	47.6%	45.7%
LT	38.3%	50.8%	48.6%	49.3%
LU	33.1%	42.6%	52.0%	71.4%
LV	48.8%	56.8%	63.6%	64.7%
MT	44.1%	55.8%	67.9%	59.4%
NL	33.0%	39.3%	58.6%	86.9%
PL	51.1%	60.1%	63.7%	71.9%
PT	46.1%	61.2%	73.1%	63.1%
RO	31.9%	38.3%	45.4%	48.8%
SE	31.3%	38.1%	39.4%	68.0%
SI	34.9%	43.2%	50.5%	51.4%
SK	52.4%	61.0%	75.5%	81.5%
UK	50.0%	55.8%	61.1%	65.6%

Note: All chi-square tests were significant at $p < .001$ level

Table 3-5 Median disposable household income by number of CIFP indicators reported. Data: EU-SILC 2010

Country	Median disposable household income by number of CIFP indicators reported			
	0	1	2	3
AT	€ 32,142.31	€ 28,326.33	€ 18,827.13	€ 20,483.60
BE	€ 29,694.78	€ 24,927.83	€ 17,606.72	€ 15,961.66
BG	€ 7,282.60	€ 5,091.05	€ 4,376.88	€ 3,287.17
CY	€ 33,950.00	€ 28,689.00	€ 24,907.00	€ 25,953.00
CZ	€ 11,952.34	€ 10,025.31	€ 8,444.68	€ 5,143.18
DE	€ 27,221.00	€ 20,947.00	€ 15,330.00	€ 15,600.00
DK	€ 31,806.96	€ 26,324.57	€ 17,922.56	€ 14,203.35
EE	€ 9,101.53	€ 6,774.63	€ 5,503.30	€ 3,798.78
ES	€ 24,116.91	€ 17,990.00	€ 15,142.00	€ 9,936.00
FI	€ 29,260.00	€ 24,291.00	€ 18,204.00	€ 20,306.00
FR	€ 31,890.00	€ 24,650.00	€ 18,890.00	€ 17,780.00
GR	€ 23,941.16	€ 15,000.00	€ 11,702.88	€ 11,230.00
HU	€ 7,847.89	€ 6,281.88	€ 5,654.01	€ 5,055.89
IE	€ 36,013.44	€ 26,984.90	€ 21,297.23	€ 18,772.10
IT	€ 26,726.00	€ 21,895.00	€ 16,991.00	€ 15,044.00
LT	€ 7,198.54	€ 5,391.05	€ 4,070.35	€ 2,939.30
LU	€ 52,929.00	€ 50,207.00	€ 27,038.00	€ 4,854.00
LV	€ 8,577.78	€ 6,087.57	€ 4,872.95	€ 3,278.29
MT	€ 20,338.71	€ 15,830.41	€ 12,254.06	€ 9,644.56
NL	€ 31,090.00	€ 25,710.00	€ 17,288.00	€ 21,304.00
PL	€ 8,931.05	€ 6,357.80	€ 5,213.05	€ 3,977.72
PT	€ 17,440.47	€ 12,793.84	€ 9,928.00	€ 8,501.00
RO	€ 4,276.04	€ 3,162.81	€ 2,640.63	€ 2,385.43
SE	€ 26,620.99	€ 23,147.82	€ 15,515.53	€ 18,283.38
SI	€ 21,158.13	€ 17,437.66	€ 13,624.94	€ 10,253.26
SK	€ 11,327.57	€ 8,856.91	€ 5,153.40	€ 5,465.19
UK	€ 27,083.14	€ 23,850.60	€ 16,485.59	€ 16,972.16

Table 3-6 Prevalence of income poverty in households reporting CIFP indicators. Data: EU-SILC 2010

Country	% of households below poverty line by number of CIFP indicators reported			
	0	1	2	3
AT	11.9	21.0	49.1	52.6
BE	11.4	19.8	42.9	54.2
BG	10.9	22.9	31.0	52.8
CY	14.3	22.7	27.2	33.6
CZ	7.8	16.4	31.6	57.6
DE	15.5	30.7	50.9	56.4
DK	15.9	23.6	47.8	100.0
EE	13.9	26.4	47.3	68.7
ES	16.3	28.4	46.0	66.3
FI	15.8	25.9	58.3	55.0
FR	9.7	23.2	41.4	44.6
GR	11.1	32.4	48.0	50.7
HU	5.4	15.2	25.3	40.7
IE	13.6	22.4	32.9	33.6
IT	13.7	23.8	42.5	53.3
LT	15.9	25.2	34.4	67.5
LU	13.0	16.3	62.2	81.0
LV	14.1	26.8	39.6	65.8
MT	13.6	20.6	28.8	59.0
NL	9.6	17.2	36.2	64.4
PL	11.1	24.5	41.6	61.4
PT	12.1	24.0	34.8	56.0
RO	14.0	23.6	30.6	38.7
SE	15.1	23.9	37.3	31.7
SI	11.7	21.3	31.3	60.2
SK	9.2	19.5	46.8	61.7
UK	16.0	24.5	40.5	48.4

Note: All chi-square tests were significant at p <.001 level

Table 3-7 Composition of households reporting CIFP indicators. Data: EU-SILC 2010

Country	# of CIFP indicators	Single household	2 adults, no children, at least 1 adult >=65 years	Other household, no children	Single parent household, 1 or more children	2 adults, 1 child	2 adults, 2 children	2 adults, 3 or more children	Other household, with children	Other household	2 adults, no children, both adults <65 years
AT	0	36.2%	12.5%	8.9%	2.6%	8.5%	8.4%	2.7%	5.2%		15.0%
	1	34.7%	9.6%	9.3%	5.6%	8.4%	6.9%	4.7%	6.3%		14.4%
	2	36.1%	3.6%	8.4%	7.7%	5.7%	8.2%	5.9%	11.4%		13.0%
	3	32.6%	9.3%	10.0%	7.0%	11.1%	13.5%	0.0%	9.0%		7.6%
BE	0	32.1%	13.7%	5.8%	4.2%	8.5%	9.4%	4.8%	3.1%	0.4%	18.1%
	1	37.3%	6.8%	5.0%	8.8%	9.9%	7.0%	6.3%	4.3%	0.7%	13.9%
	2	41.2%	3.8%	1.1%	19.7%	6.4%	4.7%	7.0%	3.7%	0.4%	12.0%
	3	43.1%	1.4%	0.0%	6.5%	0.0%	13.3%	3.2%	7.1%	3.9%	21.3%
BG	0	13.6%	12.3%	16.7%	1.9%	11.3%	11.8%	0.4%	17.7%		14.3%
	1	21.4%	15.7%	16.4%	2.6%	9.6%	6.7%	0.5%	15.4%		11.7%
	2	21.6%	13.1%	14.7%	3.6%	8.4%	7.5%	1.4%	17.2%		12.4%
	3	20.1%	10.0%	15.4%	3.8%	7.1%	6.6%	5.0%	24.4%		7.5%
CY	0	19.9%	13.7%	13.0%	2.6%	10.7%	12.5%	5.6%	7.8%		14.2%
	1	21.5%	14.4%	13.6%	2.4%	9.5%	10.5%	5.5%	10.7%		11.9%
	2	20.2%	13.6%	14.8%	4.9%	6.7%	9.2%	5.6%	11.0%		14.1%
	3	14.7%	5.1%	18.3%	12.0%	3.8%	6.1%	8.8%	14.7%		16.5%
CZ	0	22.9%	13.4%	11.4%	3.5%	10.9%	13.0%	2.1%	5.2%		17.5%
	1	24.5%	11.6%	12.2%	6.7%	9.4%	11.5%	2.4%	5.0%		16.6%
	2	27.0%	7.8%	10.9%	5.1%	9.4%	9.4%	5.4%	6.0%		19.0%
	3	26.3%	0.0%	9.0%	23.6%	18.8%	5.2%	0.0%	6.5%		10.5%
DE	0	38.5%	16.4%	5.0%	3.5%	7.8%	7.5%	2.4%	2.3%	0.1%	16.6%
	1	44.2%	9.2%	3.2%	7.9%	7.8%	6.9%	2.4%	1.8%	0.2%	16.4%
	2	44.0%	5.6%	2.4%	12.8%	7.5%	6.7%	2.2%	1.6%	0.0%	17.3%
	3	48.4%	0.0%	2.6%	8.1%	10.8%	4.8%	8.4%	5.8%	0.0%	11.0%
DK	0	44.9%	11.4%	1.2%	4.9%	6.6%	9.1%	3.5%	1.4%	0.2%	16.8%
	1	49.7%	4.9%	0.4%	9.7%	9.0%	8.2%	3.3%	1.8%	0.4%	12.6%
	2	59.5%	2.1%	0.2%	4.8%	7.0%	7.9%	0.7%	3.1%	0.0%	14.7%
	3	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EE	0	33.3%	11.5%	7.1%	4.6%	11.7%	8.4%	2.4%	4.7%	0.1%	16.2%
	1	36.3%	9.9%	7.7%	5.5%	10.0%	8.1%	3.5%	5.6%	0.1%	13.2%
	2	30.6%	3.8%	8.4%	9.5%	11.8%	10.1%	4.9%	5.6%	0.1%	15.3%

Country	# of CIFP indicators	Single household	2 adults, no children, at least 1 adult >=65 years	Other household, no children	Single parent household, 1 or more children	2 adults, 1 child	2 adults, 2 children	2 adults, 3 or more children	Other household, with children	Other household	2 adults, no children, both adults <65 years
	3	35.0%	4.0%	10.3%	31.5%	6.4%	3.9%	2.7%	6.1%	0.0%	0.0%
ES	0	18.3%	13.7%	16.2%	2.0%	12.2%	14.3%	1.3%	6.8%	0.0%	15.2%
	1	19.6%	12.9%	17.0%	2.4%	11.1%	12.6%	1.6%	7.4%	0.1%	15.2%
	2	16.8%	8.3%	15.6%	3.9%	9.1%	16.5%	3.1%	13.1%	0.0%	13.6%
	3	17.3%	6.5%	12.0%	3.2%	13.7%	11.0%	4.6%	12.8%	0.0%	19.0%
FI	0	39.3%	12.2%	2.1%	3.7%	7.9%	8.2%	4.0%	1.3%		21.2%
	1	41.1%	5.3%	1.6%	5.7%	8.5%	10.4%	5.4%	1.9%		20.2%
	2	47.9%	1.2%	4.5%	5.6%	5.6%	6.9%	13.6%	4.7%		10.0%
	3	53.1%	0.0%	0.0%	12.1%	15.0%	4.6%	6.4%	0.0%		8.9%
FR	0	34.2%	13.2%	4.1%	4.1%	9.0%	9.9%	4.2%	2.4%	0.1%	18.8%
	1	36.5%	8.8%	3.5%	8.6%	8.0%	8.4%	6.0%	3.0%	0.5%	16.7%
	2	39.1%	4.3%	5.2%	13.3%	7.7%	8.2%	7.0%	3.4%	0.5%	11.1%
	3	46.4%	0.0%	4.2%	15.1%	4.8%	4.9%	7.7%	6.3%	0.0%	10.7%
GR	0	18.5%	16.3%	19.2%	1.1%	9.7%	17.5%	1.1%	4.6%	0.2%	11.9%
	1	21.9%	17.9%	16.0%	1.7%	9.2%	15.8%	1.3%	6.7%	0.1%	9.5%
	2	27.0%	12.7%	20.8%	1.7%	7.9%	11.3%	2.1%	7.5%	0.0%	9.1%
	3	22.7%	18.4%	18.7%	.2%	10.8%	14.4%	1.6%	9.5%	0.3%	3.4%
HU	0	22.4%	14.6%	11.8%	3.2%	10.8%	9.7%	3.0%	8.0%		16.6%
	1	27.7%	12.0%	9.8%	4.5%	11.2%	8.1%	4.4%	8.6%		13.6%
	2	25.1%	7.1%	8.0%	8.8%	9.6%	9.9%	6.8%	10.4%		14.5%
	3	23.2%	7.2%	8.5%	9.4%	8.2%	8.8%	7.9%	14.0%		12.8%
IE	0	21.0%	11.4%	8.5%	6.4%	10.2%	13.2%	6.1%	6.0%		17.1%
	1	22.4%	8.3%	6.2%	15.2%	9.5%	10.0%	7.5%	6.5%		14.5%
	2	30.8%	1.6%	4.8%	22.1%	5.0%	10.0%	8.1%	7.1%		10.7%
	3	43.1%	4.6%	6.7%	19.0%	2.3%	12.9%	4.3%	4.2%		2.9%
IT	0	30.7%	14.5%	12.4%	3.0%	10.4%	11.1%	1.8%	4.8%		11.3%
	1	31.6%	12.5%	12.1%	4.3%	9.9%	9.7%	2.6%	6.5%		10.8%
	2	34.6%	9.6%	12.6%	3.8%	8.5%	9.6%	3.4%	6.8%		11.0%
	3	24.4%	8.7%	10.5%	10.6%	9.7%	16.5%	3.2%	9.4%		7.2%
LT	0	28.1%	9.9%	8.3%	4.0%	14.4%	12.2%	2.7%	7.9%	0.1%	12.4%
	1	35.7%	9.8%	8.8%	6.1%	11.0%	8.2%	2.1%	7.4%	0.1%	10.8%
	2	32.1%	7.9%	8.2%	7.4%	9.4%	7.9%	3.1%	9.1%	0.0%	14.9%
	3	29.7%	1.6%	1.7%	2.2%	17.9%	15.4%	9.3%	3.7%	0.0%	18.6%

Country	# of CIFP indicators	Single household	2 adults, no children, at least 1 adult >=65 years	Other household, no children	Single parent household, 1 or more children	2 adults, 1 child	2 adults, 2 children	2 adults, 3 or more children	Other household, with children	Other household	2 adults, no children, both adults <65 years
LU	0	30.7%	11.2%	8.3%	3.2%	9.4%	12.9%	4.4%	5.1%		14.8%
	1	20.8%	6.8%	8.7%	5.7%	13.9%	16.5%	5.3%	5.3%		17.0%
	2	8.8%	0.0%	1.6%	12.3%	12.5%	12.5%	11.2%	0.8%		40.3%
	3	0.0%	0.0%	0.0%	9.5%	0.0%	0.0%	19.0%	0.0%		71.4%
LV	0	25.3%	12.8%	11.7%	4.5%	12.0%	7.3%	2.0%	10.8%	0.1%	13.5%
	1	29.5%	9.4%	10.3%	5.9%	13.1%	6.7%	2.1%	10.4%	0.1%	12.6%
	2	31.1%	9.3%	9.8%	9.8%	10.8%	6.7%	2.0%	10.6%	0.2%	9.7%
	3	27.1%	2.1%	13.0%	12.7%	7.0%	10.4%	1.8%	11.8%	0.0%	14.2%
MT	0	17.1%	12.5%	18.2%	2.0%	12.1%	12.6%	3.6%	10.2%		11.8%
	1	20.9%	12.5%	17.7%	2.9%	8.4%	10.1%	3.3%	13.9%		10.3%
	2	26.2%	10.7%	10.5%	10.0%	5.0%	4.7%	4.0%	14.4%		14.7%
	3	29.2%	15.9%	8.8%	8.8%	7.3%	0.0%	8.2%	13.7%		8.2%
NL	0	34.7%	13.6%	4.0%	2.7%	8.0%	10.8%	5.0%	2.1%		19.1%
	1	39.7%	6.6%	3.7%	5.5%	7.8%	12.0%	5.5%	2.2%		17.0%
	2	61.8%	1.9%	.5%	15.9%	3.8%	3.5%	6.2%	0.6%		5.8%
	3	58.9%	0.0%	0.0%	3.2%	3.9%	26.3%	0.0%	7.7%		0.0%
PL	0	23.1%	9.0%	13.2%	1.6%	10.7%	10.0%	2.8%	13.2%	2.3%	14.1%
	1	26.6%	8.2%	12.7%	2.6%	9.2%	9.1%	3.4%	13.5%	2.3%	12.4%
	2	29.2%	7.2%	12.7%	3.9%	8.9%	8.5%	5.1%	12.1%	2.8%	9.8%
	3	28.2%	7.3%	11.7%	5.3%	9.2%	4.6%	5.7%	14.8%	1.8%	11.5%
PT	0	14.9%	16.1%	14.5%	2.9%	16.1%	10.9%	1.9%	7.9%	0.1%	14.7%
	1	19.3%	15.0%	16.1%	4.2%	12.8%	10.5%	1.6%	9.3%	0.3%	10.8%
	2	24.3%	16.7%	12.9%	3.9%	11.9%	8.1%	1.4%	9.9%	1.2%	9.7%
	3	24.4%	7.7%	3.5%	11.6%	12.1%	3.3%	12.4%	15.5%	0.0%	9.6%
RO	0	18.0%	11.3%	13.1%	1.5%	13.2%	11.5%	1.8%	14.7%	0.2%	14.8%
	1	24.4%	11.6%	10.7%	2.3%	12.0%	8.8%	2.7%	16.7%	0.2%	10.7%
	2	27.1%	11.3%	11.2%	1.3%	11.0%	8.7%	3.6%	14.7%	0.1%	11.0%
	3	25.8%	6.6%	12.9%	2.6%	7.8%	9.1%	6.5%	21.9%	0.0%	6.9%
SE	0	38.7%	14.3%	1.9%	4.5%	7.3%	10.0%	3.5%	2.1%	0.5%	17.3%
	1	39.0%	7.6%	2.0%	8.8%	7.8%	10.5%	4.1%	2.6%	1.1%	16.5%
	2	56.0%	4.3%	1.4%	11.6%	5.2%	8.0%	2.2%	2.4%	0.0%	9.0%
	3	79.8%	0.0%	0.0%	11.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.2%
SI	0	24.6%	13.0%	11.1%	3.2%	10.1%	15.3%	3.4%	6.6%		12.7%

Country	# of CIFP indicators	Single household	2 adults, no children, at least 1 adult >=65 years	Other household, no children	Single parent household, 1 or more children	2 adults, 1 child	2 adults, 2 children	2 adults, 3 or more children	Other household, with children	Other household	2 adults, no children, both adults <65 years
	1	27.0%	12.3%	11.1%	3.9%	9.4%	13.3%	3.5%	7.8%		11.6%
	2	35.3%	6.3%	11.2%	7.8%	8.2%	9.2%	3.8%	8.0%		10.1%
	3	39.2%	7.4%	8.1%	10.9%	6.0%	5.8%	4.4%	7.5%		10.5%
SK	0	21.5%	10.4%	16.6%	2.6%	9.9%	12.2%	3.3%	11.5%		12.1%
	1	27.4%	8.8%	13.1%	4.5%	8.1%	11.0%	2.3%	13.6%		11.1%
	2	39.0%	8.6%	10.8%	8.3%	5.5%	2.5%	4.5%	11.6%		9.3%
	3	40.9%	0.0%	10.0%	0.0%	11.1%	0.0%	4.5%	9.4%		24.1%
UK	0	31.1%	13.9%	7.5%	4.3%	7.9%	9.0%	3.4%	4.3%	0.2%	18.2%
	1	27.3%	8.7%	6.2%	9.9%	7.2%	11.3%	5.3%	5.9%	0.0%	18.3%
	2	41.1%	1.3%	4.5%	17.9%	9.4%	5.0%	3.7%	3.8%	0.0%	13.2%
	3	22.6%	0.0%	0.0%	23.2%	7.7%	14.1%	12.0%	9.8%	0.0%	10.6%

Note: All chi-square tests were significant at p <.001 level

Table 3-8 Dwelling type of households reporting CIFP indicators. Data: EU-SILC 2010

Country	Dwelling type	Number of CIFP indicators reported			
		0	1	2	3
AT	Apartment in building with >=10 units	32.2%	32.7%	49.4%	43.3%
	Apartment in building with <10 units	16.4%	18.5%	18.6%	14.5%
	Semi-detached house	13.4%	11.5%	9.5%	0.0%
	Detached house	38.0%	37.4%	22.5%	42.1%
BE	Apartment in building with >=10 units	9.7%	6.6%	8.9%	6.2%
	Apartment in building with <10 units	16.3%	21.8%	28.6%	35.7%
	Semi-detached house	38.0%	46.4%	48.5%	35.7%
	Detached house	36.0%	25.2%	14.0%	22.4%
BG	Apartment in building with >=10 units	39.3%	39.8%	41.1%	25.7%
	Apartment in building with <10 units	6.1%	6.2%	5.8%	3.4%
	Semi-detached house	9.5%	10.5%	9.6%	13.6%
	Detached house	45.1%	43.5%	43.5%	57.3%
CY	Apartment in building with >=10 units	10.9%	9.3%	7.1%	5.8%
	Apartment in building with <10 units	19.6%	14.4%	16.4%	19.5%
	Semi-detached house	28.2%	32.8%	29.7%	22.3%
	Detached house	41.3%	43.4%	46.8%	52.4%
CZ	Apartment in building with >=10 units	46.0%	37.0%	39.2%	16.1%
	Apartment in building with <10 units	11.5%	16.0%	19.8%	45.7%
	Semi-detached house	9.7%	10.1%	8.8%	9.0%
	Detached house	32.9%	36.9%	32.1%	29.2%
DE	Apartment in building with >=10 units	22.1%	22.9%	23.1%	24.1%
	Apartment in building with <10 units	38.2%	51.3%	52.1%	54.8%
	Semi-detached house	14.3%	9.4%	8.4%	0.0%
	Detached house	25.4%	16.4%	16.4%	21.0%
DK	Apartment in building with >=10 units	28.8%	35.9%	55.4%	100.0%
	Apartment in building with <10 units	7.6%	12.6%	6.0%	0.0%
	Semi-detached house	13.4%	13.2%	4.8%	0.0%
	Detached house	50.2%	38.4%	33.7%	0.0%
EE	Apartment in building with >=10 units	58.4%	51.1%	57.7%	50.7%
	Apartment in building with <10 units	9.7%	15.8%	14.9%	24.1%
	Semi-detached house	4.7%	5.5%	3.4%	9.0%
	Detached house	27.2%	27.6%	24.0%	16.2%
ES	Apartment in building with >=10 units	52.6%	34.7%	28.6%	21.0%
	Apartment in building with <10 units	18.8%	19.0%	20.1%	32.4%
	Semi-detached house	16.9%	28.5%	35.2%	36.2%
	Detached house	11.7%	17.8%	16.1%	10.5%
FI	Apartment in building with >=10 units	40.3%	43.9%	35.7%	6.4%
	Apartment in building with <10 units	1.8%	1.8%	1.5%	0.0%
	Semi-detached house	19.3%	19.3%	22.8%	0.0%
	Detached house	38.6%	35.0%	40.0%	93.6%
FR	Apartment in building with >=10 units	25.6%	25.0%	23.8%	15.6%
	Apartment in building with <10 units	12.1%	19.6%	22.8%	21.5%
	Semi-detached house	20.5%	24.6%	30.0%	28.5%
	Detached house	41.8%	30.8%	23.4%	34.4%
GR	Apartment in building with >=10 units	28.0%	22.4%	17.6%	10.7%
	Apartment in building with <10 units	36.3%	30.6%	28.2%	25.4%
	Semi-detached house	7.3%	9.7%	9.1%	11.6%
	Detached house	28.3%	37.3%	45.1%	52.3%
HU	Apartment in building with >=10 units	33.1%	29.9%	23.5%	18.6%
	Apartment in building with <10 units	4.0%	4.3%	5.1%	6.1%
	Semi-detached house	4.4%	5.3%	6.8%	8.3%
	Detached house	58.5%	60.4%	64.6%	67.0%
IE	Apartment in building with >=10 units	2.9%	2.9%	5.1%	2.5%
	Apartment in building with <10 units	2.0%	3.4%	2.3%	16.5%
	Semi-detached house	55.0%	63.8%	64.2%	65.2%
	Detached house	40.1%	29.9%	28.4%	15.8%
IT	Apartment in building with >=10 units	29.8%	23.7%	20.8%	21.8%
	Apartment in building with <10 units	27.4%	28.1%	28.4%	39.0%
	Semi-detached house	20.1%	18.4%	18.4%	15.5%
	Detached house	22.7%	29.8%	32.3%	23.8%

Country	Dwelling type	Number of CIFP indicators reported			
		0	1	2	3
LT	Apartment in building with >=10 units	50.2%	53.9%	51.3%	31.9%
	Apartment in building with <10 units	5.6%	9.6%	13.1%	17.4%
	Semi-detached house	6.9%	7.9%	9.3%	6.8%
	Detached house	37.3%	28.5%	26.3%	43.9%
LU	Apartment in building with >=10 units	13.2%	11.2%	6.1%	0.0%
	Apartment in building with <10 units	27.3%	30.0%	58.1%	19.0%
	Semi-detached house	21.0%	20.5%	7.1%	71.4%
	Detached house	38.5%	38.3%	28.8%	9.5%
LV	Apartment in building with >=10 units	59.1%	62.7%	65.0%	49.3%
	Apartment in building with <10 units	7.3%	12.1%	14.8%	26.5%
	Semi-detached house	4.2%	3.6%	3.4%	7.1%
	Detached house	29.4%	21.6%	16.7%	17.2%
MT	Apartment in building with >=10 units	2.5%	1.9%	1.2%	12.9%
	Apartment in building with <10 units	47.0%	47.4%	42.0%	52.7%
	Semi-detached house	45.3%	46.7%	51.8%	34.5%
	Detached house	5.1%	3.9%	5.0%	0.0%
NL	Apartment in building with >=10 units	21.4%	19.9%	20.8%	6.3%
	Apartment in building with <10 units	7.1%	10.8%	19.1%	39.4%
	Semi-detached house	56.9%	56.0%	57.5%	50.3%
	Detached house	14.6%	13.3%	2.5%	4.0%
PL	Apartment in building with >=10 units	46.6%	37.4%	26.2%	28.9%
	Apartment in building with <10 units	7.9%	14.3%	21.0%	17.6%
	Semi-detached house	4.2%	5.4%	4.8%	5.5%
	Detached house	41.3%	42.9%	48.0%	48.0%
PT	Apartment in building with >=10 units	16.9%	12.1%	11.1%	12.8%
	Apartment in building with <10 units	23.7%	24.2%	22.9%	16.3%
	Semi-detached house	19.1%	24.7%	23.8%	22.5%
	Detached house	40.4%	39.0%	42.2%	48.4%
RO	Apartment in building with >=10 units	39.8%	35.7%	33.3%	27.9%
	Apartment in building with <10 units	3.9%	2.2%	4.0%	1.4%
	Semi-detached house	1.1%	2.4%	1.3%	5.9%
	Detached house	55.2%	59.6%	61.4%	64.8%
SE	Apartment in building with >=10 units	39.5%	41.1%	24.5%	21.0%
	Apartment in building with <10 units	10.6%	14.2%	11.0%	0.0%
	Semi-detached house	8.0%	6.5%	3.3%	17.9%
	Detached house	41.8%	38.2%	61.2%	61.0%
SI	Apartment in building with >=10 units	26.0%	21.7%	22.6%	15.8%
	Apartment in building with <10 units	6.9%	9.6%	13.0%	11.9%
	Semi-detached house	4.0%	4.3%	3.0%	2.0%
	Detached house	63.1%	64.4%	61.4%	70.3%
SK	Apartment in building with >=10 units	48.5%	36.5%	19.6%	7.9%
	Apartment in building with <10 units	6.1%	6.3%	6.2%	13.6%
	Semi-detached house	2.2%	1.1%	1.7%	0.0%
	Detached house	43.2%	56.0%	72.5%	78.5%
UK	Apartment in building with >=10 units	6.1%	9.4%	10.5%	13.6%
	Apartment in building with <10 units	10.4%	15.6%	22.6%	28.6%
	Semi-detached house	57.1%	59.2%	58.7%	57.8%
	Detached house	26.3%	15.8%	8.2%	0.0%

Note: All chi-square tests were significant at p <.001 level

Table 3-9 Central heating type of households reporting CIFP indicators. Data: EU-SILC 2007

Country	Heating type	Number of CIFP indicators reported			
		0	1	2	3
AT	None	3.3%	9.4%	14.0%	52.2%
	Other fixed heating	6.8%	9.2%	8.3%	0.0%
	Central heating	89.8%	81.4%	77.8%	47.8%
BE	None	7.1%	13.1%	17.5%	30.8%
	Other fixed heating	6.6%	7.5%	10.8%	8.7%
	Central heating	86.3%	79.4%	71.6%	60.5%
BG	None	7.1%	19.3%	12.7%	7.5%
	Other fixed heating	72.3%	60.5%	61.3%	85.5%
	Central heating	20.5%	20.2%	25.9%	7.0%
CY	None	10.5%	25.4%	40.0%	41.6%
	Other fixed heating	23.9%	46.0%	51.8%	53.1%
	Central heating	65.5%	28.6%	8.2%	5.3%
CZ	None	0.2%	0.9%	2.2%	2.7%
	Other fixed heating	14.5%	25.7%	41.5%	60.9%
	Central heating	85.3%	73.4%	56.3%	36.4%
DE	None	0.1%	0.4%	1.5%	1.7%
	Other fixed heating	2.3%	5.7%	9.7%	14.9%
	Central heating	97.6%	93.9%	88.8%	83.4%
DK	Other fixed heating	0.9%	0.8%	0.0%	11.1%
	Central heating	99.1%	99.2%	100.0%	88.9%
EE	None	0.0%	0.0%	0.0%	0.0%
	Other fixed heating	23.3%	41.7%	41.5%	67.0%
	Central heating	76.7%	58.3%	58.5%	33.0%
ES	None	22.3%	38.4%	65.4%	64.0%
	Other fixed heating	22.9%	25.6%	21.8%	18.2%
	Central heating	54.9%	35.9%	12.8%	17.8%
FI	None	0.4%	1.2%	1.6%	0.0%
	Other fixed heating	6.5%	8.9%	8.9%	0.0%
	Central heating	93.1%	90.0%	89.6%	100.0%
FR	None	1.5%	2.9%	5.2%	9.0%
	Other fixed heating	4.4%	6.4%	8.3%	13.5%
	Central heating	94.1%	90.7%	86.5%	77.5%
GR	None	4.9%	15.5%	27.1%	46.1%
	Other fixed heating	12.4%	23.5%	29.5%	29.3%
	Central heating	82.7%	61.0%	43.4%	24.6%
HU	None	0.9%	1.3%	0.7%	0.9%
	Other fixed heating	6.7%	13.4%	23.4%	33.6%
	Central heating	92.4%	85.3%	75.9%	65.6%
IE	None	1.2%	1.9%	7.2%	9.5%
	Other fixed heating	9.3%	16.4%	25.3%	19.9%
	Central heating	89.5%	81.6%	67.5%	70.7%
IT	None	1.9%	4.9%	10.8%	12.9%
	Other fixed heating	8.2%	14.7%	20.9%	23.7%
	Central heating	89.9%	80.4%	68.3%	63.4%
LT	None	0.3%	0.3%	0.9%	4.9%
	Other fixed heating	16.1%	21.6%	32.9%	29.5%
	Central heating	83.6%	78.1%	66.2%	65.5%
LU	None	0.5%	0.9%	2.7%	0.0%
	Other fixed heating	2.6%	4.1%	3.7%	0.0%
	Central heating	96.9%	95.0%	93.6%	100.0%
LV	None	0.7%	1.7%	1.9%	0.6%
	Other fixed heating	24.6%	33.8%	49.1%	55.1%
	Central heating	74.7%	64.5%	49.0%	44.4%
NL	None	0.5%	0.4%	0.0%	22.3%
	Other fixed heating	0.9%	3.1%	2.4%	0.0%
	Central heating	98.7%	96.5%	97.6%	77.7%
PL	None	0.0%	0.0%	0.1%	0.0%
	Other fixed heating	13.6%	25.9%	43.9%	58.2%
	Central heating	86.4%	74.1%	56.0%	41.8%
PT	None	84.7%	90.9%	91.7%	91.5%

Country	Heating type	Number of CIFP indicators reported			
		0	1	2	3
	Other fixed heating	7.4%	6.7%	7.6%	8.5%
	Central heating	7.8%	2.4%	0.6%	0.0%
SE	None	0.0%	0.0%	0.0%	0.0%
	Other fixed heating	3.3%	5.8%	11.7%	0.0%
	Central heating	96.7%	94.2%	88.3%	100.0%
SI	None	0.5%	1.1%	2.6%	2.1%
	Other fixed heating	7.5%	18.6%	30.9%	61.1%
	Central heating	92.0%	80.3%	66.5%	36.8%
SK	None	0.1%	0.6%	1.7%	4.5%
	Other fixed heating	5.4%	13.5%	21.4%	42.6%
	Central heating	94.5%	85.9%	76.9%	52.9%
UK	None	0.8%	1.2%	3.2%	0.0%
	Other fixed heating	3.9%	7.4%	10.8%	12.9%
	Central heating	95.3%	91.4%	86.0%	87.1%

Note: All chi-square tests were significant at p <.001 level

Table 3-10 Tenure type of households reporting CIFP indicators. Data: EU-SILC 2010

Country	Tenure	Number of CIFP indicators reported			
		0	1	2	3
AT	Provided free	7.9%	7.4%	7.3%	3.9%
	Tenant sub-market rate	12.3%	13.1%	7.7%	11.6%
	Tenant market rate	27.4%	34.2%	59.7%	63.0%
	Owner	52.3%	45.3%	25.3%	21.5%
BE	Provided free	1.1%	1.5%	3.1%	0.0%
	Tenant sub-market rate	7.8%	12.0%	14.8%	16.4%
	Tenant market rate	18.4%	33.6%	47.3%	58.8%
	Owner	72.7%	52.9%	34.8%	24.8%
BG	Provided free	8.0%	9.4%	11.4%	15.0%
	Tenant sub-market rate	1.0%	0.9%	2.5%	3.2%
	Tenant market rate	2.6%	2.6%	2.5%	1.9%
	Owner	88.4%	87.1%	83.5%	79.9%
CY	Provided free	15.9%	22.1%	26.5%	29.3%
	Tenant sub-market rate	0.9%	0.7%	1.2%	1.3%
	Tenant market rate	11.2%	13.1%	13.0%	11.3%
	Owner	72.0%	64.2%	59.3%	58.1%
CZ	Provided free	2.7%	3.8%	3.7%	0.0%
	Tenant sub-market rate	13.1%	21.4%	35.1%	27.8%
	Tenant market rate	4.5%	7.4%	9.8%	24.6%
	Owner	79.7%	67.5%	51.3%	47.6%
DE	Provided free	2.6%	2.7%	1.5%	6.1%
	Tenant sub-market rate	4.2%	7.3%	12.3%	13.0%
	Tenant market rate	43.6%	63.4%	66.4%	66.6%
	Owner	49.6%	26.6%	19.8%	14.3%
DK	Provided free	0.1%	0.0%	0.0%	0.0%
	Tenant market rate	39.7%	59.6%	71.2%	100.0%
	Owner	60.1%	40.4%	28.8%	0.0%
EE	Provided free	10.4%	13.5%	15.9%	17.6%
	Tenant sub-market rate	2.5%	5.0%	3.3%	0.0%
	Tenant market rate	3.0%	2.3%	4.1%	9.7%
	Owner	84.1%	79.2%	76.7%	72.7%
ES	Provided free	5.3%	7.0%	10.6%	5.9%
	Tenant sub-market rate	2.0%	4.8%	5.8%	7.2%
	Tenant market rate	8.2%	9.7%	14.2%	23.8%
	Owner	84.5%	78.5%	69.5%	63.1%
FI	Provided free	0.8%	0.9%	0.0%	12.1%
	Tenant sub-market rate	16.2%	28.1%	38.7%	6.4%
	Tenant market rate	12.0%	17.8%	17.6%	31.9%
	Owner	70.9%	53.2%	43.7%	49.6%
FR	Provided free	3.1%	4.1%	4.3%	2.2%
	Tenant sub-market rate	13.8%	23.9%	19.9%	21.4%
	Tenant market rate	18.9%	29.4%	47.9%	54.1%
	Owner	64.2%	42.6%	27.9%	22.3%
GR	Provided free	4.4%	4.7%	5.6%	3.0%
	Tenant sub-market rate	0.7%	0.8%	0.9%	0.6%
	Tenant market rate	19.4%	23.8%	29.5%	27.8%
	Owner	75.6%	70.7%	64.0%	68.7%
HU	Provided free	4.6%	7.1%	7.3%	6.8%
	Tenant sub-market rate	1.8%	4.6%	8.0%	10.5%
	Tenant market rate	2.4%	3.2%	3.4%	5.0%
	Owner	91.2%	85.1%	81.3%	77.7%
IE	Provided free	0.9%	2.1%	3.5%	0.6%
	Tenant sub-market rate	9.8%	23.9%	35.2%	53.9%
	Tenant market rate	10.5%	12.2%	23.4%	11.9%
	Owner	78.8%	61.7%	37.9%	33.6%
IT	Provided free	9.4%	9.8%	13.4%	8.1%
	Tenant sub-market rate	3.6%	6.5%	10.1%	15.5%
	Tenant market rate	11.5%	17.7%	24.2%	37.5%
	Owner	75.5%	65.9%	52.3%	38.9%
LT	Provided free	3.3%	3.7%	8.8%	14.8%

Country	Tenure	Number of CIFP indicators reported			
		0	1	2	3
	Tenant sub-market rate	0.5%	0.9%	3.6%	6.8%
	Tenant market rate	1.0%	1.2%	3.4%	3.6%
	Owner	95.2%	94.2%	84.2%	74.8%
LU	Provided free	2.0%	1.8%	0.2%	0.0%
	Tenant sub-market rate	3.0%	4.9%	8.0%	0.0%
	Tenant market rate	28.8%	37.4%	55.4%	19.0%
	Owner	66.2%	55.9%	36.5%	81.0%
LV	Provided free	4.1%	5.2%	6.9%	6.1%
	Tenant sub-market rate	2.3%	5.5%	12.1%	19.9%
	Tenant market rate	6.0%	9.0%	8.0%	16.3%
	Owner	87.5%	80.4%	73.1%	57.7%
MT	Provided free	5.0%	7.0%	6.4%	26.3%
	Tenant sub-market rate	13.0%	22.1%	31.5%	55.1%
	Tenant market rate	1.7%	2.3%	1.7%	0.0%
	Owner	80.3%	68.5%	60.5%	18.6%
NL	Provided free	0.4%	0.1%	0.0%	0.0%
	Tenant market rate	39.0%	56.3%	76.2%	96.1%
	Owner	60.6%	43.6%	23.8%	3.9%
PL	Provided free	12.7%	21.7%	28.2%	36.6%
	Tenant sub-market rate	1.0%	1.7%	2.2%	2.4%
	Tenant market rate	2.7%	3.4%	3.7%	2.4%
	Owner	83.6%	73.2%	65.9%	58.6%
PT	Provided free	5.8%	6.9%	14.8%	10.7%
	Tenant sub-market rate	3.8%	7.4%	13.1%	18.6%
	Tenant market rate	8.9%	17.3%	20.1%	33.0%
	Owner	81.6%	68.4%	51.9%	37.6%
RO	Provided free	0.4%	1.2%	1.5%	2.7%
	Tenant sub-market rate	0.3%	0.8%	0.7%	3.1%
	Tenant market rate	0.9%	1.3%	1.8%	2.4%
	Owner	98.4%	96.7%	96.0%	91.8%
SE	Tenant sub-market rate	0.6%	0.4%	0.0%	0.0%
	Tenant market rate	34.0%	49.1%	44.7%	61.9%
	Owner	65.4%	50.5%	55.3%	38.1%
SI	Provided free	14.9%	13.9%	17.6%	9.1%
	Tenant sub-market rate	2.1%	3.4%	3.9%	5.6%
	Tenant market rate	3.7%	6.1%	9.6%	15.6%
	Owner	79.3%	76.5%	68.9%	69.8%
SK	Provided free	1.2%	0.9%	1.5%	0.0%
	Tenant sub-market rate	0.5%	0.6%	0.0%	0.0%
	Tenant market rate	6.6%	13.2%	18.7%	13.8%
	Owner	91.6%	85.4%	79.8%	86.2%
UK	Provided free	1.1%	0.8%	1.7%	4.3%
	Tenant sub-market rate	15.7%	27.3%	49.0%	58.7%
	Tenant market rate	9.1%	19.4%	25.9%	32.8%
	Owner	74.1%	52.6%	23.5%	4.2%

Note: All chi-square tests were significant at p <.001 level

Table 3-11 Urban-rural classification of households reporting CIFP indicators. Data: EU-SILC 2010

Country	Location	Number of CIFP indicators reported			
		0	1	2	3
AT	Rural	36.2%	35.4%	22.7%	47.8%
	Intermediate	24.8%	24.5%	18.1%	5.5%
	Urban	39.0%	40.1%	59.3%	46.7%
BE	Rural	3.4%	6.1%	5.7%	3.2%
	Intermediate	41.5%	35.7%	28.9%	23.9%
	Urban	55.2%	58.2%	65.4%	72.9%
BG	Rural	50.0%	49.6%	47.5%	54.3%
	Intermediate	6.2%	5.8%	4.7%	5.3%
	Urban	43.8%	44.6%	47.8%	40.4%
CY	Rural	27.0%	32.1%	32.4%	27.0%
	Intermediate	11.4%	12.2%	12.5%	19.5%
	Urban	61.6%	55.7%	55.1%	53.4%
CZ	Rural	37.3%	42.5%	47.0%	42.9%
	Intermediate	23.2%	25.5%	24.6%	19.0%
	Urban	39.4%	32.0%	28.4%	38.1%
DE	Rural	12.6%	14.7%	16.8%	16.4%
	Intermediate	33.8%	29.1%	30.7%	24.9%
	Urban	53.6%	56.2%	52.5%	58.7%
DK	Rural	24.0%	23.4%	18.5%	0.0%
	Intermediate	39.8%	38.4%	47.1%	0.0%
	Urban	36.1%	38.2%	34.4%	100.0%
EE	Rural	47.1%	55.3%	64.6%	68.9%
	Urban	52.9%	44.7%	35.4%	31.1%
ES	Rural	23.1%	33.6%	38.3%	39.8%
	Intermediate	19.8%	22.2%	28.0%	25.0%
	Urban	57.1%	44.2%	33.7%	35.2%
FI	Rural	58.3%	56.1%	62.7%	81.5%
	Intermediate	14.1%	14.8%	14.9%	18.5%
	Urban	27.5%	29.1%	22.4%	0.0%
FR	Rural	17.2%	18.1%	21.8%	14.9%
	Intermediate	34.4%	32.7%	35.1%	44.4%
	Urban	48.4%	49.2%	43.1%	40.7%
GR	Rural	39.5%	49.8%	57.3%	67.8%
	Intermediate	11.6%	9.1%	6.7%	3.7%
	Urban	48.9%	41.1%	36.0%	28.5%
HU	Rural	44.0%	46.7%	48.6%	46.5%
	Intermediate	19.2%	21.1%	23.0%	29.1%
	Urban	36.9%	32.2%	28.4%	24.4%
IE	Rural	40.3%	37.6%	36.0%	25.7%
	Intermediate	27.7%	27.6%	29.2%	29.7%
	Urban	32.0%	34.8%	34.8%	44.6%
IT	Rural	16.1%	18.3%	22.5%	13.2%
	Intermediate	37.6%	42.1%	42.1%	38.5%
	Urban	46.2%	39.6%	35.4%	48.4%
LT	Rural	62.2%	50.9%	56.6%	85.3%
	Urban	37.8%	49.1%	43.4%	14.7%
LU	Rural	20.9%	23.2%	17.9%	9.5%
	Intermediate	33.0%	32.5%	25.5%	19.0%
	Urban	46.2%	44.3%	56.6%	71.4%
LV	Rural	48.2%	45.7%	48.0%	63.7%
	Urban	51.8%	54.3%	52.0%	36.3%
MT	Rural/intermediate	9.5%	12.5%	17.7%	15.5%
	Urban	90.5%	87.5%	82.3%	84.5%
PL	Rural	38.9%	46.0%	51.1%	48.1%
	Intermediate	13.2%	12.8%	12.2%	12.5%
	Urban	47.9%	41.2%	36.7%	39.4%
PT	Rural	25.2%	24.8%	22.0%	16.8%
	Intermediate	30.8%	30.1%	35.0%	27.5%
	Urban	44.0%	45.0%	43.0%	55.7%
RO	Rural	60.3%	60.1%	59.2%	59.2%

Country	Location	Number of CIFP indicators reported			
		0	1	2	3
	Intermediate	1.0%	0.9%	0.8%	0.5%
	Urban	38.6%	39.0%	39.9%	40.3%
SE	Rural	62.5%	62.3%	63.6%	61.0%
	Intermediate	15.8%	14.1%	11.9%	39.0%
	Urban	21.7%	23.7%	24.6%	0.0%
SK	Rural	38.9%	46.1%	54.2%	75.1%
	Intermediate	31.9%	33.5%	34.1%	16.4%
	Urban	29.2%	20.5%	11.7%	8.5%
UK	Rural	16.6%	14.5%	13.5%	6.1%
	Intermediate	19.0%	16.6%	12.8%	10.9%
	Urban	64.4%	68.9%	73.7%	83.0%

Note: All chi-square tests were significant at p <.001 level

Appendix 4: Multinomial logistic regression models

Across the following multinomial logistic regression models, a number of reference categories have been used to produce odds ratios (Exp(B)). As Scott *et al*. explain, a reference category is "essentially a baseline against which households with different characteristics may be compared. The odds ratio shown in the table for each characteristic reflects the odds that a household with that characteristic will be fuel poor, relative to a household in the reference category. An odds ratio of 1 would indicate that households with that characteristic would be equally likely to be fuel poor as those in the reference category. An odds ratio greater than 1 indicates a higher risk of fuel poverty, while a ratio below 1 indicates a lower risk" (Scott *et al*., 2008: 19).

It should be noted that a minority of predictor variables have very large Exp(B) values. This is likely to have been caused by small cell sizes leading to complete, or quasi-complete, separation, whereby a linear combination of the predictors yield a perfect prediction of the response variable (Field, 2009). The main method of overcoming this would be to merge variable categories to increase their size, however, this would also result in a loss of detail, and thus this approach has not been used.

Table 4-1 Multinomial logistic regression model of CIFP in Austria. Data: EU-SILC 2010

Austria	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-1.87	0.01	0.000			
Pre-primary education	1.07	0.01	0.000	2.90	2.82	2.99
Primary education	21.52	642.43	0.973	2218454302.60	0.00	
Lower secondary education	0.11	0.01	0.000	1.12	1.11	1.13
Upper secondary education	-0.05	0.00	0.000	0.95	0.94	0.95
Post-secondary non-tertiary education	-0.10	0.01	0.000	0.90	0.89	0.91
Unemployed	0.26	0.01	0.000	1.30	1.29	1.31
Retired	-0.20	0.00	0.000	0.82	0.81	0.83
Chronic illness	0.31	0.00	0.000	1.36	1.35	1.37
Below poverty line	0.55	0.00	0.000	1.73	1.71	1.74
Apartment in building with >=10 units	-0.36	0.01	0.000	0.70	0.69	0.71
Apartment in building with <10 units	-0.24	0.01	0.000	0.78	0.78	0.79
Semi-detached house	-0.25	0.01	0.000	0.78	0.77	0.79
Accommodation provided free	0.00	0.01	0.666	1.00	0.98	1.01
Tenant paying below market rate	0.32	0.01	0.000	1.37	1.36	1.39
Tenant paying market rate	0.47	0.00	0.000	1.60	1.58	1.61
One person household	-0.08	0.00	0.000	0.92	0.91	0.93
2 adults, dependent children, at least one adult >=65 years	-0.12	0.01	0.000	0.89	0.88	0.90
Other households without dependent children	0.13	0.01	0.000	1.14	1.12	1.15
Single parent household, one or more dependent children	0.70	0.01	0.000	2.02	1.99	2.05
2 adults, one dependent child	0.03	0.01	0.000	1.04	1.02	1.05
2 adults, two dependent children	-0.11	0.01	0.000	0.89	0.88	0.90
2 adults, three or more dependent children	0.55	0.01	0.000	1.74	1.71	1.77
Other households with dependent children	0.11	0.01	0.000	1.11	1.10	1.13
Thinly populated area	0.01	0.00	0.002	1.01	1.01	1.02
Intermediate area	0.04	0.00	0.000	1.04	1.03	1.05
2 indicators versus 0						
Intercept	-5.31	0.02	0.000			
Pre-primary education	1.22	0.02	0.000	3.37	3.21	3.54
Primary education	-0.01	3672.50	1.000	0.99	0.00	
Lower secondary education	0.47	0.01	0.000	1.59	1.55	1.64
Upper secondary education	0.46	0.01	0.000	1.59	1.56	1.62
Post-secondary non-tertiary education	0.66	0.01	0.000	1.93	1.88	1.98
Unemployed	0.83	0.01	0.000	2.30	2.26	2.34
Retired	-0.16	0.01	0.000	0.85	0.84	0.87
Chronic illness	1.26	0.01	0.000	3.51	3.46	3.57

Below poverty line	1.60	0.01	0.000	4.93	4.85	5.01
Apartment in building with >=10 units	-0.26	0.01	0.000	0.77	0.75	0.80
Apartment in building with <10 units	-0.40	0.01	0.000	0.67	0.65	0.69
Semi-detached house	-0.27	0.01	0.000	0.76	0.74	0.79
Accommodation provided free	0.49	0.02	0.000	1.64	1.59	1.69
Tenant paying below market rate	-0.18	0.02	0.000	0.83	0.81	0.86
Tenant paying market rate	1.08	0.01	0.000	2.95	2.88	3.02
One person household	-0.13	0.01	0.000	0.88	0.86	0.90
2 adults, dependent children, at least one adult >=65 years	-0.85	0.02	0.000	0.43	0.41	0.44
Other households without dependent children	0.43	0.02	0.000	1.54	1.49	1.59
Single parent household, one or more dependent children	0.97	0.02	0.000	2.63	2.54	2.72
2 adults, one dependent child	0.03	0.02	0.053	1.03	1.00	1.07
2 adults, two dependent children	0.50	0.02	0.000	1.65	1.60	1.70
2 adults, three or more dependent children	0.99	0.02	0.000	2.70	2.60	2.80
Other households with dependent children	0.86	0.01	0.000	2.37	2.30	2.44
Thinly populated area	-0.61	0.01	0.000	0.55	0.53	0.56
Intermediate area	-0.37	0.01	0.000	0.69	0.67	0.70
3 indicators versus 0						
Intercept	-8.29	0.06	0.000			
Pre-primary education	-16.04	962.78	0.987	0.00	0.00	
Primary education	1.95	0.00		7.01	7.01	7.01
Lower secondary education	2.39	0.04	0.000	10.90	10.04	11.84
Upper secondary education	0.82	0.04	0.000	2.27	2.09	2.46
Post-secondary non-tertiary education	1.80	0.05	0.000	6.05	5.54	6.61
Unemployed	0.68	0.02	0.000	1.97	1.88	2.06
Retired	-1.40	0.03	0.000	0.25	0.23	0.26
Chronic illness	0.67	0.02	0.000	1.95	1.87	2.04
Below poverty line	1.69	0.02	0.000	5.42	5.19	5.67
Apartment in building with >=10 units	-1.76	0.04	0.000	0.17	0.16	0.18
Apartment in building with <10 units	-2.18	0.04	0.000	0.11	0.11	0.12
Semi-detached house	-18.87	190.00	0.921	0.00	0.00	
Accommodation provided free	0.03	0.05	0.535	1.03	0.93	1.15
Tenant paying below market rate	2.16	0.04	0.000	8.65	7.97	9.39
Tenant paying market rate	2.75	0.03	0.000	15.61	14.63	16.65
One person household	-0.01	0.04	0.810	0.99	0.92	1.07
2 adults, dependent children, at least one adult >=65 years	1.35	0.05	0.000	3.88	3.49	4.30
Other households without dependent children	1.43	0.05	0.000	4.19	3.82	4.60
Single parent household, one or more dependent children	0.56	0.05	0.000	1.75	1.58	1.93
2 adults, one dependent child	0.83	0.05	0.000	2.28	2.08	2.50
2 adults, two dependent children	1.14	0.04	0.000	3.13	2.87	3.41
2 adults, three or more dependent children	-17.74	410.39	0.966	0.00	0.00	
Other households with dependent children	1.06	0.05	0.000	2.89	2.63	3.17
Thinly populated area	0.42	0.03	0.000	1.53	1.44	1.62
Intermediate area	-1.32	0.05	0.000	0.27	0.24	0.29
Note: Pseudo R^2=.07 (Cox & Snell), .11 (Nagelkerke). Model χ^2 (75)= 276911.42, *p* <.001. Percentage Correct Prediction 81.6%						

Table 4-2 Multinomial logistic regression model of CIFP in Belgium. Data: EU-SILC 2010

Belgium	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-2.22	0.00	0.000			
Pre-primary education	0.06	0.01	0.000	1.06	1.04	1.08
Primary education	-0.04	0.01	0.000	0.96	0.95	0.97
Lower secondary education	0.17	0.00	0.000	1.19	1.18	1.20
Upper secondary education	0.03	0.00	0.000	1.03	1.02	1.03
Post-secondary non-tertiary education	0.33	0.01	0.000	1.39	1.37	1.41
Unemployed	0.30	0.00	0.000	1.35	1.34	1.36
Retired	-0.28	0.00	0.000	0.76	0.75	0.76
Chronic illness	0.46	0.00	0.000	1.59	1.58	1.60
Below poverty line	0.52	0.00	0.000	1.69	1.68	1.70
Apartment in building with >=10 units	-0.64	0.01	0.000	0.53	0.52	0.53
Apartment in building with <10 units	-0.14	0.00	0.000	0.87	0.86	0.88
Semi-detached house	0.35	0.00	0.000	1.42	1.41	1.43
Accommodation provided free	0.66	0.01	0.000	1.94	1.90	1.98
Tenant paying below market rate	0.61	0.00	0.000	1.85	1.83	1.86
Tenant paying market rate	0.96	0.00	0.000	2.62	2.60	2.64
One person household	0.39	0.00	0.000	1.48	1.47	1.49
2 adults, dependent children, at least one adult >=65 years	-0.23	0.01	0.000	0.79	0.78	0.80
Other households without dependent children	0.25	0.01	0.000	1.29	1.27	1.30
Single parent household, one or more dependent children	0.73	0.01	0.000	2.08	2.06	2.10
2 adults, one dependent child	0.42	0.01	0.000	1.53	1.51	1.54
2 adults, two dependent children	0.08	0.01	0.000	1.08	1.07	1.09
2 adults, three or more dependent children	0.57	0.01	0.000	1.77	1.74	1.79
Other households with dependent children	0.53	0.01	0.000	1.70	1.67	1.72
Other household type	1.41	1.76	0.424	4.09	0.13	128.88
Thinly populated area	0.60	0.01	0.000	1.81	1.79	1.83
Intermediate area	-0.10	0.00	0.000	0.91	0.90	0.91
2 indicators versus 0						
Intercept	-4.70	0.01	0.000			
Pre-primary education	1.09	0.01	0.000	2.99	2.91	3.06
Primary education	0.42	0.01	0.000	1.52	1.49	1.55
Lower secondary education	0.75	0.01	0.000	2.12	2.09	2.16
Upper secondary education	0.46	0.01	0.000	1.58	1.55	1.60
Post-secondary non-tertiary education	0.47	0.02	0.000	1.59	1.54	1.65
Unemployed	0.58	0.01	0.000	1.79	1.77	1.81
Retired	-0.54	0.01	0.000	0.59	0.58	0.59
Chronic illness	0.63	0.01	0.000	1.88	1.86	1.90
Below poverty line	1.13	0.01	0.000	3.08	3.05	3.12
Apartment in building with >=10 units	-0.14	0.01	0.000	0.87	0.85	0.89
Apartment in building with <10 units	0.07	0.01	0.000	1.07	1.05	1.09
Semi-detached house	0.59	0.01	0.000	1.81	1.78	1.84
Accommodation provided free	1.64	0.02	0.000	5.15	5.00	5.31
Tenant paying below market rate	0.43	0.01	0.000	1.54	1.51	1.56
Tenant paying market rate	1.07	0.01	0.000	2.93	2.89	2.97
One person household	0.46	0.01	0.000	1.59	1.56	1.61
2 adults, dependent children, at least one adult >=65 years	-0.37	0.01	0.000	0.69	0.67	0.71
Other households without dependent children	-0.48	0.02	0.000	0.62	0.60	0.64
Single parent household, one or more dependent children	1.34	0.01	0.000	3.83	3.76	3.90
2 adults, one dependent child	0.18	0.01	0.000	1.20	1.17	1.23
2 adults, two dependent children	-0.22	0.01	0.000	0.80	0.78	0.82
2 adults, three or more dependent children	0.74	0.01	0.000	2.10	2.05	2.15
Other households with dependent children	0.51	0.01	0.000	1.67	1.62	1.72
Other household type	6.13	1.12	0.000	460.49	51.57	4112.34
Thinly populated area	0.64	0.01	0.000	1.90	1.86	1.95
Intermediate area	-0.16	0.01	0.000	0.85	0.84	0.86

3 indicators versus 0						
Intercept	-5.11	0.02	0.000			
Pre-primary education	0.34	0.02	0.000	1.41	1.34	1.48
Primary education	-1.08	0.03	0.000	0.34	0.32	0.36
Lower secondary education	-0.10	0.02	0.000	0.91	0.88	0.94
Upper secondary education	0.16	0.01	0.000	1.17	1.14	1.20
Post-secondary non-tertiary education	1.14	0.02	0.000	3.12	3.00	3.25
Unemployed	1.29	0.01	0.000	3.63	3.56	3.71
Retired	-0.64	0.02	0.000	0.53	0.51	0.54
Chronic illness	0.64	0.01	0.000	1.89	1.85	1.93
Below poverty line	1.66	0.01	0.000	5.23	5.13	5.34
Apartment in building with >=10 units	-1.32	0.02	0.000	0.27	0.26	0.28
Apartment in building with <10 units	-0.70	0.02	0.000	0.50	0.48	0.51
Semi-detached house	-0.30	0.01	0.000	0.74	0.72	0.76
Accommodation provided free	-0.86	0.10	0.000	0.42	0.35	0.51
Tenant paying below market rate	1.22	0.02	0.000	3.38	3.27	3.49
Tenant paying market rate	1.59	0.01	0.000	4.91	4.78	5.04
One person household	0.15	0.01	0.000	1.16	1.13	1.19
2 adults, dependent children, at least one adult >=65 years	-0.66	0.03	0.000	0.51	0.49	0.54
Other households without dependent children	-1.06	0.04	0.000	0.34	0.32	0.37
Single parent household, one or more dependent children	-1.32	0.03	0.000	0.27	0.25	0.28
2 adults, one dependent child	-1.26	0.03	0.000	0.28	0.27	0.30
2 adults, two dependent children	-0.01	0.02	0.727	0.99	0.96	1.03
2 adults, three or more dependent children	-0.48	0.03	0.000	0.62	0.59	0.65
Other households with dependent children	0.49	0.02	0.000	1.63	1.57	1.70
Other household type	14.93	1.05	0.000	3043571.09	386081.57	23993181.13
Thinly populated area	-0.19	0.03	0.000	0.82	0.78	0.87
Intermediate area	-0.36	0.01	0.000	0.70	0.68	0.72
Note: Pseudo R^2=.06 (Cox & Snell), .08 (Nagelkerke). Model χ^2 (78)= 277300.93, *p* <.001. Percentage Correct Prediction 75.3%						

Table 4-3 Multinomial logistic regression model of CIFP in Bulgaria. Data: EU-SILC 2010

Bulgaria	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-0.48	0.01	0.000			
Pre-primary education	1.00	0.04	0.000	2.71	2.51	2.93
Primary education	0.41	0.01	0.000	1.51	1.48	1.54
Lower secondary education	0.63	0.01	0.000	1.87	1.85	1.90
Upper secondary education	0.51	0.00	0.000	1.67	1.66	1.69
Post-secondary non-tertiary education	-0.03	0.02	0.061	0.97	0.94	1.00
Unemployed	0.66	0.01	0.000	1.93	1.91	1.95
Retired	0.16	0.00	0.000	1.17	1.16	1.18
Chronic illness	0.49	0.00	0.000	1.63	1.62	1.64
Below poverty line	0.64	0.01	0.000	1.90	1.88	1.92
Apartment in building with >=10 units	0.37	0.00	0.000	1.45	1.44	1.46
Apartment in building with <10 units	0.33	0.01	0.000	1.40	1.38	1.42
Semi-detached house	0.29	0.01	0.000	1.34	1.32	1.36
Accommodation provided free	0.05	0.01	0.000	1.05	1.04	1.06
Tenant paying below market rate	0.07	0.02	0.000	1.07	1.03	1.11
Tenant paying market rate	0.19	0.01	0.000	1.21	1.19	1.23
One person household	0.40	0.01	0.000	1.49	1.47	1.51
2 adults, dependent children, at least one adult >=65 years	0.28	0.01	0.000	1.33	1.31	1.35
Other households without dependent children	0.14	0.01	0.000	1.15	1.13	1.16
Single parent household, one or more dependent children	0.48	0.01	0.000	1.62	1.59	1.66
2 adults, one dependent child	0.12	0.01	0.000	1.12	1.11	1.14
2 adults, two dependent children	-0.24	0.01	0.000	0.78	0.77	0.79
2 adults, three or more dependent children	0.57	0.02	0.000	1.77	1.69	1.86
Other households with dependent children	0.02	0.01	0.001	1.02	1.01	1.03
Thinly populated area	-0.21	0.00	0.000	0.81	0.81	0.82
Intermediate area	-0.14	0.01	0.000	0.87	0.86	0.88
2 indicators versus 0						
Intercept	-1.23	0.01	0.000			
Pre-primary education	2.31	0.04	0.000	10.05	9.33	10.82
Primary education	0.83	0.01	0.000	2.29	2.24	2.34
Lower secondary education	1.13	0.01	0.000	3.09	3.05	3.13
Upper secondary education	0.68	0.00	0.000	1.98	1.96	1.99
Post-secondary non-tertiary education	0.47	0.02	0.000	1.60	1.55	1.66
Unemployed	1.08	0.01	0.000	2.94	2.91	2.97
Retired	0.15	0.00	0.000	1.17	1.15	1.18
Chronic illness	0.67	0.00	0.000	1.96	1.95	1.98
Below poverty line	0.95	0.01	0.000	2.58	2.55	2.61
Apartment in building with >=10 units	0.46	0.01	0.000	1.59	1.57	1.60
Apartment in building with <10 units	0.36	0.01	0.000	1.43	1.41	1.45
Semi-detached house	0.17	0.01	0.000	1.19	1.17	1.20
Accommodation provided free	0.24	0.01	0.000	1.27	1.25	1.28
Tenant paying below market rate	0.71	0.02	0.000	2.03	1.97	2.10
Tenant paying market rate	0.27	0.01	0.000	1.31	1.28	1.34
One person household	0.20	0.01	0.000	1.23	1.21	1.24
2 adults, dependent children, at least one adult >=65 years	0.01	0.01	0.239	1.01	0.99	1.02
Other households without dependent children	-0.03	0.01	0.000	0.97	0.96	0.98
Single parent household, one or more dependent children	0.67	0.01	0.000	1.96	1.91	2.01
2 adults, one dependent child	-0.11	0.01	0.000	0.89	0.88	0.91
2 adults, two dependent children	-0.21	0.01	0.000	0.81	0.80	0.82
2 adults, three or more dependent children	1.23	0.02	0.000	3.42	3.26	3.58
Other households with dependent children	0.01	0.01	0.068	1.01	1.00	1.03
Thinly populated area	-0.52	0.01	0.000	0.59	0.59	0.60
Intermediate area	-0.55	0.01	0.000	0.58	0.57	0.59
3 indicators versus 0						
Intercept	-3.55	0.02	0.000			
Pre-primary education	4.07	0.04	0.000	58.72	54.38	63.41
Primary education	2.21	0.02	0.000	9.09	8.82	9.37
Lower secondary education	2.04	0.01	0.000	7.65	7.49	7.83
Upper secondary education	1.16	0.01	0.000	3.19	3.13	3.25

Post-secondary non-tertiary education	1.15	0.03	0.000	3.16	2.98	3.35
Unemployed	1.35	0.01	0.000	3.87	3.81	3.93
Retired	-0.14	0.01	0.000	0.87	0.86	0.88
Chronic illness	0.96	0.01	0.000	2.61	2.57	2.64
Below poverty line	1.48	0.01	0.000	4.40	4.33	4.47
Apartment in building with >=10 units	0.00	0.01	0.736	1.00	0.98	1.02
Apartment in building with <10 units	-0.13	0.02	0.000	0.88	0.85	0.90
Semi-detached house	0.22	0.01	0.000	1.24	1.22	1.27
Accommodation provided free	0.33	0.01	0.000	1.39	1.37	1.42
Tenant paying below market rate	0.90	0.02	0.000	2.47	2.36	2.58
Tenant paying market rate	0.56	0.02	0.000	1.76	1.69	1.83
One person household	0.35	0.01	0.000	1.41	1.38	1.45
2 adults, dependent children, at least one adult >=65 years	0.22	0.01	0.000	1.24	1.21	1.28
Other households without dependent children	0.70	0.01	0.000	2.01	1.96	2.06
Single parent household, one or more dependent children	1.11	0.02	0.000	3.05	2.93	3.17
2 adults, one dependent child	0.33	0.01	0.000	1.39	1.35	1.43
2 adults, two dependent children	0.09	0.02	0.000	1.09	1.06	1.13
2 adults, three or more dependent children	2.21	0.03	0.000	9.14	8.65	9.66
Other households with dependent children	0.77	0.01	0.000	2.17	2.12	2.22
Thinly populated area	-0.97	0.01	0.000	0.38	0.37	0.38
Intermediate area	-0.81	0.01	0.000	0.44	0.43	0.46

Note: Pseudo R^2=.15 (Cox & Snell), .17 (Nagelkerke). Model χ^2 (75)= 424389.06, p <.001. Percentage Correct Prediction 46.4%

Table 4-4 Multinomial logistic regression model of CIFP in Cyprus. Data: EU-SILC 2010 Cross Sectional

Cyprus	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-1.45	0.02	0.000			
Pre-primary education	1.33	0.03	0.000	3.77	3.57	3.98
Primary education	1.02	0.02	0.000	2.77	2.67	2.87
Lower secondary education	1.10	0.02	0.000	2.99	2.88	3.11
Upper secondary education	0.63	0.01	0.000	1.87	1.83	1.91
Post-secondary non-tertiary education	0.59	0.03	0.000	1.80	1.71	1.89
Unemployed	0.71	0.02	0.000	2.03	1.96	2.09
Retired	-0.37	0.01	0.000	0.69	0.67	0.71
Chronic illness	0.33	0.01	0.000	1.40	1.37	1.42
Below poverty line	0.28	0.01	0.000	1.32	1.29	1.36
Apartment in building with >=10 units	-0.05	0.02	0.011	0.96	0.92	0.99
Apartment in building with <10 units	-0.29	0.02	0.000	0.75	0.73	0.77
Semi-detached house	0.06	0.01	0.000	1.07	1.04	1.09
Accommodation provided free	0.29	0.01	0.000	1.33	1.30	1.36
Tenant paying below market rate	-0.11	0.05	0.046	0.90	0.81	1.00
Tenant paying market rate	0.48	0.02	0.000	1.62	1.57	1.67
One person household	0.06	0.02	0.001	1.06	1.02	1.09
2 adults, dependent children, at least one adult >=65 years	0.04	0.02	0.059	1.04	1.00	1.08
Other households without dependent children	0.39	0.02	0.000	1.47	1.42	1.52
Single parent household, one or more dependent children	0.13	0.03	0.000	1.13	1.07	1.21
2 adults, one dependent child	0.26	0.02	0.000	1.29	1.24	1.34
2 adults, two dependent children	0.21	0.02	0.000	1.24	1.19	1.29
2 adults, three or more dependent children	0.24	0.02	0.000	1.27	1.21	1.33
Other households with dependent children	0.65	0.02	0.000	1.91	1.84	1.99
Thinly populated area	0.01	0.01	0.337	1.01	0.99	1.03
Intermediate area	-0.04	0.02	0.005	0.96	0.93	0.99
2 indicators versus 0						
Intercept	-2.43	0.02	0.000			
Pre-primary education	1.66	0.03	0.000	5.28	4.94	5.65
Primary education	1.38	0.02	0.000	3.97	3.79	4.15
Lower secondary education	1.46	0.02	0.000	4.29	4.09	4.50
Upper secondary education	0.97	0.01	0.000	2.65	2.57	2.73
Post-secondary non-tertiary education	0.39	0.04	0.000	1.48	1.37	1.59
Unemployed	1.21	0.02	0.000	3.37	3.24	3.49
Retired	-0.46	0.02	0.000	0.63	0.61	0.66
Chronic illness	0.69	0.01	0.000	1.99	1.93	2.04
Below poverty line	0.44	0.02	0.000	1.55	1.50	1.60
Apartment in building with >=10 units	-0.41	0.02	0.000	0.66	0.63	0.70
Apartment in building with <10 units	-0.32	0.02	0.000	0.72	0.70	0.75
Semi-detached house	-0.22	0.01	0.000	0.80	0.78	0.83
Accommodation provided free	0.52	0.02	0.000	1.69	1.63	1.74
Tenant paying below market rate	0.54	0.06	0.000	1.72	1.53	1.92
Tenant paying market rate	0.58	0.02	0.000	1.78	1.71	1.85
One person household	-0.13	0.02	0.000	0.88	0.84	0.92
2 adults, dependent children, at least one adult >=65 years	-0.31	0.03	0.000	0.74	0.70	0.77
Other households without dependent children	0.31	0.02	0.000	1.37	1.31	1.43
Single parent household, one or more dependent children	0.72	0.03	0.000	2.06	1.93	2.20
2 adults, one dependent child	-0.13	0.03	0.000	0.88	0.84	0.93
2 adults, two dependent children	0.09	0.02	0.001	1.09	1.04	1.14
2 adults, three or more dependent children	0.21	0.03	0.000	1.24	1.17	1.31
Other households with dependent children	0.54	0.03	0.000	1.72	1.64	1.81
Thinly populated area	-0.15	0.01	0.000	0.86	0.84	0.89
Intermediate area	-0.14	0.02	0.000	0.87	0.83	0.90
3 indicators versus 0						
Intercept	-4.43	0.05	0.000			
Pre-primary education	1.66	0.08	0.000	5.27	4.49	6.18
Primary education	1.58	0.05	0.000	4.83	4.38	5.33
Lower secondary education	2.25	0.04	0.000	9.53	8.80	10.33
Upper secondary education	1.17	0.03	0.000	3.23	3.03	3.44

Post-secondary non-tertiary education	-0.03	0.09	0.787	0.97	0.81	1.17
Unemployed	0.90	0.03	0.000	2.47	2.31	2.64
Retired	-1.32	0.04	0.000	0.27	0.25	0.29
Chronic illness	0.87	0.03	0.000	2.38	2.26	2.52
Below poverty line	1.17	0.03	0.000	3.22	3.03	3.41
Apartment in building with >=10 units	-0.51	0.06	0.000	0.60	0.54	0.67
Apartment in building with <10 units	-0.14	0.04	0.000	0.87	0.80	0.93
Semi-detached house	-0.58	0.03	0.000	0.56	0.53	0.60
Accommodation provided free	0.90	0.03	0.000	2.47	2.33	2.62
Tenant paying below market rate	0.73	0.11	0.000	2.07	1.67	2.56
Tenant paying market rate	0.27	0.04	0.000	1.31	1.20	1.42
One person household	-0.26	0.05	0.000	0.77	0.71	0.85
2 adults, dependent children, at least one adult >=65 years	-1.18	0.07	0.000	0.31	0.27	0.35
Other households without dependent children	0.77	0.04	0.000	2.15	1.98	2.35
Single parent household, one or more dependent children	1.56	0.05	0.000	4.74	4.29	5.23
2 adults, one dependent child	-0.75	0.07	0.000	0.47	0.42	0.54
2 adults, two dependent children	-0.27	0.06	0.000	0.76	0.68	0.85
2 adults, three or more dependent children	0.70	0.05	0.000	2.01	1.81	2.22
Other households with dependent children	1.08	0.05	0.000	2.93	2.67	3.21
Thinly populated area	-0.39	0.03	0.000	0.68	0.64	0.72
Intermediate area	0.22	0.04	0.000	1.24	1.16	1.33

Note: Pseudo R^2=.14 (Cox & Snell), .16 (Nagelkerke). Model χ^2 (75)= 40778.74, p <.001. Percentage Correct Prediction 54.1%

Table 4-5 Multinomial logistic regression model of CIFP in Czech Republic. Data: EU-SILC 2010

Czech Republic	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-2.26	0.01	0.000			
Primary education	0.14	0.04	0.000	1.15	1.07	1.24
Lower secondary education	0.46	0.01	0.000	1.59	1.57	1.60
Upper secondary education	0.33	0.00	0.000	1.39	1.38	1.40
Post-secondary non-tertiary education	0.14	0.01	0.000	1.15	1.12	1.18
Unemployed	0.45	0.00	0.000	1.57	1.55	1.58
Retired	-0.23	0.00	0.000	0.80	0.79	0.80
Chronic illness	0.50	0.00	0.000	1.65	1.64	1.66
Below poverty line	0.47	0.00	0.000	1.60	1.59	1.62
Apartment in building with >=10 units	-0.58	0.00	0.000	0.56	0.55	0.56
Apartment in building with <10 units	-0.16	0.00	0.000	0.85	0.84	0.86
Semi-detached house	-0.05	0.00	0.000	0.95	0.94	0.96
Accommodation provided free	0.22	0.01	0.000	1.25	1.23	1.27
Tenant paying below market rate	0.82	0.00	0.000	2.27	2.25	2.29
Tenant paying market rate	0.79	0.01	0.000	2.20	2.17	2.22
One person household	0.10	0.00	0.000	1.11	1.10	1.12
2 adults, dependent children, at least one adult >=65 years	0.03	0.01	0.000	1.03	1.02	1.05
Other households without dependent children	0.11	0.01	0.000	1.12	1.11	1.13
Single parent household, one or more dependent children	0.58	0.01	0.000	1.79	1.76	1.81
2 adults, one dependent child	-0.01	0.01	0.058	0.99	0.98	1.00
2 adults, two dependent children	-0.05	0.01	0.000	0.95	0.94	0.96
2 adults, three or more dependent children	0.05	0.01	0.000	1.05	1.03	1.07
Other households with dependent children	-0.11	0.01	0.000	0.90	0.89	0.91
Thinly populated area	0.14	0.00	0.000	1.15	1.15	1.16
Intermediate area	0.16	0.00	0.000	1.17	1.17	1.18
2 indicators versus 0						
Intercept	-4.93	0.02	0.000			
Primary education	-22.78	6588.69	0.997	0.00	0.00	
Lower secondary education	0.36	0.01	0.000	1.43	1.40	1.47
Upper secondary education	0.16	0.01	0.000	1.17	1.15	1.19
Post-secondary non-tertiary education	0.24	0.03	0.000	1.27	1.20	1.35
Unemployed	0.99	0.01	0.000	2.69	2.64	2.74
Retired	-0.21	0.01	0.000	0.81	0.80	0.83
Chronic illness	1.09	0.01	0.000	2.97	2.93	3.01
Below poverty line	1.06	0.01	0.000	2.89	2.84	2.94
Apartment in building with >=10 units	-0.64	0.01	0.000	0.53	0.52	0.54
Apartment in building with <10 units	-0.20	0.01	0.000	0.82	0.80	0.84
Semi-detached house	-0.02	0.01	0.182	0.98	0.96	1.01
Accommodation provided free	0.34	0.02	0.000	1.41	1.36	1.46
Tenant paying below market rate	1.54	0.01	0.000	4.69	4.60	4.77
Tenant paying market rate	1.37	0.01	0.000	3.93	3.83	4.03
One person household	0.05	0.01	0.000	1.05	1.03	1.07
2 adults, dependent children, at least one adult >=65 years	-0.38	0.02	0.000	0.68	0.66	0.71
Other households without dependent children	-0.05	0.01	0.000	0.95	0.92	0.97
Single parent household, one or more dependent children	0.00	0.02	0.821	1.00	0.97	1.04
2 adults, one dependent child	0.00	0.01	0.999	1.00	0.97	1.03
2 adults, two dependent children	-0.30	0.01	0.000	0.74	0.72	0.76
2 adults, three or more dependent children	0.67	0.02	0.000	1.95	1.89	2.02
Other households with dependent children	-0.24	0.02	0.000	0.78	0.76	0.81
Thinly populated area	0.49	0.01	0.000	1.63	1.60	1.66
Intermediate area	0.36	0.01	0.000	1.44	1.41	1.47
3 indicators versus 0						
Intercept	-8.94	0.09	0.000			
Primary education	-18.58	0.00		0.00	0.00	0.00
Lower secondary education	3.51	0.09	0.000	33.38	27.90	39.94
Upper secondary education	2.62	0.09	0.000	13.73	11.53	16.34
Post-secondary non-tertiary education	-18.23	3456.97	0.996	0.00	0.00	

Unemployed	2.02	0.02	0.000	7.51	7.18	7.86
Retired	-2.49	0.05	0.000	0.08	0.07	0.09
Chronic illness	0.42	0.02	0.000	1.52	1.46	1.58
Below poverty line	1.16	0.02	0.000	3.17	3.03	3.32
Apartment in building with >=10 units	-2.15	0.03	0.000	0.12	0.11	0.12
Apartment in building with <10 units	-0.01	0.03	0.637	0.99	0.93	1.04
Semi-detached house	0.16	0.04	0.000	1.17	1.09	1.26
Accommodation provided free	-21.25	1900.40	0.991	0.00	0.00	
Tenant paying below market rate	1.09	0.03	0.000	2.96	2.81	3.12
Tenant paying market rate	1.37	0.03	0.000	3.93	3.72	4.16
One person household	1.11	0.04	0.000	3.03	2.83	3.25
2 adults, dependent children, at least one adult >=65 years	-18.69	1205.87	0.988	0.00	0.00	
Other households without dependent children	0.51	0.04	0.000	1.67	1.54	1.81
Single parent household, one or more dependent children	1.54	0.04	0.000	4.66	4.33	5.02
2 adults, one dependent child	1.03	0.04	0.000	2.81	2.62	3.02
2 adults, two dependent children	-0.69	0.05	0.000	0.50	0.45	0.55
2 adults, three or more dependent children	-21.13	2036.12	0.992	0.00	0.00	
Other households with dependent children	0.23	0.05	0.000	1.26	1.16	1.38
Thinly populated area	-0.20	0.02	0.000	0.82	0.78	0.86
Intermediate area	-0.51	0.03	0.000	0.60	0.57	0.63
Note: Pseudo R^2=.08 (Cox & Snell), .12 (Nagelkerke). Model χ^2 (72)= 345824.91, *p* <.001. Percentage Correct Prediction 82.0%						

Table 4-6 Multinomial logistic regression model of CIFP in Germany. Data: EU-SILC 2010

Germany	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-2.47	0.00	0.000			
Primary education	-0.05	0.01	0.000	0.95	0.94	0.96
Lower secondary education	0.15	0.00	0.000	1.17	1.16	1.17
Upper secondary education	0.01	0.00	0.000	1.01	1.01	1.01
Post-secondary non-tertiary education	0.13	0.00	0.000	1.14	1.13	1.14
Unemployed	0.43	0.00	0.000	1.54	1.54	1.55
Retired	-0.55	0.00	0.000	0.58	0.57	0.58
Chronic illness	0.35	0.00	0.000	1.42	1.42	1.43
Below poverty line	0.49	0.00	0.000	1.64	1.63	1.64
Apartment in building with >=10 units	-0.30	0.00	0.000	0.74	0.74	0.74
Apartment in building with <10 units	0.08	0.00	0.000	1.08	1.08	1.09
Semi-detached house	-0.04	0.00	0.000	0.96	0.96	0.97
Accommodation provided free	0.59	0.00	0.000	1.80	1.79	1.81
Tenant paying below market rate	0.88	0.00	0.000	2.42	2.41	2.43
Tenant paying market rate	0.86	0.00	0.000	2.36	2.36	2.37
One person household	0.08	0.00	0.000	1.08	1.08	1.08
2 adults, dependent children, at least one adult >=65 years	0.02	0.00	0.000	1.02	1.01	1.02
Other households without dependent children	-0.20	0.00	0.000	0.82	0.82	0.82
Single parent household, one or more dependent children	0.46	0.00	0.000	1.59	1.58	1.60
2 adults, one dependent child	0.13	0.00	0.000	1.14	1.14	1.15
2 adults, two dependent children	0.14	0.00	0.000	1.15	1.15	1.16
2 adults, three or more dependent children	0.08	0.00	0.000	1.09	1.08	1.10
Other households with dependent children	-0.01	0.00	0.018	0.99	0.98	1.00
Other household type	0.58	0.01	0.000	1.78	1.74	1.82
Thinly populated area	0.22	0.00	0.000	1.25	1.25	1.26
Intermediate area	-0.03	0.00	0.000	0.97	0.97	0.97
2 indicators versus 0						
Intercept	-4.71	0.00	0.000			
Primary education	1.13	0.01	0.000	3.10	3.05	3.15
Lower secondary education	1.10	0.00	0.000	3.01	2.99	3.03
Upper secondary education	0.41	0.00	0.000	1.51	1.50	1.52
Post-secondary non-tertiary education	0.41	0.00	0.000	1.51	1.50	1.52
Unemployed	0.93	0.00	0.000	2.53	2.51	2.54
Retired	-0.54	0.00	0.000	0.58	0.58	0.59
Chronic illness	0.54	0.00	0.000	1.71	1.71	1.72
Below poverty line	0.94	0.00	0.000	2.55	2.54	2.57
Apartment in building with >=10 units	-0.83	0.00	0.000	0.44	0.43	0.44
Apartment in building with <10 units	-0.38	0.00	0.000	0.68	0.68	0.69
Semi-detached house	-0.27	0.00	0.000	0.76	0.75	0.77
Accommodation provided free	0.38	0.01	0.000	1.47	1.44	1.49
Tenant paying below market rate	1.54	0.00	0.000	4.67	4.63	4.71
Tenant paying market rate	1.23	0.00	0.000	3.42	3.40	3.44
One person household	-0.27	0.00	0.000	0.76	0.76	0.77
2 adults, dependent children, at least one adult >=65 years	-0.45	0.01	0.000	0.64	0.63	0.65
Other households without dependent children	-0.49	0.01	0.000	0.62	0.61	0.62
Single parent household, one or more dependent children	0.44	0.00	0.000	1.55	1.54	1.56
2 adults, one dependent child	0.18	0.00	0.000	1.20	1.19	1.21
2 adults, two dependent children	0.11	0.00	0.000	1.12	1.11	1.13
2 adults, three or more dependent children	-0.36	0.01	0.000	0.70	0.69	0.71
Other households with dependent children	-0.31	0.01	0.000	0.73	0.72	0.75
Other household type	-23.95	5094.52	0.996	0.00	0.00	
Thinly populated area	0.23	0.00	0.000	1.26	1.25	1.26
Intermediate area	0.11	0.00	0.000	1.11	1.11	1.12
3 indicators versus 0						
Intercept	-7.04	0.01	0.000			
Primary education	-23.07	3275.05	0.994	0.00	0.00	
Lower secondary education	1.52	0.01	0.000	4.55	4.48	4.63

Upper secondary education	0.94	0.01	0.000	2.57	2.53	2.60
Post-secondary non-tertiary education	0.96	0.01	0.000	2.62	2.57	2.67
Unemployed	1.23	0.01	0.000	3.43	3.40	3.47
Retired	-1.04	0.01	0.000	0.36	0.35	0.36
Chronic illness	0.47	0.00	0.000	1.61	1.59	1.62
Below poverty line	1.09	0.01	0.000	2.98	2.95	3.02
Apartment in building with >=10 units	-1.20	0.01	0.000	0.30	0.29	0.31
Apartment in building with <10 units	-0.72	0.01	0.000	0.49	0.48	0.49
Semi-detached house	-26.11	2491.87	0.992	0.00	0.00	
Accommodation provided free	2.35	0.01	0.000	10.49	10.25	10.73
Tenant paying below market rate	1.79	0.01	0.000	5.97	5.85	6.10
Tenant paying market rate	1.49	0.01	0.000	4.42	4.34	4.50
One person household	0.17	0.01	0.000	1.19	1.17	1.20
2 adults, dependent children, at least one adult >=65 years	-24.24	2148.54	0.991	0.00	0.00	
Other households without dependent children	0.10	0.02	0.000	1.11	1.07	1.14
Single parent household, one or more dependent children	0.28	0.01	0.000	1.32	1.29	1.35
2 adults, one dependent child	1.03	0.01	0.000	2.81	2.76	2.87
2 adults, two dependent children	0.21	0.01	0.000	1.23	1.20	1.27
2 adults, three or more dependent children	1.64	0.01	0.000	5.17	5.05	5.28
Other households with dependent children	1.69	0.01	0.000	5.43	5.30	5.57
Other household type	-21.83	6223.13	0.997	0.00	0.00	
Thinly populated area	0.05	0.01	0.000	1.05	1.03	1.06
Intermediate area	-0.24	0.01	0.000	0.79	0.78	0.80

Note: Pseudo R^2=.09 (Cox & Snell), .14 (Nagelkerke). Model χ^2 (75)= 3772141.18, *p* <.001. Percentage Correct Prediction 81.8%

Table 4-7 Multinomial logistic regression model of CIFP in Denmark. Data: EU-SILC 2010

Denmark	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-2.92	0.01	0.000			
Primary education	24.20	1246.50	0.985	32279820128.08	0.00	
Lower secondary education	0.42	0.01	0.000	1.53	1.51	1.55
Upper secondary education	0.17	0.01	0.000	1.19	1.17	1.20
Unemployed	0.78	0.01	0.000	2.18	2.15	2.20
Retired	-0.67	0.01	0.000	0.51	0.51	0.52
Chronic illness	0.46	0.00	0.000	1.59	1.58	1.61
Below poverty line	0.27	0.01	0.000	1.31	1.30	1.33
Apartment in building with >=10 units	-0.29	0.01	0.000	0.75	0.74	0.76
Apartment in building with <10 units	0.13	0.01	0.000	1.14	1.12	1.15
Semi-detached house	-0.15	0.01	0.000	0.86	0.85	0.88
Accommodation provided free	-15.83	154.82	0.919	0.00	0.00	
Tenant paying market rate	0.79	0.01	0.000	2.20	2.17	2.22
One person household	0.13	0.01	0.000	1.14	1.13	1.16
2 adults, dependent children, at least one adult >=65 years	-0.04	0.01	0.001	0.96	0.94	0.98
Other households without dependent children	-0.95	0.03	0.000	0.39	0.37	0.41
Single parent household, one or more dependent children	0.57	0.01	0.000	1.77	1.74	1.81
2 adults, one dependent child	0.65	0.01	0.000	1.92	1.89	1.96
2 adults, two dependent children	0.28	0.01	0.000	1.32	1.30	1.35
2 adults, three or more dependent children	0.27	0.01	0.000	1.31	1.27	1.34
Other households with dependent children	0.56	0.02	0.000	1.74	1.69	1.80
Other household type	0.85	0.03	0.000	2.35	2.20	2.50
Thinly populated area	-0.04	0.01	0.000	0.96	0.95	0.97
Intermediate area	-0.02	0.01	0.000	0.98	0.97	0.99
2 indicators versus 0						
Intercept	-5.54	0.02	0.000			
Primary education	-0.26	0.00		0.77	0.77	0.77
Lower secondary education	-0.30	0.02	0.000	0.74	0.72	0.77
Upper secondary education	-0.24	0.01	0.000	0.79	0.77	0.81
Unemployed	1.19	0.01	0.000	3.28	3.20	3.38
Retired	-0.89	0.02	0.000	0.41	0.39	0.43
Chronic illness	1.17	0.01	0.000	3.22	3.15	3.30
Below poverty line	1.05	0.01	0.000	2.85	2.77	2.92
Apartment in building with >=10 units	-0.15	0.02	0.000	0.86	0.83	0.90
Apartment in building with <10 units	-0.83	0.03	0.000	0.44	0.41	0.46
Semi-detached house	-0.90	0.03	0.000	0.41	0.38	0.43
Accommodation provided free	-15.03	410.81	0.971	0.00	0.00	
Tenant paying market rate	1.25	0.02	0.000	3.49	3.37	3.61
One person household	-0.05	0.02	0.004	0.95	0.92	0.98
2 adults, dependent children, at least one adult >=65 years	-0.73	0.04	0.000	0.48	0.44	0.52
Other households without dependent children	-1.63	0.11	0.000	0.20	0.16	0.24
Single parent household, one or more dependent children	-0.66	0.03	0.000	0.51	0.48	0.55
2 adults, one dependent child	-0.48	0.03	0.000	0.62	0.58	0.66
2 adults, two dependent children	0.07	0.02	0.004	1.07	1.02	1.13
2 adults, three or more dependent children	-1.81	0.07	0.000	0.16	0.14	0.19
Other households with dependent children	0.74	0.04	0.000	2.10	1.96	2.26
Other household type	-14.78	222.28	0.947	0.00	0.00	
Thinly populated area	0.21	0.02	0.000	1.24	1.19	1.28
Intermediate area	0.56	0.01	0.000	1.76	1.71	1.81
Note: Pseudo R^2=.07 (Cox & Snell), .13 (Nagelkerke). Model χ^2 (46)= 190141.70, p <.001. Percentage Correct Prediction 88.3%						

Table 4-8 Multinomial logistic regression model of CIFP in Estonia. Data: EU-SILC 2010

Estonia	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-2.36	0.01	0.000			
Pre-primary education	-19.75	1743.27	0.991	0.00	0.00	
Primary education	0.77	0.02	0.000	2.15	2.06	2.24
Lower secondary education	0.72	0.01	0.000	2.05	2.00	2.10
Upper secondary education	0.37	0.01	0.000	1.44	1.42	1.47
Post-secondary non-tertiary education	0.17	0.02	0.000	1.19	1.15	1.23
Unemployed	0.51	0.01	0.000	1.67	1.64	1.70
Retired	-0.40	0.01	0.000	0.67	0.66	0.68
Chronic illness	0.65	0.01	0.000	1.91	1.88	1.94
Below poverty line	0.50	0.01	0.000	1.64	1.62	1.67
Apartment in building with >=10 units	0.03	0.01	0.001	1.03	1.01	1.05
Apartment in building with <10 units	0.44	0.01	0.000	1.56	1.52	1.59
Semi-detached house	0.25	0.02	0.000	1.29	1.25	1.33
Accommodation provided free	0.15	0.01	0.000	1.16	1.14	1.19
Tenant paying below market rate	0.64	0.02	0.000	1.89	1.82	1.96
Tenant paying market rate	-0.24	0.02	0.000	0.79	0.75	0.82
One person household	0.25	0.01	0.000	1.28	1.25	1.31
2 adults, dependent children, at least one adult >=65 years	0.22	0.02	0.000	1.24	1.21	1.28
Other households without dependent children	0.30	0.02	0.000	1.34	1.30	1.38
Single parent household, one or more dependent children	0.41	0.02	0.000	1.50	1.45	1.56
2 adults, one dependent child	0.14	0.01	0.000	1.15	1.12	1.19
2 adults, two dependent children	0.34	0.01	0.000	1.41	1.37	1.45
2 adults, three or more dependent children	0.49	0.02	0.000	1.63	1.56	1.70
Other households with dependent children	0.36	0.02	0.000	1.43	1.38	1.48
Other household type	0.23	0.10	0.029	1.26	1.02	1.54
Thinly populated area	0.21	0.01	0.000	1.24	1.22	1.26
2 indicators versus 0						
Intercept	-5.19	0.03	0.000			
Pre-primary education	3.90	0.07	0.000	49.40	42.88	56.91
Primary education	1.26	0.05	0.000	3.52	3.18	3.91
Lower secondary education	1.48	0.03	0.000	4.37	4.15	4.60
Upper secondary education	0.59	0.02	0.000	1.80	1.73	1.87
Post-secondary non-tertiary education	0.86	0.03	0.000	2.37	2.22	2.52
Unemployed	0.66	0.02	0.000	1.93	1.86	1.99
Retired	-0.88	0.02	0.000	0.41	0.40	0.43
Chronic illness	0.77	0.02	0.000	2.17	2.10	2.24
Below poverty line	1.41	0.02	0.000	4.08	3.95	4.21
Apartment in building with >=10 units	0.59	0.02	0.000	1.81	1.74	1.88
Apartment in building with <10 units	0.55	0.03	0.000	1.74	1.66	1.83
Semi-detached house	-0.02	0.04	0.572	0.98	0.90	1.06
Accommodation provided free	0.22	0.02	0.000	1.25	1.20	1.30
Tenant paying below market rate	0.15	0.04	0.001	1.16	1.06	1.26
Tenant paying market rate	0.01	0.04	0.822	1.01	0.94	1.09
One person household	-0.26	0.03	0.000	0.77	0.74	0.81
2 adults, dependent children, at least one adult >=65 years	-0.49	0.04	0.000	0.61	0.56	0.67
Other households without dependent children	0.37	0.03	0.000	1.45	1.36	1.54
Single parent household, one or more dependent children	0.46	0.03	0.000	1.58	1.48	1.68
2 adults, one dependent child	0.09	0.03	0.001	1.09	1.04	1.16
2 adults, two dependent children	0.39	0.03	0.000	1.48	1.40	1.57
2 adults, three or more dependent children	0.65	0.04	0.000	1.91	1.77	2.07
Other households with dependent children	0.32	0.04	0.000	1.38	1.29	1.48
Other household type	0.61	0.20	0.002	1.84	1.25	2.73

Thinly populated area	0.74	0.02	0.000	2.09	2.02	2.16
3 indicators versus 0						
Intercept	-26.81	217.11	0.902			
Pre-primary education	-16.81	0.00		0.00	0.00	0.00
Primary education	2.49	0.15	0.000	12.04	8.99	16.12
Lower secondary education	2.28	0.09	0.000	9.78	8.14	11.75
Upper secondary education	1.95	0.08	0.000	7.01	5.97	8.23
Post-secondary non-tertiary education	-15.42	366.92	0.966	0.00	0.00	
Unemployed	0.59	0.04	0.000	1.80	1.65	1.96
Retired	-2.23	0.07	0.000	0.11	0.09	0.12
Chronic illness	2.10	0.05	0.000	8.19	7.38	9.09
Below poverty line	1.98	0.04	0.000	7.23	6.65	7.85
Apartment in building with >=10 units	0.84	0.06	0.000	2.31	2.06	2.59
Apartment in building with <10 units	1.29	0.06	0.000	3.62	3.21	4.09
Semi-detached house	1.25	0.08	0.000	3.48	2.97	4.06
Accommodation provided free	0.29	0.05	0.000	1.33	1.20	1.47
Tenant paying below market rate	-17.37	501.06	0.972	0.00	0.00	
Tenant paying market rate	0.65	0.07	0.000	1.92	1.68	2.19
One person household	17.17	217.11	0.937	28631869.23	0.00	
2 adults, dependent children, at least one adult >=65 years	17.71	217.11	0.935	49324253.59	0.00	
Other households without dependent children	18.02	217.11	0.934	67057973.36	0.00	
Single parent household, one or more dependent children	18.65	217.11	0.932	125263307.44	0.00	
2 adults, one dependent child	16.53	217.11	0.939	15157152.07	0.00	
2 adults, two dependent children	16.57	217.11	0.939	15768694.33	0.00	
2 adults, three or more dependent children	17.17	217.11	0.937	28646899.89	0.00	
Other households with dependent children	17.65	217.11	0.935	46097083.99	0.00	
Other household type	0.22	3387.33	1.000	1.25	0.00	
Thinly populated area	0.83	0.05	0.000	2.28	2.09	2.50
Note: Pseudo R^2=.11 (Cox & Snell), .15 (Nagelkerke). Model χ^2 (75)= 69136.29, *p* <.001. Percentage Correct Prediction 73.5%						

Table 4-9 Multinomial logistic regression model of CIFP in Spain. Data: EU-SILC 2010

Spain	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-1.28	0.00	0.000			
Primary education	0.39	0.00	0.000	1.48	1.47	1.48
Lower secondary education	0.30	0.00	0.000	1.35	1.34	1.35
Upper secondary education	0.12	0.00	0.000	1.12	1.12	1.13
Post-secondary non-tertiary education	-0.66	0.01	0.000	0.52	0.51	0.53
Unemployed	0.45	0.00	0.000	1.57	1.56	1.57
Retired	-0.24	0.00	0.000	0.79	0.78	0.79
Chronic illness	0.39	0.00	0.000	1.47	1.47	1.48
Below poverty line	0.42	0.00	0.000	1.52	1.51	1.52
Apartment in building with >=10 units	-0.71	0.00	0.000	0.49	0.49	0.50
Apartment in building with <10 units	-0.41	0.00	0.000	0.66	0.66	0.67
Semi-detached house	0.08	0.00	0.000	1.08	1.08	1.09
Accommodation provided free	0.16	0.00	0.000	1.18	1.17	1.18
Tenant paying below market rate	0.98	0.00	0.000	2.66	2.65	2.68
Tenant paying market rate	0.34	0.00	0.000	1.41	1.40	1.41
One person household	-0.03	0.00	0.000	0.97	0.97	0.97
2 adults, dependent children, at least one adult >=65 years	-0.22	0.00	0.000	0.80	0.80	0.81
Other households without dependent children	-0.07	0.00	0.000	0.93	0.92	0.93
Single parent household, one or more dependent children	0.13	0.00	0.000	1.14	1.13	1.15
2 adults, one dependent child	-0.08	0.00	0.000	0.93	0.92	0.93
2 adults, two dependent children	-0.18	0.00	0.000	0.83	0.83	0.84
2 adults, three or more dependent children	0.02	0.01	0.001	1.02	1.01	1.03
Other households with dependent children	-0.14	0.00	0.000	0.87	0.87	0.88
Other household type	1.75	0.03	0.000	5.74	5.38	6.13
Thinly populated area	0.17	0.00	0.000	1.19	1.18	1.19
Intermediate area	0.11	0.00	0.000	1.12	1.11	1.12
2 indicators versus 0						
Intercept	-4.44	0.01	0.000			
Primary education	1.14	0.00	0.000	3.13	3.10	3.15
Lower secondary education	0.82	0.00	0.000	2.28	2.26	2.29
Upper secondary education	0.36	0.00	0.000	1.44	1.43	1.45
Post-secondary non-tertiary education	0.37	0.02	0.000	1.45	1.40	1.50
Unemployed	1.17	0.00	0.000	3.22	3.20	3.24
Retired	-0.23	0.00	0.000	0.80	0.79	0.80
Chronic illness	0.60	0.00	0.000	1.82	1.81	1.83
Below poverty line	0.85	0.00	0.000	2.34	2.33	2.35
Apartment in building with >=10 units	-0.65	0.00	0.000	0.52	0.52	0.53
Apartment in building with <10 units	-0.35	0.00	0.000	0.70	0.70	0.71
Semi-detached house	0.30	0.00	0.000	1.35	1.34	1.36
Accommodation provided free	0.61	0.00	0.000	1.84	1.82	1.86
Tenant paying below market rate	1.28	0.01	0.000	3.60	3.56	3.65
Tenant paying market rate	0.78	0.00	0.000	2.17	2.16	2.19
One person household	-0.22	0.01	0.000	0.80	0.79	0.81
2 adults, dependent children, at least one adult >=65 years	-0.79	0.01	0.000	0.45	0.45	0.46
Other households without dependent children	-0.11	0.00	0.000	0.90	0.89	0.90
Single parent household, one or more dependent children	0.50	0.01	0.000	1.66	1.63	1.68
2 adults, one dependent child	-0.13	0.01	0.000	0.88	0.87	0.88
2 adults, two dependent children	0.21	0.00	0.000	1.23	1.22	1.24
2 adults, three or more dependent children	0.72	0.01	0.000	2.06	2.02	2.09
Other households with dependent children	0.39	0.01	0.000	1.48	1.46	1.49
Other household type	-22.71	9825.27	0.998	0.00	0.00	
Thinly populated area	0.39	0.00	0.000	1.47	1.46	1.48
Intermediate area	0.53	0.00	0.000	1.69	1.68	1.71
3 indicators versus 0						
Intercept	-6.84	0.02	0.000			
Primary education	0.04	0.01	0.004	1.04	1.01	1.06
Lower secondary education	0.70	0.01	0.000	2.02	1.98	2.06
Upper secondary education	0.04	0.01	0.000	1.04	1.02	1.06
Post-secondary non-tertiary education	-21.25	2274.76	0.993	0.00	0.00	

Unemployed	1.65	0.01	0.000	5.22	5.13	5.30
Retired	-1.46	0.02	0.000	0.23	0.23	0.24
Chronic illness	1.04	0.01	0.000	2.84	2.80	2.88
Below poverty line	1.64	0.01	0.000	5.15	5.07	5.23
Apartment in building with >=10 units	-0.84	0.01	0.000	0.43	0.42	0.45
Apartment in building with <10 units	0.20	0.01	0.000	1.22	1.19	1.25
Semi-detached house	0.56	0.01	0.000	1.75	1.71	1.79
Accommodation provided free	-0.16	0.01	0.000	0.86	0.83	0.88
Tenant paying below market rate	1.37	0.01	0.000	3.94	3.83	4.05
Tenant paying market rate	0.97	0.01	0.000	2.65	2.60	2.70
One person household	0.06	0.01	0.000	1.06	1.04	1.09
2 adults, dependent children, at least one adult >=65 years	-0.28	0.02	0.000	0.76	0.73	0.79
Other households without dependent children	-0.55	0.01	0.000	0.58	0.56	0.59
Single parent household, one or more dependent children	-0.19	0.02	0.000	0.83	0.80	0.86
2 adults, one dependent child	-0.20	0.01	0.000	0.82	0.80	0.84
2 adults, two dependent children	-0.69	0.01	0.000	0.50	0.49	0.52
2 adults, three or more dependent children	0.40	0.02	0.000	1.49	1.43	1.54
Other households with dependent children	-0.12	0.01	0.000	0.89	0.87	0.91
Other household type	-21.83	0.00		0.00	0.00	0.00
Thinly populated area	0.35	0.01	0.000	1.42	1.40	1.45
Intermediate area	0.38	0.01	0.000	1.46	1.44	1.49
Note: R^2=.11 (Cox & Snell), .15 (Nagelkerke). Model χ^2 (75)= 1979810.46, *p* <.001. Percentage Correct Prediction 72.0%						

Table 4-10 Multinomial logistic regression model of CIFP in Finland. Data: EU-SILC 2010

Finland	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-2.55	0.01	0.000			
Lower secondary education	0.66	0.01	0.000	1.94	1.91	1.97
Upper secondary education	0.47	0.01	0.000	1.60	1.58	1.62
Post-secondary non-tertiary education	-1.84	0.07	0.000	0.16	0.14	0.18
Unemployed	0.52	0.01	0.000	1.68	1.66	1.70
Retired	-0.84	0.01	0.000	0.43	0.43	0.44
Chronic illness	0.31	0.00	0.000	1.36	1.35	1.37
Below poverty line	0.36	0.01	0.000	1.43	1.42	1.45
Apartment in building with >=10 units	-0.40	0.01	0.000	0.67	0.66	0.68
Apartment in building with <10 units	-0.44	0.02	0.000	0.64	0.62	0.66
Semi-detached house	-0.21	0.01	0.000	0.81	0.80	0.83
Accommodation provided free	0.05	0.03	0.070	1.05	1.00	1.10
Tenant paying below market rate	0.73	0.01	0.000	2.07	2.04	2.10
Tenant paying market rate	0.64	0.01	0.000	1.89	1.86	1.92
One person household	0.01	0.01	0.052	1.01	1.00	1.03
2 adults, dependent children, at least one adult >=65 years	-0.14	0.01	0.000	0.87	0.85	0.89
Other households without dependent children	-0.02	0.02	0.309	0.98	0.95	1.02
Single parent household, one or more dependent children	0.26	0.01	0.000	1.30	1.27	1.32
2 adults, one dependent child	0.18	0.01	0.000	1.20	1.18	1.22
2 adults, two dependent children	0.43	0.01	0.000	1.54	1.51	1.56
2 adults, three or more dependent children	0.39	0.01	0.000	1.48	1.45	1.51
Other households with dependent children	0.43	0.02	0.000	1.54	1.49	1.59
Thinly populated area	-0.24	0.01	0.000	0.79	0.78	0.80
Intermediate area	-0.09	0.01	0.000	0.91	0.90	0.92
2 indicators versus 0						
Intercept	-6.06	0.03	0.000			
Lower secondary education	0.87	0.02	0.000	2.38	2.27	2.49
Upper secondary education	0.50	0.02	0.000	1.65	1.59	1.72
Post-secondary non-tertiary education	-20.76	3860.44	0.996	0.00	0.00	
Unemployed	0.84	0.02	0.000	2.32	2.25	2.39
Retired	-1.95	0.03	0.000	0.14	0.13	0.15
Chronic illness	0.73	0.01	0.000	2.07	2.02	2.13
Below poverty line	1.80	0.02	0.000	6.07	5.88	6.27
Apartment in building with >=10 units	-1.37	0.02	0.000	0.25	0.24	0.27
Apartment in building with <10 units	-1.53	0.06	0.000	0.22	0.19	0.24
Semi-detached house	-0.62	0.02	0.000	0.54	0.51	0.56
Accommodation provided free	-22.89	5772.34	0.997	0.00	0.00	
Tenant paying below market rate	1.29	0.02	0.000	3.62	3.46	3.79
Tenant paying market rate	0.98	0.02	0.000	2.66	2.53	2.79
One person household	0.48	0.02	0.000	1.62	1.55	1.70
2 adults, dependent children, at least one adult >=65 years	0.07	0.07	0.300	1.07	0.94	1.23
Other households without dependent children	1.90	0.04	0.000	6.69	6.16	7.27
Single parent household, one or more dependent children	0.51	0.04	0.000	1.67	1.56	1.79
2 adults, one dependent child	0.44	0.04	0.000	1.56	1.45	1.67
2 adults, two dependent children	0.73	0.03	0.000	2.08	1.94	2.22
2 adults, three or more dependent children	1.88	0.03	0.000	6.58	6.21	6.97
Other households with dependent children	1.49	0.05	0.000	4.42	4.05	4.83

Thinly populated area	-0.24	0.02	0.000	0.79	0.76	0.82
Intermediate area	-0.05	0.02	0.035	0.95	0.91	1.00
3 indicators versus 0						
Intercept	-27.92	0.16	0.000			
Lower secondary education	1.14	0.14	0.000	3.13	2.40	4.09
Upper secondary education	2.39	0.12	0.000	10.88	8.61	13.74
Post-secondary non-tertiary education	-19.47	8905.05	0.998	0.00	0.00	
Unemployed	-1.98	0.14	0.000	0.14	0.11	0.18
Retired	-0.40	0.07	0.000	0.67	0.58	0.77
Chronic illness	1.62	0.07	0.000	5.03	4.39	5.77
Below poverty line	1.32	0.07	0.000	3.73	3.27	4.26
Apartment in building with >=10 units	-22.08	624.45	0.972	0.00	0.00	
Apartment in building with <10 units	-23.29	4972.21	0.996	0.00	0.00	
Semi-detached house	-20.49	736.23	0.978	0.00	0.00	
Accommodation provided free	2.69	0.09	0.000	14.80	12.48	17.54
Tenant paying below market rate	-17.78	1459.86	0.990	0.00	0.00	
Tenant paying market rate	2.95	0.06	0.000	19.15	16.92	21.67
One person household	1.23	0.10	0.000	3.42	2.83	4.13
2 adults, dependent children, at least one adult >=65 years	-18.42	949.31	0.985	0.00	0.00	
Other households without dependent children	-20.32	4460.44	0.996	0.00	0.00	
Single parent household, one or more dependent children	2.17	0.11	0.000	8.74	7.05	10.84
2 adults, one dependent child	1.66	0.10	0.000	5.25	4.29	6.43
2 adults, two dependent children	0.85	0.14	0.000	2.33	1.77	3.07
2 adults, three or more dependent children	-19.59	2669.67	0.994	0.00	0.00	
Other households with dependent children	-17.91	2292.80	0.994	0.00	0.00	
Thinly populated area	17.66	0.08	0.000	46854675.06	39805385.48	55152350.57
Intermediate area	18.68	0.00		129153195.42	129153195.42	129153195.42
Note: Pseudo R^2=.06 (Cox & Snell), .12 (Nagelkerke). Model χ^2 (69)= 156917.58, *p* <.001. Percentage Correct Prediction 88.7%						

Table 4-11 Multinomial logistic regression model of CIFP in France. Data: EU-SILC 2010

France	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-2.46	0.00	0.000			
Pre-primary education	0.15	0.01	0.000	1.16	1.14	1.18
Primary education	0.21	0.00	0.000	1.23	1.23	1.24
Lower secondary education	0.54	0.00	0.000	1.72	1.71	1.72
Upper secondary education	0.04	0.00	0.000	1.04	1.04	1.04
Unemployed	0.28	0.00	0.000	1.33	1.32	1.33
Retired	-0.41	0.00	0.000	0.66	0.66	0.66
Chronic illness	0.38	0.00	0.000	1.46	1.46	1.46
Below poverty line	0.69	0.00	0.000	1.99	1.99	2.00
Apartment in building with >=10 units	-0.20	0.00	0.000	0.82	0.82	0.82
Apartment in building with <10 units	0.27	0.00	0.000	1.31	1.31	1.32
Semi-detached house	0.28	0.00	0.000	1.32	1.31	1.32
Accommodation provided free	0.58	0.00	0.000	1.78	1.77	1.79
Tenant paying below market rate	0.82	0.00	0.000	2.27	2.26	2.28
Tenant paying market rate	0.68	0.00	0.000	1.98	1.98	1.99
One person household	0.08	0.00	0.000	1.09	1.08	1.09
2 adults, dependent children, at least one adult >=65 years	0.05	0.00	0.000	1.05	1.05	1.06
Other households without dependent children	0.07	0.00	0.000	1.07	1.07	1.08
Single parent household, one or more dependent children	0.47	0.00	0.000	1.61	1.60	1.61
2 adults, one dependent child	-0.04	0.00	0.000	0.96	0.96	0.97
2 adults, two dependent children	0.02	0.00	0.000	1.02	1.02	1.03
2 adults, three or more dependent children	0.39	0.00	0.000	1.48	1.47	1.48
Other households with dependent children	0.22	0.00	0.000	1.24	1.24	1.25
Other household type	1.41	0.01	0.000	4.10	4.02	4.18
Thinly populated area	0.21	0.00	0.000	1.24	1.24	1.24
Intermediate area	0.02	0.00	0.000	1.02	1.02	1.02
2 indicators versus 0						
Intercept	-5.63	0.01	0.000			
Pre-primary education	2.27	0.01	0.000	9.67	9.52	9.83
Primary education	0.88	0.00	0.000	2.40	2.38	2.42
Lower secondary education	0.90	0.00	0.000	2.45	2.43	2.47
Upper secondary education	0.57	0.00	0.000	1.76	1.75	1.77
Unemployed	0.76	0.00	0.000	2.13	2.12	2.15
Retired	-0.43	0.00	0.000	0.65	0.65	0.66
Chronic illness	0.53	0.00	0.000	1.69	1.68	1.70
Below poverty line	1.23	0.00	0.000	3.44	3.42	3.45
Apartment in building with >=10 units	-0.21	0.00	0.000	0.81	0.81	0.82
Apartment in building with <10 units	0.36	0.00	0.000	1.44	1.43	1.45
Semi-detached house	0.49	0.00	0.000	1.62	1.61	1.63
Accommodation provided free	0.96	0.01	0.000	2.61	2.58	2.64
Tenant paying below market rate	0.87	0.00	0.000	2.40	2.38	2.41
Tenant paying market rate	1.35	0.00	0.000	3.87	3.85	3.90
One person household	0.33	0.00	0.000	1.39	1.38	1.40
2 adults, dependent children, at least one adult >=65 years	-0.20	0.01	0.000	0.82	0.81	0.83
Other households without dependent children	0.87	0.01	0.000	2.39	2.36	2.42
Single parent household, one or more dependent children	1.10	0.00	0.000	3.02	2.99	3.04
2 adults, one dependent child	0.39	0.01	0.000	1.47	1.46	1.49
2 adults, two dependent children	0.49	0.01	0.000	1.63	1.62	1.65
2 adults, three or more dependent children	0.87	0.01	0.000	2.39	2.36	2.41
Other households with dependent children	0.55	0.01	0.000	1.74	1.72	1.76
Other household type	1.61	0.02	0.000	4.99	4.82	5.17
Thinly populated area	0.61	0.00	0.000	1.84	1.83	1.85
Intermediate area	0.24	0.00	0.000	1.28	1.27	1.28
3 indicators versus 0						
Intercept	-8.08	0.01	0.000			
Pre-primary education	3.20	0.02	0.000	24.53	23.58	25.53
Primary education	1.61	0.01	0.000	4.99	4.87	5.12

Lower secondary education	2.68	0.01	0.000	14.52	14.18	14.86
Upper secondary education	1.79	0.01	0.000	5.98	5.85	6.11
Unemployed	1.51	0.01	0.000	4.54	4.49	4.59
Retired	-0.60	0.01	0.000	0.55	0.54	0.56
Chronic illness	0.77	0.01	0.000	2.17	2.15	2.19
Below poverty line	1.09	0.01	0.000	2.99	2.96	3.02
Apartment in building with >=10 units	-1.89	0.01	0.000	0.15	0.15	0.15
Apartment in building with <10 units	-0.97	0.01	0.000	0.38	0.38	0.39
Semi-detached house	-0.43	0.01	0.000	0.65	0.64	0.66
Accommodation provided free	0.62	0.02	0.000	1.87	1.81	1.93
Tenant paying below market rate	1.40	0.01	0.000	4.05	3.98	4.11
Tenant paying market rate	1.94	0.01	0.000	6.94	6.84	7.03
One person household	0.90	0.01	0.000	2.47	2.43	2.51
2 adults, dependent children, at least one adult >=65 years	-23.69	1744.18	0.989	0.00	0.00	
Other households without dependent children	0.29	0.01	0.000	1.34	1.30	1.38
Single parent household, one or more dependent children	1.35	0.01	0.000	3.85	3.77	3.92
2 adults, one dependent child	-0.04	0.01	0.003	0.96	0.94	0.99
2 adults, two dependent children	-0.09	0.01	0.000	0.92	0.89	0.94
2 adults, three or more dependent children	0.94	0.01	0.000	2.56	2.51	2.62
Other households with dependent children	0.85	0.01	0.000	2.33	2.28	2.39
Other household type	-22.50	6251.81	0.997	0.00	0.00	
Thinly populated area	-0.21	0.01	0.000	0.81	0.80	0.82
Intermediate area	0.15	0.01	0.000	1.16	1.15	1.18
Note: Pseudo R^2=.11 (Cox & Snell), .16 (Nagelkerke). Model χ^2 (75)= 3134099.19, *p* <.001. Percentage Correct Prediction 80.1%						

Table 4-12 Multinomial logistic regression model of CIFP in Greece. Data: EU-SILC 2010

Greece	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-1.67	0.01	0.000			
Pre-primary education	1.40	0.01	0.000	4.05	4.00	4.11
Primary education	0.60	0.00	0.000	1.83	1.81	1.84
Lower secondary education	0.99	0.00	0.000	2.69	2.66	2.71
Upper secondary education	0.50	0.00	0.000	1.64	1.63	1.65
Post-secondary non-tertiary education	0.44	0.01	0.000	1.56	1.54	1.57
Unemployed	0.43	0.00	0.000	1.53	1.52	1.54
Retired	-0.26	0.00	0.000	0.77	0.77	0.78
Chronic illness	0.19	0.00	0.000	1.21	1.21	1.22
Below poverty line	1.05	0.00	0.000	2.86	2.84	2.88
Apartment in building with >=10 units	-0.29	0.00	0.000	0.75	0.74	0.75
Apartment in building with <10 units	-0.26	0.00	0.000	0.77	0.76	0.77
Semi-detached house	0.10	0.00	0.000	1.10	1.09	1.11
Accommodation provided free	0.15	0.01	0.000	1.17	1.15	1.18
Tenant paying below market rate	0.29	0.01	0.000	1.34	1.30	1.38
Tenant paying market rate	0.37	0.00	0.000	1.44	1.43	1.45
One person household	0.11	0.00	0.000	1.12	1.11	1.13
2 adults, dependent children, at least one adult >=65 years	0.19	0.01	0.000	1.21	1.20	1.23
Other households without dependent children	0.17	0.01	0.000	1.19	1.17	1.20
Single parent household, one or more dependent children	0.51	0.01	0.000	1.66	1.62	1.69
2 adults, one dependent child	0.17	0.01	0.000	1.19	1.18	1.20
2 adults, two dependent children	0.20	0.00	0.000	1.22	1.21	1.23
2 adults, three or more dependent children	0.50	0.01	0.000	1.66	1.62	1.69
Other households with dependent children	0.53	0.01	0.000	1.70	1.67	1.72
Other household type	-0.88	0.04	0.000	0.41	0.38	0.45
Thinly populated area	0.11	0.00	0.000	1.12	1.11	1.13
Intermediate area	-0.12	0.00	0.000	0.89	0.88	0.89
2 indicators versus 0						
Intercept	-4.09	0.01	0.000			
Pre-primary education	2.03	0.01	0.000	7.62	7.46	7.79
Primary education	1.87	0.01	0.000	6.50	6.40	6.59
Lower secondary education	1.30	0.01	0.000	3.65	3.59	3.72
Upper secondary education	1.15	0.01	0.000	3.16	3.12	3.20
Post-secondary non-tertiary education	0.85	0.01	0.000	2.34	2.30	2.38
Unemployed	0.83	0.01	0.000	2.29	2.27	2.31
Retired	-0.01	0.01	0.211	0.99	0.98	1.00
Chronic illness	0.57	0.00	0.000	1.77	1.75	1.79
Below poverty line	1.56	0.00	0.000	4.78	4.74	4.82
Apartment in building with >=10 units	-0.55	0.01	0.000	0.58	0.57	0.58
Apartment in building with <10 units	-0.48	0.01	0.000	0.62	0.61	0.62
Semi-detached house	-0.09	0.01	0.000	0.91	0.90	0.93
Accommodation provided free	0.30	0.01	0.000	1.35	1.32	1.37
Tenant paying below market rate	0.49	0.02	0.000	1.63	1.57	1.70
Tenant paying market rate	1.01	0.01	0.000	2.74	2.71	2.77
One person household	0.12	0.01	0.000	1.13	1.11	1.15
2 adults, dependent children, at least one adult >=65 years	-0.51	0.01	0.000	0.60	0.59	0.61
Other households without dependent children	0.52	0.01	0.000	1.69	1.66	1.72
Single parent household, one or more dependent children	0.65	0.02	0.000	1.92	1.86	1.98
2 adults, one dependent child	0.28	0.01	0.000	1.32	1.30	1.35
2 adults, two dependent children	0.22	0.01	0.000	1.25	1.23	1.27
2 adults, three or more dependent children	1.34	0.02	0.000	3.81	3.69	3.93
Other households with dependent children	0.72	0.01	0.000	2.06	2.02	2.10
Other household type	-24.70	0.00		0.00	0.00	0.00
Thinly populated area	0.24	0.01	0.000	1.27	1.26	1.28
Intermediate area	-0.30	0.01	0.000	0.74	0.73	0.75
3 indicators versus 0						
Intercept	-7.64	0.03	0.000			
Pre-primary education	2.22	0.02	0.000	9.23	8.81	9.68
Primary education	2.66	0.02	0.000	14.26	13.77	14.75

Lower secondary education	2.90	0.02	0.000	18.17	17.57	18.81
Upper secondary education	1.86	0.02	0.000	6.41	6.20	6.61
Post-secondary non-tertiary education	1.72	0.02	0.000	5.56	5.35	5.79
Unemployed	1.46	0.01	0.000	4.31	4.23	4.38
Retired	-0.14	0.01	0.000	0.87	0.86	0.89
Chronic illness	1.14	0.01	0.000	3.13	3.08	3.18
Below poverty line	1.52	0.01	0.000	4.55	4.49	4.62
Apartment in building with >=10 units	-1.10	0.01	0.000	0.33	0.32	0.34
Apartment in building with <10 units	-0.52	0.01	0.000	0.59	0.58	0.60
Semi-detached house	0.09	0.01	0.000	1.10	1.08	1.12
Accommodation provided free	-0.18	0.02	0.000	0.83	0.80	0.87
Tenant paying below market rate	-0.24	0.04	0.000	0.79	0.72	0.86
Tenant paying market rate	1.17	0.01	0.000	3.21	3.15	3.27
One person household	1.30	0.02	0.000	3.67	3.53	3.81
2 adults, dependent children, at least one adult >=65 years	0.85	0.02	0.000	2.34	2.25	2.44
Other households without dependent children	1.14	0.02	0.000	3.13	3.01	3.26
Single parent household, one or more dependent children	-0.13	0.07	0.071	0.88	0.77	1.01
2 adults, one dependent child	1.77	0.02	0.000	5.89	5.66	6.13
2 adults, two dependent children	1.64	0.02	0.000	5.18	4.98	5.38
2 adults, three or more dependent children	2.33	0.03	0.000	10.23	9.61	10.89
Other households with dependent children	1.71	0.02	0.000	5.51	5.29	5.75
Other household type	2.00	0.07	0.000	7.37	6.47	8.39
Thinly populated area	0.45	0.01	0.000	1.57	1.54	1.60
Intermediate area	-1.02	0.02	0.000	0.36	0.35	0.37

Note: Pseudo R^2=.19 (Cox & Snell), .23 (Nagelkerke). Model χ^2 (78)= 862213.93, p <.001. Percentage Correct Prediction 64.0%

Table 4-13 Multinomial logistic regression model of CIFP in Hungary. Data: EU-SILC 2010

Hungary	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-1.94	0.01	0.000			
Primary education	0.56	0.01	0.000	1.75	1.72	1.77
Lower secondary education	0.81	0.00	0.000	2.25	2.23	2.27
Upper secondary education	0.40	0.00	0.000	1.49	1.48	1.50
Post-secondary non-tertiary education	0.33	0.01	0.000	1.39	1.37	1.40
Unemployed	0.55	0.00	0.000	1.74	1.72	1.75
Retired	-0.11	0.00	0.000	0.89	0.89	0.90
Chronic illness	0.41	0.00	0.000	1.51	1.50	1.52
Below poverty line	0.76	0.00	0.000	2.14	2.12	2.16
Apartment in building with >=10 units	-0.05	0.00	0.000	0.95	0.94	0.96
Apartment in building with <10 units	0.11	0.01	0.000	1.11	1.10	1.13
Semi-detached house	0.18	0.01	0.000	1.20	1.18	1.21
Accommodation provided free	0.41	0.01	0.000	1.51	1.49	1.52
Tenant paying below market rate	0.97	0.01	0.000	2.65	2.61	2.69
Tenant paying market rate	0.44	0.01	0.000	1.55	1.53	1.58
One person household	0.31	0.00	0.000	1.36	1.35	1.37
2 adults, dependent children, at least one adult >=65 years	-0.01	0.01	0.071	0.99	0.98	1.00
Other households without dependent children	0.01	0.01	0.222	1.01	1.00	1.02
Single parent household, one or more dependent children	0.54	0.01	0.000	1.72	1.69	1.74
2 adults, one dependent child	0.29	0.01	0.000	1.34	1.33	1.36
2 adults, two dependent children	0.12	0.01	0.000	1.13	1.11	1.14
2 adults, three or more dependent children	0.54	0.01	0.000	1.72	1.69	1.74
Other households with dependent children	0.18	0.01	0.000	1.20	1.18	1.21
Thinly populated area	-0.01	0.00	0.000	0.99	0.98	0.99
Intermediate area	0.15	0.00	0.000	1.16	1.15	1.17
2 indicators versus 0						
Intercept	-3.40	0.01	0.000			
Primary education	0.88	0.01	0.000	2.40	2.35	2.46
Lower secondary education	1.31	0.01	0.000	3.71	3.66	3.77
Upper secondary education	0.80	0.01	0.000	2.23	2.21	2.25
Post-secondary non-tertiary education	0.60	0.01	0.000	1.81	1.78	1.85
Unemployed	1.18	0.01	0.000	3.26	3.23	3.29
Retired	-0.22	0.00	0.000	0.80	0.80	0.81
Chronic illness	0.82	0.00	0.000	2.28	2.26	2.30
Below poverty line	1.00	0.01	0.000	2.72	2.69	2.75
Apartment in building with >=10 units	-0.35	0.01	0.000	0.71	0.70	0.71
Apartment in building with <10 units	0.18	0.01	0.000	1.19	1.17	1.22
Semi-detached house	0.30	0.01	0.000	1.36	1.34	1.38
Accommodation provided free	0.52	0.01	0.000	1.69	1.66	1.71
Tenant paying below market rate	1.46	0.01	0.000	4.31	4.24	4.39
Tenant paying market rate	0.63	0.01	0.000	1.88	1.84	1.92
One person household	0.26	0.01	0.000	1.30	1.28	1.32
2 adults, dependent children, at least one adult >=65 years	-0.52	0.01	0.000	0.60	0.59	0.61
Other households without dependent children	-0.35	0.01	0.000	0.71	0.70	0.72
Single parent household, one or more dependent children	1.22	0.01	0.000	3.40	3.34	3.46
2 adults, one dependent child	0.08	0.01	0.000	1.09	1.07	1.10
2 adults, two dependent children	0.29	0.01	0.000	1.34	1.32	1.36
2 adults, three or more dependent children	0.89	0.01	0.000	2.44	2.39	2.48
Other households with dependent children	0.13	0.01	0.000	1.14	1.12	1.16
Thinly populated area	-0.10	0.01	0.000	0.90	0.89	0.91
Intermediate area	0.25	0.01	0.000	1.28	1.27	1.30
3 indicators versus 0						
Intercept	-5.25	0.02	0.000			
Primary education	1.30	0.02	0.000	3.66	3.49	3.84
Lower secondary education	2.32	0.01	0.000	10.20	9.92	10.49
Upper secondary education	1.56	0.01	0.000	4.74	4.63	4.86
Post-secondary non-tertiary education	1.12	0.02	0.000	3.08	2.97	3.19
Unemployed	1.04	0.01	0.000	2.82	2.78	2.87
Retired	-0.63	0.01	0.000	0.53	0.52	0.54

Chronic illness	0.68	0.01	0.000	1.97	1.94	2.00
Below poverty line	1.61	0.01	0.000	4.99	4.91	5.06
Apartment in building with >=10 units	-0.62	0.01	0.000	0.54	0.53	0.55
Apartment in building with <10 units	0.36	0.01	0.000	1.43	1.39	1.47
Semi-detached house	0.45	0.01	0.000	1.56	1.53	1.60
Accommodation provided free	0.57	0.01	0.000	1.76	1.72	1.80
Tenant paying below market rate	1.68	0.01	0.000	5.39	5.25	5.53
Tenant paying market rate	1.08	0.02	0.000	2.93	2.85	3.02
One person household	0.28	0.01	0.000	1.32	1.29	1.35
2 adults, dependent children, at least one adult >=65 years	0.02	0.02	0.177	1.02	0.99	1.05
Other households without dependent children	0.07	0.01	0.000	1.08	1.05	1.11
Single parent household, one or more dependent children	1.13	0.01	0.000	3.10	3.02	3.19
2 adults, one dependent child	-0.11	0.01	0.000	0.89	0.87	0.92
2 adults, two dependent children	0.11	0.01	0.000	1.12	1.09	1.15
2 adults, three or more dependent children	0.89	0.01	0.000	2.44	2.37	2.51
Other households with dependent children	0.61	0.01	0.000	1.85	1.80	1.89
Thinly populated area	-0.34	0.01	0.000	0.71	0.70	0.72
Intermediate area	0.45	0.01	0.000	1.56	1.53	1.59
Note: Pseudo R^2=.15 (Cox & Snell), .17 (Nagelkerke). Model χ^2 (72)= 603570.55, p <.001. Percentage Correct Prediction 64.1%						

Table 4-14 Multinomial logistic regression model of CIFP in Ireland. Data: EU-SILC 2010

Ireland	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-2.21	0.01	0.000			
Primary education	0.26	0.01	0.000	1.30	1.28	1.32
Lower secondary education	0.11	0.01	0.000	1.11	1.10	1.13
Upper secondary education	-0.04	0.01	0.000	0.96	0.95	0.97
Post-secondary non-tertiary education	-0.15	0.01	0.000	0.86	0.85	0.88
Unemployed	0.49	0.01	0.000	1.63	1.61	1.64
Retired	-0.33	0.01	0.000	0.72	0.71	0.73
Chronic illness	0.62	0.00	0.000	1.86	1.84	1.88
Below poverty line	0.40	0.01	0.000	1.49	1.48	1.51
Apartment in building with >=10 units	-0.03	0.01	0.026	0.97	0.94	1.00
Apartment in building with <10 units	0.56	0.01	0.000	1.76	1.71	1.81
Semi-detached house	0.21	0.01	0.000	1.23	1.22	1.25
Accommodation provided free	1.04	0.02	0.000	2.84	2.75	2.93
Tenant paying below market rate	0.64	0.01	0.000	1.90	1.88	1.93
Tenant paying market rate	0.30	0.01	0.000	1.35	1.33	1.37
One person household	0.08	0.01	0.000	1.08	1.07	1.10
2 adults, dependent children, at least one adult >=65 years	0.00	0.01	0.914	1.00	0.98	1.02
Other households without dependent children	-0.21	0.01	0.000	0.81	0.80	0.83
Single parent household, one or more dependent children	0.86	0.01	0.000	2.36	2.32	2.40
2 adults, one dependent child	0.13	0.01	0.000	1.14	1.12	1.16
2 adults, two dependent children	0.01	0.01	0.235	1.01	0.99	1.03
2 adults, three or more dependent children	0.37	0.01	0.000	1.45	1.42	1.47
Other households with dependent children	0.15	0.01	0.000	1.17	1.15	1.19
Thinly populated area	-0.02	0.01	0.000	0.98	0.97	0.99
Intermediate area	-0.06	0.01	0.000	0.94	0.93	0.95
2 indicators versus 0						
Intercept	-4.31	0.02	0.000			
Primary education	0.31	0.01	0.000	1.36	1.32	1.40
Lower secondary education	0.68	0.01	0.000	1.97	1.92	2.02
Upper secondary education	0.04	0.01	0.000	1.04	1.02	1.07
Post-secondary non-tertiary education	0.58	0.01	0.000	1.79	1.74	1.84
Unemployed	0.57	0.01	0.000	1.77	1.73	1.80
Retired	-0.94	0.02	0.000	0.39	0.38	0.41
Chronic illness	0.68	0.01	0.000	1.98	1.95	2.02
Below poverty line	0.58	0.01	0.000	1.78	1.75	1.82
Apartment in building with >=10 units	-0.87	0.03	0.000	0.42	0.40	0.44
Apartment in building with <10 units	-0.80	0.03	0.000	0.45	0.43	0.48
Semi-detached house	-0.21	0.01	0.000	0.81	0.79	0.83
Accommodation provided free	1.91	0.02	0.000	6.75	6.45	7.06
Tenant paying below market rate	1.52	0.01	0.000	4.59	4.50	4.69
Tenant paying market rate	1.51	0.01	0.000	4.54	4.43	4.64
One person household	0.93	0.01	0.000	2.54	2.47	2.61
2 adults, dependent children, at least one adult >=65 years	-0.78	0.03	0.000	0.46	0.43	0.49
Other households without dependent children	-0.02	0.02	0.285	0.98	0.94	1.02
Single parent household, one or more dependent children	1.25	0.02	0.000	3.50	3.39	3.60
2 adults, one dependent child	-0.18	0.02	0.000	0.83	0.80	0.87
2 adults, two dependent children	0.48	0.02	0.000	1.61	1.56	1.66
2 adults, three or more dependent children	0.65	0.02	0.000	1.92	1.86	1.99
Other households with dependent children	0.26	0.02	0.000	1.30	1.25	1.35
Thinly populated area	-0.13	0.01	0.000	0.87	0.86	0.89
Intermediate area	-0.05	0.01	0.000	0.95	0.93	0.97
3 indicators versus 0						
Intercept	-8.85	0.06	0.000			
Primary education	0.03	0.04	0.418	1.03	0.96	1.10
Lower secondary education	1.16	0.03	0.000	3.19	3.01	3.39
Upper secondary education	0.44	0.03	0.000	1.55	1.46	1.64
Post-secondary non-tertiary education	1.41	0.03	0.000	4.09	3.85	4.35
Unemployed	1.22	0.02	0.000	3.40	3.25	3.54
Retired	-0.08	0.03	0.016	0.93	0.87	0.99

Chronic illness	1.39	0.02	0.000	4.03	3.86	4.21
Below poverty line	0.45	0.02	0.000	1.57	1.51	1.64
Apartment in building with >=10 units	-0.29	0.07	0.000	0.75	0.66	0.85
Apartment in building with <10 units	1.52	0.04	0.000	4.56	4.18	4.98
Semi-detached house	0.37	0.03	0.000	1.45	1.36	1.54
Accommodation provided free	0.02	0.11	0.887	1.02	0.81	1.27
Tenant paying below market rate	1.76	0.02	0.000	5.84	5.58	6.12
Tenant paying market rate	0.86	0.03	0.000	2.36	2.21	2.52
One person household	2.40	0.05	0.000	11.03	9.92	12.26
2 adults, dependent children, at least one adult >=65 years	1.06	0.07	0.000	2.90	2.52	3.33
Other households without dependent children	1.26	0.06	0.000	3.54	3.14	3.99
Single parent household, one or more dependent children	2.51	0.06	0.000	12.36	11.07	13.80
2 adults, one dependent child	0.31	0.08	0.000	1.36	1.17	1.58
2 adults, two dependent children	2.25	0.06	0.000	9.47	8.47	10.58
2 adults, three or more dependent children	1.41	0.07	0.000	4.09	3.59	4.65
Other households with dependent children	1.10	0.07	0.000	3.01	2.64	3.43
Thinly populated area	-0.29	0.03	0.000	0.75	0.71	0.79
Intermediate area	-0.08	0.02	0.000	0.92	0.88	0.96
Note: Pseudo R^2=.13 (Cox & Snell), .17 (Nagelkerke). Model χ^2 (72)= 222511.45, *p* <.001. Percentage Correct Prediction 75.5%						

Table 4-15 Multinomial logistic regression model of CIFP in Italy. Data: EU-SILC 2010

Italy	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-1.53	0.00	0.000			
Pre-primary education	0.47	0.00	0.000	1.60	1.59	1.61
Primary education	0.34	0.00	0.000	1.40	1.40	1.41
Lower secondary education	0.35	0.00	0.000	1.41	1.41	1.42
Upper secondary education	0.08	0.00	0.000	1.09	1.09	1.09
Post-secondary non-tertiary education	0.42	0.00	0.000	1.52	1.51	1.52
Unemployed	0.50	0.00	0.000	1.66	1.65	1.66
Retired	-0.17	0.00	0.000	0.84	0.84	0.84
Chronic illness	0.59	0.00	0.000	1.80	1.79	1.80
Below poverty line	0.43	0.00	0.000	1.54	1.54	1.55
Apartment in building with >=10 units	-0.49	0.00	0.000	0.61	0.61	0.61
Apartment in building with <10 units	-0.33	0.00	0.000	0.72	0.72	0.72
Semi-detached house	-0.33	0.00	0.000	0.72	0.72	0.72
Accommodation provided free	0.12	0.00	0.000	1.13	1.13	1.13
Tenant paying below market rate	0.75	0.00	0.000	2.11	2.10	2.12
Tenant paying market rate	0.65	0.00	0.000	1.91	1.90	1.91
One person household	-0.02	0.00	0.000	0.98	0.98	0.99
2 adults, dependent children, at least one adult >=65 years	-0.20	0.00	0.000	0.82	0.81	0.82
Other households without dependent children	-0.04	0.00	0.000	0.96	0.95	0.96
Single parent household, one or more dependent children	0.39	0.00	0.000	1.47	1.46	1.48
2 adults, one dependent child	0.03	0.00	0.000	1.03	1.02	1.03
2 adults, two dependent children	-0.05	0.00	0.000	0.95	0.95	0.96
2 adults, three or more dependent children	0.39	0.00	0.000	1.48	1.47	1.49
Other households with dependent children	0.15	0.00	0.000	1.16	1.15	1.17
Thinly populated area	0.13	0.00	0.000	1.14	1.13	1.14
Intermediate area	0.20	0.00	0.000	1.22	1.21	1.22
2 indicators versus 0						
Intercept	-3.70	0.00	0.000			
Pre-primary education	1.40	0.01	0.000	4.06	4.02	4.11
Primary education	0.89	0.00	0.000	2.42	2.40	2.44
Lower secondary education	0.98	0.00	0.000	2.66	2.64	2.68
Upper secondary education	0.35	0.00	0.000	1.42	1.41	1.43
Post-secondary non-tertiary education	0.78	0.01	0.000	2.18	2.16	2.21
Unemployed	0.77	0.00	0.000	2.16	2.15	2.17
Retired	-0.38	0.00	0.000	0.68	0.68	0.68
Chronic illness	0.79	0.00	0.000	2.20	2.19	2.21
Below poverty line	1.12	0.00	0.000	3.07	3.06	3.08
Apartment in building with >=10 units	-0.72	0.00	0.000	0.49	0.49	0.49
Apartment in building with <10 units	-0.51	0.00	0.000	0.60	0.60	0.61
Semi-detached house	-0.38	0.00	0.000	0.68	0.68	0.69
Accommodation provided free	0.53	0.00	0.000	1.71	1.70	1.72
Tenant paying below market rate	1.42	0.00	0.000	4.14	4.11	4.17
Tenant paying market rate	1.17	0.00	0.000	3.22	3.20	3.23
One person household	-0.17	0.00	0.000	0.85	0.84	0.85
2 adults, dependent children, at least one adult >=65 years	-0.42	0.00	0.000	0.66	0.65	0.66
Other households without dependent children	0.11	0.00	0.000	1.12	1.11	1.13
Single parent household, one or more dependent children	0.06	0.01	0.000	1.06	1.05	1.07
2 adults, one dependent child	-0.20	0.00	0.000	0.82	0.82	0.83
2 adults, two dependent children	-0.12	0.00	0.000	0.89	0.88	0.89
2 adults, three or more dependent children	0.38	0.01	0.000	1.47	1.45	1.48
Other households with dependent children	0.10	0.00	0.000	1.10	1.09	1.11
Thinly populated area	0.35	0.00	0.000	1.42	1.41	1.43
Intermediate area	0.30	0.00	0.000	1.35	1.35	1.36
3 indicators versus 0						
Intercept	-6.36	0.01	0.000			
Pre-primary education	2.79	0.01	0.000	16.23	15.86	16.61
Primary education	1.92	0.01	0.000	6.79	6.66	6.93
Lower secondary education	1.86	0.01	0.000	6.43	6.32	6.55
Upper secondary education	1.19	0.01	0.000	3.29	3.23	3.35

Post-secondary non-tertiary education	0.79	0.01	0.000	2.21	2.15	2.27
Unemployed	0.86	0.00	0.000	2.36	2.34	2.38
Retired	-0.66	0.01	0.000	0.52	0.51	0.52
Chronic illness	0.89	0.00	0.000	2.44	2.42	2.46
Below poverty line	1.32	0.00	0.000	3.76	3.73	3.78
Apartment in building with >=10 units	-0.83	0.01	0.000	0.44	0.43	0.44
Apartment in building with <10 units	-0.18	0.00	0.000	0.83	0.82	0.84
Semi-detached house	-0.23	0.01	0.000	0.80	0.79	0.81
Accommodation provided free	0.07	0.01	0.000	1.07	1.05	1.08
Tenant paying below market rate	1.80	0.01	0.000	6.03	5.96	6.10
Tenant paying market rate	1.58	0.00	0.000	4.87	4.83	4.91
One person household	-0.22	0.01	0.000	0.80	0.79	0.81
2 adults, dependent children, at least one adult >=65 years	-0.07	0.01	0.000	0.93	0.91	0.95
Other households without dependent children	0.37	0.01	0.000	1.45	1.43	1.48
Single parent household, one or more dependent children	1.37	0.01	0.000	3.95	3.89	4.02
2 adults, one dependent child	0.39	0.01	0.000	1.48	1.46	1.51
2 adults, two dependent children	0.74	0.01	0.000	2.09	2.06	2.12
2 adults, three or more dependent children	0.54	0.01	0.000	1.72	1.68	1.76
Other households with dependent children	0.68	0.01	0.000	1.97	1.94	2.00
Thinly populated area	-0.35	0.01	0.000	0.71	0.70	0.71
Intermediate area	-0.05	0.00	0.000	0.95	0.94	0.96
Note: Pseudo R^2=.12 (Cox & Snell), .15 (Nagelkerke). Model χ^2 (75)= 3073352.39, p <.001. Percentage Correct Prediction 69.6%						

Table 4-16 Multinomial logistic regression model of CIFP in Lithuania. Data: EU-SILC 2010

Lithuania	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-1.20	0.01	0.000			
Pre-primary education	0.61	0.02	0.000	1.84	1.77	1.91
Primary education	0.60	0.01	0.000	1.82	1.79	1.85
Lower secondary education	0.52	0.01	0.000	1.69	1.66	1.71
Upper secondary education	0.51	0.01	0.000	1.67	1.65	1.69
Post-secondary non-tertiary education	0.34	0.01	0.000	1.40	1.39	1.42
Unemployed	0.48	0.01	0.000	1.62	1.60	1.64
Retired	0.09	0.01	0.000	1.10	1.08	1.11
Chronic illness	0.49	0.00	0.000	1.64	1.62	1.65
Below poverty line	0.50	0.01	0.000	1.64	1.63	1.66
Apartment in building with >=10 units	0.22	0.01	0.000	1.25	1.24	1.26
Apartment in building with <10 units	0.74	0.01	0.000	2.09	2.05	2.12
Semi-detached house	0.23	0.01	0.000	1.26	1.24	1.28
Accommodation provided free	0.16	0.01	0.000	1.18	1.15	1.20
Tenant paying below market rate	0.10	0.02	0.000	1.11	1.06	1.16
Tenant paying market rate	0.22	0.02	0.000	1.25	1.20	1.30
One person household	0.18	0.01	0.000	1.19	1.18	1.21
2 adults, dependent children, at least one adult >=65 years	-0.05	0.01	0.000	0.95	0.93	0.97
Other households without dependent children	0.04	0.01	0.000	1.04	1.02	1.06
Single parent household, one or more dependent children	0.50	0.01	0.000	1.66	1.62	1.69
2 adults, one dependent child	-0.07	0.01	0.000	0.93	0.92	0.95
2 adults, two dependent children	-0.13	0.01	0.000	0.88	0.86	0.89
2 adults, three or more dependent children	-0.06	0.01	0.000	0.95	0.92	0.97
Other households with dependent children	-0.04	0.01	0.000	0.96	0.94	0.98
Other household type	-0.20	0.08	0.006	0.81	0.70	0.94
Thinly populated area	-0.66	0.00	0.000	0.52	0.51	0.52
2 indicators versus 0						
Intercept	-2.93	0.01	0.000			
Pre-primary education	2.44	0.02	0.000	11.44	10.91	11.99
Primary education	1.44	0.02	0.000	4.22	4.10	4.35
Lower secondary education	1.31	0.01	0.000	3.70	3.61	3.79
Upper secondary education	1.22	0.01	0.000	3.39	3.33	3.45
Post-secondary non-tertiary education	0.64	0.01	0.000	1.89	1.85	1.92
Unemployed	1.09	0.01	0.000	2.97	2.92	3.01
Retired	0.06	0.01	0.000	1.06	1.04	1.08
Chronic illness	0.44	0.01	0.000	1.55	1.53	1.57
Below poverty line	0.60	0.01	0.000	1.81	1.79	1.84
Apartment in building with >=10 units	0.45	0.01	0.000	1.57	1.54	1.60
Apartment in building with <10 units	1.16	0.01	0.000	3.19	3.12	3.26
Semi-detached house	0.40	0.01	0.000	1.49	1.45	1.52
Accommodation provided free	0.95	0.01	0.000	2.59	2.52	2.65
Tenant paying below market rate	1.34	0.02	0.000	3.83	3.66	4.01
Tenant paying market rate	1.42	0.02	0.000	4.12	3.96	4.30
One person household	-0.43	0.01	0.000	0.65	0.64	0.66
2 adults, dependent children, at least one adult >=65 years	-0.50	0.02	0.000	0.61	0.59	0.63
Other households without dependent children	-0.28	0.01	0.000	0.76	0.74	0.78
Single parent household, one or more dependent children	0.29	0.02	0.000	1.34	1.30	1.38
2 adults, one dependent child	-0.61	0.01	0.000	0.54	0.53	0.56
2 adults, two dependent children	-0.50	0.01	0.000	0.61	0.59	0.62
2 adults, three or more dependent children	-0.40	0.02	0.000	0.67	0.65	0.70
Other households with dependent children	-0.16	0.01	0.000	0.85	0.83	0.87
Other household type	-23.37	8698.75	0.998	0.00	0.00	
Thinly populated area	-0.55	0.01	0.000	0.58	0.57	0.58
3 indicators versus 0						
Intercept	-6.20	0.04	0.000			
Pre-primary education	-19.94	3852.58	0.996	0.00	0.00	
Primary education	0.58	0.07	0.000	1.78	1.56	2.02

Lower secondary education	1.42	0.03	0.000	4.12	3.87	4.39
Upper secondary education	1.88	0.02	0.000	6.57	6.27	6.89
Post-secondary non-tertiary education	0.95	0.03	0.000	2.59	2.46	2.72
Unemployed	1.59	0.02	0.000	4.92	4.77	5.07
Retired	-1.26	0.03	0.000	0.28	0.27	0.30
Chronic illness	1.26	0.02	0.000	3.51	3.41	3.61
Below poverty line	1.48	0.02	0.000	4.38	4.25	4.52
Apartment in building with >=10 units	-0.29	0.02	0.000	0.75	0.72	0.77
Apartment in building with <10 units	0.71	0.02	0.000	2.04	1.96	2.12
Semi-detached house	-0.73	0.03	0.000	0.48	0.46	0.51
Accommodation provided free	1.04	0.02	0.000	2.84	2.71	2.96
Tenant paying below market rate	2.15	0.03	0.000	8.57	8.01	9.16
Tenant paying market rate	2.49	0.04	0.000	12.02	11.09	13.02
One person household	-0.23	0.02	0.000	0.79	0.76	0.83
2 adults, dependent children, at least one adult >=65 years	-1.21	0.06	0.000	0.30	0.27	0.33
Other households without dependent children	-1.82	0.05	0.000	0.16	0.15	0.18
Single parent household, one or more dependent children	-1.19	0.05	0.000	0.30	0.28	0.33
2 adults, one dependent child	-0.22	0.02	0.000	0.80	0.76	0.84
2 adults, two dependent children	-0.18	0.02	0.000	0.84	0.80	0.88
2 adults, three or more dependent children	0.44	0.03	0.000	1.56	1.47	1.66
Other households with dependent children	-1.50	0.04	0.000	0.22	0.21	0.24
Other household type	-23.14	0.00		0.00	0.00	0.00
Thinly populated area	0.66	0.02	0.000	1.94	1.86	2.02
Note: Pseudo R^2=.17 (Cox & Snell), .20 (Nagelkerke). Model χ^2 (75)= 240255.78, *p* <.001. Percentage Correct Prediction 59.1%						

Table 4-17 Multinomial logistic regression model of CIFP in Luxembourg. Data: EU-SILC

Luxembourg	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-1.87	0.02	0.000			
Primary education	-0.01	0.02	0.798	0.99	0.96	1.04
Lower secondary education	-0.01	0.02	0.599	0.99	0.94	1.04
Upper secondary education	-0.05	0.02	0.001	0.95	0.92	0.98
Post-secondary non-tertiary education	-0.39	0.04	0.000	0.68	0.63	0.73
Unemployed	0.33	0.02	0.000	1.39	1.33	1.45
Retired	-0.02	0.02	0.206	0.98	0.94	1.01
Chronic illness	0.50	0.01	0.000	1.65	1.61	1.70
Below poverty line	0.01	0.02	0.729	1.01	0.97	1.05
Apartment in building with >=10 units	-0.22	0.02	0.000	0.81	0.77	0.85
Apartment in building with <10 units	-0.17	0.02	0.000	0.85	0.81	0.88
Semi-detached house	-0.02	0.02	0.233	0.98	0.94	1.01
Accommodation provided free	0.02	0.05	0.641	1.02	0.93	1.13
Tenant paying below market rate	0.76	0.03	0.000	2.15	2.01	2.29
Tenant paying market rate	0.54	0.02	0.000	1.71	1.66	1.77
One person household	-0.53	0.02	0.000	0.59	0.56	0.61
2 adults, dependent children, at least one adult >=65 years	-0.60	0.03	0.000	0.55	0.52	0.58
Other households without dependent children	-0.15	0.03	0.000	0.86	0.81	0.91
Single parent household, one or more dependent children	0.40	0.03	0.000	1.49	1.40	1.59
2 adults, one dependent child	0.29	0.02	0.000	1.33	1.27	1.39
2 adults, two dependent children	0.15	0.02	0.000	1.17	1.12	1.22
2 adults, three or more dependent children	0.08	0.03	0.008	1.09	1.02	1.16
Other households with dependent children	-0.18	0.03	0.000	0.83	0.78	0.89
Thinly populated area	0.20	0.02	0.000	1.22	1.18	1.26
Intermediate area	0.08	0.02	0.000	1.09	1.06	1.12
2 indicators versus 0						
Intercept	-3.99	0.09	0.000			
Primary education	-2.02	0.14	0.000	0.13	0.10	0.17
Lower secondary education	0.43	0.08	0.000	1.54	1.30	1.81
Upper secondary education	-0.11	0.07	0.107	0.89	0.78	1.03
Post-secondary non-tertiary education	-0.28	0.28	0.327	0.76	0.43	1.32
Unemployed	0.85	0.07	0.000	2.34	2.04	2.68
Retired	-1.47	0.18	0.000	0.23	0.16	0.32
Chronic illness	1.01	0.06	0.000	2.75	2.45	3.08
Below poverty line	2.27	0.07	0.000	9.68	8.45	11.09
Apartment in building with >=10 units	-1.59	0.13	0.000	0.20	0.16	0.27
Apartment in building with <10 units	-0.03	0.08	0.739	0.97	0.83	1.14
Semi-detached house	-1.24	0.12	0.000	0.29	0.23	0.36
Accommodation provided free	-2.21	0.61	0.000	0.11	0.03	0.36
Tenant paying below market rate	0.39	0.12	0.001	1.48	1.16	1.89
Tenant paying market rate	-0.02	0.07	0.797	0.98	0.85	1.13
One person household	-1.99	0.11	0.000	0.14	0.11	0.17
2 adults, dependent children, at least one adult >=65 years	-18.79	1203.22	0.988	0.00	0.00	
Other households without dependent children	-2.44	0.22	0.000	0.09	0.06	0.13
Single parent household, one or more dependent children	-0.29	0.10	0.003	0.74	0.61	0.90
2 adults, one dependent child	-0.82	0.09	0.000	0.44	0.37	0.53
2 adults, two dependent children	-1.27	0.10	0.000	0.28	0.23	0.34
2 adults, three or more dependent children	-0.44	0.10	0.000	0.65	0.53	0.79
Other households with dependent children	-3.57	0.30	0.000	0.03	0.02	0.05
Thinly populated area	-1.27	0.11	0.000	0.28	0.23	0.35
Intermediate area	-0.33	0.07	0.000	0.72	0.63	0.82

3 indicators versus 0						
Intercept	-28.72	1.21	0.000			
Primary education	15.42	0.89	0.000	4980143.10	866563.28	28620904.86
Lower secondary education	-0.32	4490.14	1.000	0.73	0.00	
Upper secondary education	18.05	0.00		69319812.89	69319812.89	69319812.89
Post-secondary non-tertiary education	0.87	8175.20	1.000	2.39	0.00	
Unemployed	-17.96	4510.93	0.997	0.00	0.00	
Retired	-16.50	2593.81	0.995	0.00	0.00	
Chronic illness	2.70	0.61	0.000	14.90	4.48	49.54
Below poverty line	4.62	0.67	0.000	101.08	27.12	376.69
Apartment in building with >=10 units	-15.29	3567.53	0.997	0.00	0.00	
Apartment in building with <10 units	1.05	1.04	0.312	2.87	0.37	22.14
Semi-detached house	2.79	0.80	0.001	16.35	3.38	79.13
Accommodation provided free	-18.35	7089.15	0.998	0.00	0.00	
Tenant paying below market rate	-15.88	7332.00	0.998	0.00	0.00	
Tenant paying market rate	-0.42	0.84	0.613	0.65	0.13	3.38
One person household	-19.42	2771.16	0.994	0.00	0.00	
2 adults, dependent children, at least one adult >=65 years	-18.00	4462.50	0.997	0.00	0.00	
Other households without dependent children	-18.49	5753.48	0.997	0.00	0.00	
Single parent household, one or more dependent children	-2.35	0.92	0.010	0.10	0.02	0.57
2 adults, one dependent child	-19.12	5569.50	0.997	0.00	0.00	
2 adults, two dependent children	-20.43	3911.03	0.996	0.00	0.00	
2 adults, three or more dependent children	-0.85	0.64	0.185	0.43	0.12	1.50
Other households with dependent children	-20.73	5222.45	0.997	0.00	0.00	.
Thinly populated area	-0.31	0.90	0.731	0.73	0.12	4.31
Intermediate area	0.18	0.67	0.788	1.20	0.32	4.48

Note: Pseudo R^2=.05 (Cox & Snell), .09 (Nagelkerke). Model χ^2 (72)= 10770.95, p <.001. Percentage Correct Prediction 82.9%

Table 4-18 Multinomial logistic regression model of CIFP in Latvia. Data: EU-SILC 2010

Latvia	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-1.57	0.01	0.000			
Pre-primary education	-0.69	0.05	0.000	0.50	0.45	0.55
Primary education	0.28	0.02	0.000	1.33	1.27	1.39
Lower secondary education	0.61	0.01	0.000	1.85	1.81	1.88
Upper secondary education	0.30	0.01	0.000	1.34	1.33	1.36
Post-secondary non-tertiary education	0.29	0.01	0.000	1.33	1.31	1.36
Unemployed	0.62	0.01	0.000	1.85	1.83	1.88
Retired	0.08	0.01	0.000	1.09	1.07	1.10
Chronic illness	0.41	0.01	0.000	1.51	1.49	1.52
Below poverty line	0.59	0.01	0.000	1.81	1.79	1.83
Apartment in building with >=10 units	0.43	0.01	0.000	1.53	1.51	1.55
Apartment in building with <10 units	0.75	0.01	0.000	2.11	2.07	2.15
Semi-detached house	0.11	0.01	0.000	1.12	1.09	1.15
Accommodation provided free	0.07	0.01	0.000	1.08	1.05	1.10
Tenant paying below market rate	0.61	0.01	0.000	1.85	1.80	1.90
Tenant paying market rate	0.29	0.01	0.000	1.34	1.32	1.37
One person household	0.05	0.01	0.000	1.05	1.04	1.07
2 adults, dependent children, at least one adult >=65 years	-0.34	0.01	0.000	0.71	0.70	0.73
Other households without dependent children	-0.16	0.01	0.000	0.86	0.84	0.87
Single parent household, one or more dependent children	0.39	0.01	0.000	1.48	1.44	1.52
2 adults, one dependent child	0.25	0.01	0.000	1.28	1.25	1.30
2 adults, two dependent children	0.14	0.01	0.000	1.15	1.12	1.17
2 adults, three or more dependent children	0.08	0.02	0.000	1.08	1.04	1.13
Other households with dependent children	-0.01	0.01	0.282	0.99	0.97	1.01
Other household type	0.63	0.10	0.000	1.87	1.55	2.26
Thinly populated area	-0.12	0.01	0.000	0.89	0.88	0.90
2 indicators versus 0						
Intercept	-3.92	0.02	0.000			
Pre-primary education	0.98	0.05	0.000	2.66	2.43	2.92
Primary education	0.72	0.03	0.000	2.05	1.93	2.17
Lower secondary education	1.08	0.01	0.000	2.94	2.87	3.02
Upper secondary education	0.64	0.01	0.000	1.89	1.86	1.93
Post-secondary non-tertiary education	0.64	0.01	0.000	1.90	1.85	1.96
Unemployed	1.16	0.01	0.000	3.19	3.14	3.25
Retired	-0.12	0.01	0.000	0.88	0.87	0.90
Chronic illness	0.83	0.01	0.000	2.29	2.25	2.33
Below poverty line	0.94	0.01	0.000	2.55	2.51	2.59
Apartment in building with >=10 units	0.80	0.01	0.000	2.23	2.19	2.28
Apartment in building with <10 units	1.16	0.01	0.000	3.20	3.12	3.29
Semi-detached house	0.31	0.02	0.000	1.37	1.31	1.42
Accommodation provided free	0.20	0.02	0.000	1.23	1.19	1.26
Tenant paying below market rate	1.27	0.01	0.000	3.57	3.47	3.68
Tenant paying market rate	0.08	0.01	0.000	1.08	1.05	1.11
One person household	0.46	0.01	0.000	1.59	1.54	1.63
2 adults, dependent children, at least one adult >=65 years	0.15	0.02	0.000	1.16	1.12	1.20
Other households without dependent children	0.11	0.02	0.000	1.12	1.09	1.16
Single parent household, one or more dependent children	1.27	0.02	0.000	3.57	3.45	3.69
2 adults, one dependent child	0.46	0.02	0.000	1.58	1.54	1.63
2 adults, two dependent children	0.54	0.02	0.000	1.71	1.65	1.77
2 adults, three or more dependent children	0.18	0.03	0.000	1.19	1.13	1.26
Other households with dependent children	0.30	0.02	0.000	1.35	1.31	1.39
Other household type	1.68	0.11	0.000	5.39	4.37	6.65
Thinly populated area	-0.04	0.01	0.000	0.96	0.94	0.97
3 indicators versus 0						
Intercept	-6.28	0.04	0.000			
Pre-primary education	1.22	0.08	0.000	3.38	2.86	3.99
Primary education	1.21	0.05	0.000	3.36	3.04	3.72
Lower secondary education	0.95	0.03	0.000	2.59	2.46	2.73
Upper secondary education	0.66	0.02	0.000	1.94	1.86	2.03

Post-secondary non-tertiary education	0.74	0.03	0.000	2.09	1.98	2.22
Unemployed	1.80	0.02	0.000	6.05	5.86	6.26
Retired	-0.59	0.02	0.000	0.55	0.53	0.57
Chronic illness	1.12	0.02	0.000	3.08	2.98	3.17
Below poverty line	1.74	0.02	0.000	5.69	5.52	5.87
Apartment in building with >=10 units	0.55	0.02	0.000	1.72	1.66	1.80
Apartment in building with <10 units	1.54	0.02	0.000	4.65	4.44	4.87
Semi-detached house	1.12	0.03	0.000	3.07	2.88	3.26
Accommodation provided free	0.21	0.03	0.000	1.23	1.16	1.30
Tenant paying below market rate	1.86	0.02	0.000	6.39	6.13	6.68
Tenant paying market rate	0.87	0.02	0.000	2.38	2.29	2.48
One person household	0.17	0.02	0.000	1.18	1.13	1.24
2 adults, dependent children, at least one adult >=65 years	-1.20	0.05	0.000	0.30	0.27	0.33
Other households without dependent children	0.14	0.03	0.000	1.15	1.09	1.21
Single parent household, one or more dependent children	1.10	0.03	0.000	3.00	2.83	3.17
2 adults, one dependent child	-0.33	0.03	0.000	0.72	0.68	0.77
2 adults, two dependent children	0.47	0.03	0.000	1.60	1.51	1.70
2 adults, three or more dependent children	-0.81	0.05	0.000	0.44	0.40	0.49
Other households with dependent children	-0.10	0.03	0.000	0.91	0.86	0.96
Other household type	-20.94	0.00		0.00	0.00	0.00
Thinly populated area	0.39	0.02	0.000	1.47	1.43	1.52
Note: Pseudo R^2=.18 (Cox & Snell), .21 (Nagelkerke). Model χ^2 (75)= 169425.05, p <.001. Percentage Correct Prediction 55.1%						

Table 4-19 Multinomial logistic regression model of CIFP in Malta. Data: EU-SILC 2010

Malta	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-2.33	0.04	0.000			
Pre-primary education	-0.28	0.13	0.031	0.75	0.58	0.97
Primary education	0.61	0.03	0.000	1.84	1.75	1.94
Lower secondary education	0.48	0.02	0.000	1.62	1.56	1.68
Upper secondary education	0.28	0.02	0.000	1.33	1.27	1.38
Post-secondary non-tertiary education	-0.26	0.05	0.000	0.77	0.69	0.85
Unemployed	0.51	0.02	0.000	1.67	1.60	1.75
Retired	-0.19	0.02	0.000	0.83	0.80	0.86
Chronic illness	0.35	0.01	0.000	1.43	1.39	1.47
Below poverty line	0.34	0.02	0.000	1.40	1.35	1.45
Apartment in building with >=10 units	0.06	0.06	0.257	1.07	0.95	1.19
Apartment in building with <10 units	0.26	0.03	0.000	1.29	1.21	1.38
Semi-detached house	0.40	0.03	0.000	1.49	1.39	1.60
Accommodation provided free	0.34	0.03	0.000	1.40	1.33	1.48
Tenant paying below market rate	0.55	0.02	0.000	1.73	1.67	1.79
Tenant paying market rate	0.44	0.05	0.000	1.55	1.41	1.70
One person household	0.06	0.03	0.035	1.06	1.00	1.11
2 adults, dependent children, at least one adult >=65 years	-0.05	0.03	0.114	0.95	0.90	1.01
Other households without dependent children	0.15	0.03	0.000	1.17	1.11	1.23
Single parent household, one or more dependent children	0.34	0.05	0.000	1.41	1.29	1.54
2 adults, one dependent child	-0.04	0.03	0.215	0.96	0.91	1.02
2 adults, two dependent children	0.03	0.03	0.326	1.03	0.97	1.09
2 adults, three or more dependent children	0.14	0.04	0.001	1.15	1.06	1.25
Other households with dependent children	0.40	0.03	0.000	1.49	1.41	1.57
Thinly populated or intermediate area	0.40	0.02	0.000	1.50	1.43	1.56
2 indicators versus 0						
Intercept	-4.05	0.08	0.000			
Pre-primary education	-18.92	2580.33	0.994	0.00	0.00	
Primary education	0.80	0.05	0.000	2.22	2.00	2.46
Lower secondary education	0.79	0.04	0.000	2.20	2.02	2.40
Upper secondary education	0.23	0.05	0.000	1.25	1.14	1.38
Post-secondary non-tertiary education	0.03	0.11	0.797	1.03	0.83	1.28
Unemployed	0.64	0.04	0.000	1.90	1.74	2.07
Retired	-0.30	0.03	0.000	0.74	0.69	0.79
Chronic illness	0.93	0.03	0.000	2.54	2.40	2.70
Below poverty line	0.53	0.03	0.000	1.69	1.59	1.80
Apartment in building with >=10 units	-0.54	0.13	0.000	0.58	0.45	0.75
Apartment in building with <10 units	-0.09	0.06	0.142	0.91	0.80	1.03
Semi-detached house	0.43	0.06	0.000	1.53	1.36	1.73
Accommodation provided free	0.21	0.05	0.000	1.23	1.10	1.37
Tenant paying below market rate	0.84	0.03	0.000	2.31	2.17	2.46
Tenant paying market rate	-0.14	0.10	0.184	0.87	0.71	1.07
One person household	-0.11	0.05	0.017	0.90	0.82	0.98
2 adults, dependent children, at least one adult >=65 years	-0.74	0.06	0.000	0.48	0.43	0.53
Other households without dependent children	-0.75	0.05	0.000	0.47	0.42	0.52
Single parent household, one or more dependent children	1.34	0.06	0.000	3.82	3.38	4.32
2 adults, one dependent child	-0.73	0.07	0.000	0.48	0.42	0.55
2 adults, two dependent children	-0.87	0.07	0.000	0.42	0.36	0.48
2 adults, three or more dependent children	0.15	0.08	0.052	1.16	1.00	1.34

Other households with dependent children	0.15	0.05	0.004	1.16	1.05	1.28
Thinly populated or intermediate area	0.80	0.04	0.000	2.23	2.08	2.40
3 indicators versus 0						
Intercept	-25.78	0.30	0.000			
Pre-primary education	-15.78	2887.41	0.996	0.00	0.00	
Primary education	1.73	0.25	0.000	5.66	3.46	9.26
Lower secondary education	0.17	0.24	0.476	1.19	0.74	1.92
Upper secondary education	1.29	0.24	0.000	3.65	2.28	5.85
Post-secondary non-tertiary education	-15.50	1560.94	0.992	0.00	0.00	
Unemployed	1.50	0.13	0.000	4.48	3.48	5.77
Retired	-0.64	0.13	0.000	0.53	0.41	0.68
Chronic illness	0.42	0.11	0.000	1.53	1.23	1.89
Below poverty line	1.82	0.11	0.000	6.20	5.04	7.63
Apartment in building with >=10 units	18.31	0.18	0.000	89929009.58	63311569.44	127736949.76
Apartment in building with <10 units	16.78	0.11	0.000	19326325.42	15659734.89	23851416.18
Semi-detached house	16.80	0.00		19863654.28	19863654.28	19863654.28
Accommodation provided free	3.09	0.15	0.000	21.88	16.38	29.23
Tenant paying below market rate	2.61	0.13	0.000	13.66	10.49	17.79
Tenant paying market rate	-15.26	1090.05	0.989	0.00	0.00	.
One person household	0.06	0.19	0.733	1.07	0.74	1.54
2 adults, dependent children, at least one adult >=65 years	0.48	0.21	0.024	1.62	1.07	2.45
Other households without dependent children	0.38	0.24	0.108	1.47	0.92	2.34
Single parent household, one or more dependent children	1.51	0.24	0.000	4.52	2.80	7.27
2 adults, one dependent child	0.71	0.25	0.004	2.04	1.26	3.32
2 adults, two dependent children	-15.70	535.20	0.977	0.00	0.00	
2 adults, three or more dependent children	0.92	0.27	0.001	2.50	1.47	4.26
Other households with dependent children	0.99	0.22	0.000	2.69	1.74	4.17
Thinly populated or intermediate area	0.98	0.14	0.000	2.66	2.03	3.47
Note: Pseudo R^2=.09 (Cox & Snell), .12 (Nagelkerke). Model χ^2 (72)= 13402.47, *p* <.001. Percentage Correct Prediction 73.5%						

Table 4-20 Multinomial logistic regression model of CIFP in the Netherlands. Data: EU-SILC 2010

Netherlands	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-1.79	0.00	0.000			
Pre-primary education	0.87	0.02	0.000	2.38	2.29	2.47
Primary education	-0.54	0.01	0.000	0.58	0.58	0.59
Lower secondary education	0.13	0.00	0.000	1.14	1.14	1.15
Upper secondary education	-0.09	0.00	0.000	0.92	0.91	0.92
Post-secondary non-tertiary education	0.01	0.01	0.015	1.01	1.00	1.02
Unemployed	0.38	0.00	0.000	1.46	1.45	1.47
Retired	-0.54	0.00	0.000	0.58	0.58	0.59
Chronic illness	0.26	0.00	0.000	1.30	1.29	1.30
Below poverty line	0.45	0.00	0.000	1.56	1.55	1.57
Apartment in building with >=10 units	-0.63	0.00	0.000	0.53	0.53	0.53
Apartment in building with <10 units	-0.19	0.00	0.000	0.83	0.82	0.83
Semi-detached house	-0.30	0.00	0.000	0.74	0.74	0.75
Accommodation provided free	-0.87	0.03	0.000	0.42	0.40	0.44
Tenant paying market rate	0.83	0.00	0.000	2.29	2.27	2.30
One person household	0.04	0.00	0.000	1.04	1.03	1.05
2 adults, dependent children, at least one adult >=65 years	-0.43	0.01	0.000	0.65	0.64	0.65
Other households without dependent children	0.09	0.01	0.000	1.10	1.09	1.11
Single parent household, one or more dependent children	0.32	0.01	0.000	1.38	1.36	1.39
2 adults, one dependent child	0.20	0.00	0.000	1.22	1.21	1.23
2 adults, two dependent children	0.29	0.00	0.000	1.34	1.33	1.35
2 adults, three or more dependent children	0.20	0.01	0.000	1.22	1.20	1.23
Other households with dependent children	0.17	0.01	0.000	1.19	1.17	1.20
2 indicators versus 0						
Intercept	-6.92	0.02	0.000			
Pre-primary education	3.09	0.03	0.000	21.99	20.93	23.09
Primary education	-1.39	0.02	0.000	0.25	0.24	0.26
Lower secondary education	0.95	0.01	0.000	2.59	2.54	2.63
Upper secondary education	0.40	0.01	0.000	1.49	1.46	1.52
Post-secondary non-tertiary education	-0.41	0.03	0.000	0.67	0.63	0.70
Unemployed	1.74	0.01	0.000	5.70	5.60	5.80
Retired	-1.20	0.02	0.000	0.30	0.29	0.31
Chronic illness	0.95	0.01	0.000	2.60	2.56	2.63
Below poverty line	0.90	0.01	0.000	2.45	2.41	2.48
Apartment in building with >=10 units	-0.11	0.02	0.000	0.90	0.86	0.94
Apartment in building with <10 units	1.08	0.02	0.000	2.95	2.83	3.09
Semi-detached house	0.76	0.02	0.000	2.15	2.06	2.23
Accommodation provided free	-21.03	2064.11	0.992	0.00	0.00	
Tenant paying market rate	0.83	0.01	0.000	2.30	2.26	2.34
One person household	1.37	0.01	0.000	3.94	3.84	4.04
2 adults, dependent children, at least one adult >=65 years	0.02	0.03	0.380	1.02	0.97	1.08
Other households without dependent children	-0.87	0.04	0.000	0.42	0.38	0.46
Single parent household, one or more dependent children	2.23	0.02	0.000	9.28	9.00	9.56
2 adults, one dependent child	0.20	0.02	0.000	1.22	1.18	1.27
2 adults, two dependent children	-0.04	0.02	0.050	0.96	0.92	1.00

2 adults, three or more dependent children	1.40	0.02	0.000	4.06	3.92	4.21
Other households with dependent children	-19.91	827.81	0.981	0.00	0.00	
3 indicators versus 0						
Intercept	-30.84	0.07	0.000			
Pre-primary education	-17.57	0.00		0.00	0.00	0.00
Primary education	-18.92	825.97	0.982	0.00	0.00	
Lower secondary education	2.37	0.04	0.000	10.65	9.80	11.56
Upper secondary education	1.52	0.04	0.000	4.55	4.20	4.93
Post-secondary non-tertiary education	-19.05	1048.08	0.985	0.00	0.00	
Unemployed	-21.88	957.97	0.982	0.00	0.00	
Retired	-19.93	443.48	0.964	0.00	0.00	
Chronic illness	2.86	0.03	0.000	17.38	16.46	18.35
Below poverty line	2.69	0.02	0.000	14.70	14.08	15.35
Apartment in building with >=10 units	-3.97	0.07	0.000	0.02	0.02	0.02
Apartment in building with <10 units	-0.38	0.06	0.000	0.68	0.61	0.77
Semi-detached house	-1.91	0.06	0.000	0.15	0.13	0.17
Accommodation provided free	-14.56	2596.97	0.996	0.00	0.00	
Tenant paying market rate	4.03	0.05	0.000	56.43	50.69	62.81
One person household	19.39	0.04	0.000	264639937.46	243137010.34	288044573.71
2 adults, dependent children, at least one adult >=65 years	1.12	594.61	0.998	3.08	0.00	
Other households without dependent children	0.38	1179.01	1.000	1.47	0.00	
Single parent household, one or more dependent children	-2.22	980.66	0.998	0.11	0.00	
2 adults, one dependent child	19.63	0.06	0.000	336647446.92	300478341.40	377170291.17
2 adults, two dependent children	21.27	0.04	0.000	1729593432.59	1587787080.39	1884064607.28
2 adults, three or more dependent children	-0.93	797.58	0.999	0.39	0.00	
Other households with dependent children	23.01	0.00		9807971730.51	9807971730.51	9807971730.51
Note: Pseudo R^2=.09 (Cox & Snell), .13 (Nagelkerke). Model χ^2 (66)= 618410.97, *p* <.001. Percentage Correct Prediction 82.2%						

Table 4-21 Multinomial logistic regression model of CIFP in Poland. Data: EU-SILC 2010

Poland	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-2.06	0.00	0.000			
Pre-primary education	1.11	0.01	0.000	3.03	2.99	3.06
Primary education	0.87	0.00	0.000	2.40	2.38	2.41
Lower secondary education	0.60	0.01	0.000	1.83	1.79	1.87
Upper secondary education	0.60	0.00	0.000	1.82	1.82	1.83
Post-secondary non-tertiary education	0.40	0.00	0.000	1.50	1.49	1.51
Unemployed	0.46	0.00	0.000	1.58	1.57	1.59
Retired	-0.14	0.00	0.000	0.87	0.87	0.87
Chronic illness	0.37	0.00	0.000	1.44	1.44	1.45
Below poverty line	0.65	0.00	0.000	1.92	1.92	1.93
Apartment in building with >=10 units	-0.26	0.00	0.000	0.77	0.77	0.77
Apartment in building with <10 units	0.38	0.00	0.000	1.46	1.46	1.47
Semi-detached house	0.30	0.00	0.000	1.35	1.34	1.36
Accommodation provided free	0.62	0.00	0.000	1.85	1.85	1.86
Tenant paying below market rate	0.71	0.01	0.000	2.03	2.01	2.05
Tenant paying market rate	0.52	0.00	0.000	1.68	1.67	1.70
One person household	0.10	0.00	0.000	1.10	1.09	1.11
2 adults, dependent children, at least one adult >=65 years	-0.09	0.00	0.000	0.91	0.91	0.92
Other households without dependent children	0.04	0.00	0.000	1.04	1.04	1.05
Single parent household, one or more dependent children	0.55	0.01	0.000	1.74	1.72	1.75
2 adults, one dependent child	0.08	0.00	0.000	1.09	1.08	1.09
2 adults, two dependent children	0.06	0.00	0.000	1.07	1.06	1.07
2 adults, three or more dependent children	0.10	0.00	0.000	1.10	1.09	1.11
Other households with dependent children	0.05	0.00	0.000	1.05	1.04	1.06
Other household type	0.03	0.00	0.000	1.03	1.02	1.04
Thinly populated area	0.06	0.00	0.000	1.06	1.06	1.06
Intermediate area	0.00	0.00	0.448	1.00	1.00	1.01
2 indicators versus 0						
Intercept	-4.01	0.01	0.000			
Pre-primary education	1.85	0.01	0.000	6.34	6.23	6.45
Primary education	1.61	0.00	0.000	4.98	4.93	5.03
Lower secondary education	1.89	0.01	0.000	6.63	6.48	6.77
Upper secondary education	1.18	0.00	0.000	3.27	3.25	3.29
Post-secondary non-tertiary education	1.07	0.01	0.000	2.91	2.88	2.94
Unemployed	0.77	0.00	0.000	2.16	2.15	2.17
Retired	-0.20	0.00	0.000	0.82	0.82	0.83
Chronic illness	0.54	0.00	0.000	1.71	1.70	1.72
Below poverty line	1.24	0.00	0.000	3.47	3.45	3.48
Apartment in building with >=10 units	-0.83	0.00	0.000	0.44	0.43	0.44
Apartment in building with <10 units	0.43	0.00	0.000	1.54	1.53	1.55
Semi-detached house	0.12	0.01	0.000	1.13	1.12	1.14
Accommodation provided free	0.98	0.00	0.000	2.66	2.64	2.67
Tenant paying below market rate	1.08	0.01	0.000	2.96	2.91	3.01
Tenant paying market rate	0.88	0.01	0.000	2.41	2.38	2.44
One person household	0.27	0.00	0.000	1.31	1.30	1.32
2 adults, dependent children, at least one adult >=65 years	-0.08	0.01	0.000	0.93	0.92	0.94
Other households without dependent children	0.25	0.00	0.000	1.28	1.27	1.29
Single parent household, one or more dependent children	0.95	0.01	0.000	2.59	2.56	2.63
2 adults, one dependent child	0.32	0.01	0.000	1.37	1.36	1.39
2 adults, two dependent children	0.14	0.01	0.000	1.15	1.13	1.16
2 adults, three or more dependent children	0.47	0.01	0.000	1.60	1.58	1.62
Other households with dependent children	0.01	0.00	0.016	1.01	1.00	1.02
Other household type	0.36	0.01	0.000	1.43	1.41	1.45
Thinly populated area	-0.05	0.00	0.000	0.95	0.94	0.96
Intermediate area	-0.16	0.00	0.000	0.85	0.85	0.86
3 indicators versus 0						
Intercept	-5.75	0.01	0.000			
Pre-primary education	2.32	0.02	0.000	10.18	9.87	10.49
Primary education	2.08	0.01	0.000	7.97	7.83	8.12

Lower secondary education	1.95	0.02	0.000	7.02	6.79	7.25
Upper secondary education	1.30	0.01	0.000	3.68	3.62	3.73
Post-secondary non-tertiary education	1.09	0.01	0.000	2.98	2.92	3.05
Unemployed	1.39	0.00	0.000	4.01	3.97	4.05
Retired	-0.89	0.01	0.000	0.41	0.41	0.41
Chronic illness	0.98	0.00	0.000	2.67	2.65	2.70
Below poverty line	1.89	0.00	0.000	6.62	6.56	6.67
Apartment in building with >=10 units	-0.94	0.01	0.000	0.39	0.39	0.40
Apartment in building with <10 units	-0.03	0.01	0.000	0.97	0.96	0.98
Semi-detached house	0.30	0.01	0.000	1.35	1.33	1.37
Accommodation provided free	1.36	0.00	0.000	3.90	3.86	3.93
Tenant paying below market rate	1.56	0.01	0.000	4.77	4.64	4.89
Tenant paying market rate	0.50	0.01	0.000	1.64	1.60	1.69
One person household	0.14	0.01	0.000	1.15	1.13	1.17
2 adults, dependent children, at least one adult >=65 years	0.22	0.01	0.000	1.24	1.22	1.27
Other households without dependent children	0.13	0.01	0.000	1.14	1.12	1.16
Single parent household, one or more dependent children	1.02	0.01	0.000	2.78	2.72	2.84
2 adults, one dependent child	0.28	0.01	0.000	1.32	1.30	1.35
2 adults, two dependent children	-0.70	0.01	0.000	0.50	0.49	0.51
2 adults, three or more dependent children	0.37	0.01	0.000	1.44	1.41	1.47
Other households with dependent children	0.11	0.01	0.000	1.11	1.10	1.13
Other household type	-0.27	0.02	0.000	0.76	0.74	0.79
Thinly populated area	-0.36	0.00	0.000	0.70	0.69	0.71
Intermediate area	-0.24	0.01	0.000	0.78	0.77	0.80
Note: Pseudo R^2=.16 (Cox & Snell), .19 (Nagelkerke). Model χ^2 (78)= 2246356.00, p <.001. Percentage Correct Prediction 68.3%						

Table 4-22 Multinomial logistic regression model of CIFP in Portugal. Data: EU-SILC 2010

Portugal	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-2.06	0.01	0.000			
Primary education	0.98	0.00	0.000	2.66	2.64	2.68
Lower secondary education	0.85	0.00	0.000	2.35	2.33	2.37
Upper secondary education	0.47	0.00	0.000	1.59	1.58	1.61
Post-secondary non-tertiary education	0.28	0.01	0.000	1.33	1.29	1.37
Unemployed	0.42	0.00	0.000	1.52	1.51	1.53
Retired	-0.02	0.00	0.000	0.98	0.97	0.98
Chronic illness	0.52	0.00	0.000	1.68	1.67	1.69
Below poverty line	0.55	0.00	0.000	1.73	1.72	1.74
Apartment in building with >=10 units	-0.18	0.00	0.000	0.83	0.83	0.84
Apartment in building with <10 units	-0.02	0.00	0.000	0.98	0.98	0.99
Semi-detached house	0.27	0.00	0.000	1.31	1.31	1.32
Accommodation provided free	0.20	0.01	0.000	1.23	1.21	1.24
Tenant paying below market rate	0.74	0.01	0.000	2.10	2.08	2.13
Tenant paying market rate	0.77	0.00	0.000	2.15	2.14	2.17
One person household	0.32	0.00	0.000	1.38	1.37	1.39
2 adults, dependent children, at least one adult >=65 years	-0.09	0.01	0.000	0.91	0.90	0.92
Other households without dependent children	0.59	0.00	0.000	1.81	1.80	1.83
Single parent household, one or more dependent children	0.87	0.01	0.000	2.39	2.36	2.42
2 adults, one dependent child	0.38	0.00	0.000	1.47	1.45	1.48
2 adults, two dependent children	0.60	0.01	0.000	1.83	1.81	1.85
2 adults, three or more dependent children	0.39	0.01	0.000	1.47	1.44	1.50
Other households with dependent children	0.62	0.01	0.000	1.86	1.84	1.88
Other household type	0.92	0.03	0.000	2.50	2.38	2.63
Thinly populated area	-0.27	0.00	0.000	0.77	0.76	0.77
Intermediate area	-0.17	0.00	0.000	0.84	0.84	0.85
2 indicators versus 0						
Intercept	-4.03	0.01	0.000			
Primary education	1.38	0.01	0.000	3.98	3.93	4.04
Lower secondary education	1.05	0.01	0.000	2.87	2.83	2.91
Upper secondary education	0.23	0.01	0.000	1.26	1.24	1.28
Post-secondary non-tertiary education	0.92	0.02	0.000	2.51	2.41	2.61
Unemployed	0.51	0.00	0.000	1.66	1.65	1.68
Retired	-0.39	0.01	0.000	0.68	0.67	0.69
Chronic illness	1.05	0.00	0.000	2.87	2.84	2.89
Below poverty line	0.84	0.00	0.000	2.32	2.30	2.34
Apartment in building with >=10 units	-0.13	0.01	0.000	0.88	0.87	0.89
Apartment in building with <10 units	-0.18	0.01	0.000	0.84	0.83	0.84
Semi-detached house	0.12	0.01	0.000	1.13	1.12	1.14
Accommodation provided free	1.18	0.01	0.000	3.25	3.21	3.29
Tenant paying below market rate	1.63	0.01	0.000	5.11	5.04	5.19
Tenant paying market rate	1.23	0.01	0.000	3.42	3.39	3.46
One person household	0.36	0.01	0.000	1.43	1.41	1.45
2 adults, dependent children, at least one adult >=65 years	0.09	0.01	0.000	1.10	1.08	1.11
Other households without dependent children	0.66	0.01	0.000	1.94	1.91	1.96
Single parent household, one or more dependent children	0.86	0.01	0.000	2.37	2.32	2.43
2 adults, one dependent child	0.50	0.01	0.000	1.65	1.62	1.67
2 adults, two dependent children	0.52	0.01	0.000	1.68	1.66	1.71
2 adults, three or more dependent children	0.23	0.02	0.000	1.25	1.21	1.29
Other households with dependent children	0.85	0.01	0.000	2.34	2.30	2.38
Other household type	1.24	0.03	0.000	3.46	3.27	3.67
Thinly populated area	-0.35	0.01	0.000	0.70	0.70	0.71
Intermediate area	-0.03	0.00	0.000	0.97	0.96	0.98
3 indicators versus 0						
Intercept	-6.74	0.03	0.000			
Primary education	1.54	0.02	0.000	4.68	4.49	4.87
Lower secondary education	0.60	0.02	0.000	1.83	1.75	1.90

Upper secondary education	-0.71	0.03	0.000	0.49	0.47	0.52
Post-secondary non-tertiary education	-22.76	7068.17	0.997	0.00	0.00	.d
Unemployed	2.12	0.01	0.000	8.29	8.10	8.50
Retired	-1.11	0.02	0.000	0.33	0.32	0.34
Chronic illness	1.11	0.01	0.000	3.04	2.97	3.12
Below poverty line	1.29	0.01	0.000	3.64	3.56	3.72
Apartment in building with >=10 units	-1.11	0.02	0.000	0.33	0.32	0.34
Apartment in building with <10 units	-1.50	0.02	0.000	0.22	0.22	0.23
Semi-detached house	-0.09	0.01	0.000	0.92	0.89	0.94
Accommodation provided free	0.73	0.02	0.000	2.07	2.00	2.15
Tenant paying below market rate	2.35	0.02	0.000	10.45	10.11	10.79
Tenant paying market rate	1.91	0.01	0.000	6.75	6.58	6.94
One person household	1.47	0.02	0.000	4.34	4.17	4.53
2 adults, dependent children, at least one adult >=65 years	0.72	0.03	0.000	2.05	1.94	2.16
Other households without dependent children	-0.42	0.03	0.000	0.66	0.62	0.70
Single parent household, one or more dependent children	2.76	0.02	0.000	15.85	15.11	16.62
2 adults, one dependent child	0.68	0.02	0.000	1.97	1.88	2.06
2 adults, two dependent children	0.09	0.03	0.005	1.09	1.03	1.16
2 adults, three or more dependent children	2.53	0.02	0.000	12.61	12.03	13.23
Other households with dependent children	1.57	0.02	0.000	4.78	4.58	5.00
Other household type	-23.42	0.00		0.00	0.00	0.00
Thinly populated area	-0.90	0.02	0.000	0.41	0.40	0.42
Intermediate area	-1.05	0.01	0.000	0.35	0.34	0.36

Note: Pseudo R^2=.18 (Cox & Snell), .21 (Nagelkerke). Model χ^2 (75)= 720602.26, p <.001. Percentage Correct Prediction 60.4%

Table 4-23 Multinomial logistic regression model of CIFP in Romania. Data: EU-SILC 2010

Romania	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-1.34	0.00	0.000			
Primary education	0.89	0.00	0.000	2.43	2.41	2.45
Lower secondary education	0.97	0.00	0.000	2.63	2.62	2.65
Upper secondary education	0.61	0.00	0.000	1.85	1.84	1.86
Post-secondary non-tertiary education	0.17	0.00	0.000	1.18	1.17	1.19
Unemployed	0.40	0.00	0.000	1.50	1.49	1.51
Retired	0.02	0.00	0.000	1.02	1.01	1.02
Chronic illness	0.23	0.00	0.000	1.25	1.25	1.26
Below poverty line	0.49	0.00	0.000	1.63	1.63	1.64
Apartment in building with >=10 units	-0.06	0.00	0.000	0.95	0.94	0.95
Apartment in building with <10 units	-0.57	0.01	0.000	0.56	0.56	0.57
Semi-detached house	0.64	0.01	0.000	1.89	1.86	1.91
Accommodation provided free	1.05	0.01	0.000	2.85	2.79	2.91
Tenant paying below market rate	0.84	0.01	0.000	2.32	2.26	2.37
Tenant paying market rate	0.62	0.01	0.000	1.87	1.84	1.90
One person household	0.39	0.00	0.000	1.48	1.47	1.49
2 adults, dependent children, at least one adult >=65 years	0.17	0.00	0.000	1.19	1.18	1.20
Other households without dependent children	0.17	0.00	0.000	1.18	1.18	1.19
Single parent household, one or more dependent children	0.66	0.01	0.000	1.94	1.91	1.96
2 adults, one dependent child	0.25	0.00	0.000	1.28	1.27	1.29
2 adults, two dependent children	0.00	0.00	0.582	1.00	0.99	1.01
2 adults, three or more dependent children	0.50	0.01	0.000	1.66	1.63	1.68
Other households with dependent children	0.38	0.00	0.000	1.47	1.46	1.48
Other household type	0.27	0.02	0.000	1.31	1.26	1.36
Thinly populated area	-0.47	0.00	0.000	0.63	0.62	0.63
Intermediate area	-0.25	0.01	0.000	0.78	0.77	0.79
2 indicators versus 0						
Intercept	-3.06	0.01	0.000			
Primary education	2.09	0.01	0.000	8.06	7.96	8.17
Lower secondary education	2.06	0.01	0.000	7.83	7.74	7.92
Upper secondary education	1.42	0.00	0.000	4.14	4.11	4.18
Post-secondary non-tertiary education	0.70	0.01	0.000	2.02	1.99	2.05
Unemployed	0.87	0.00	0.000	2.39	2.37	2.41
Retired	-0.12	0.00	0.000	0.89	0.88	0.89
Chronic illness	0.59	0.00	0.000	1.80	1.79	1.81
Below poverty line	0.77	0.00	0.000	2.16	2.15	2.18
Apartment in building with >=10 units	0.01	0.00	0.140	1.01	1.00	1.01
Apartment in building with <10 units	0.09	0.01	0.000	1.10	1.08	1.11
Semi-detached house	0.03	0.01	0.006	1.03	1.01	1.05
Accommodation provided free	1.31	0.01	0.000	3.70	3.61	3.79
Tenant paying below market rate	0.48	0.02	0.000	1.62	1.56	1.67
Tenant paying market rate	0.97	0.01	0.000	2.65	2.60	2.70
One person household	0.31	0.00	0.000	1.36	1.35	1.38
2 adults, dependent children, at least one adult >=65 years	0.05	0.01	0.000	1.05	1.04	1.07
Other households without dependent children	0.25	0.01	0.000	1.29	1.27	1.30
Single parent household, one or more dependent children	0.00	0.01	0.967	1.00	0.98	1.02
2 adults, one dependent child	0.19	0.01	0.000	1.21	1.20	1.22
2 adults, two dependent children	-0.03	0.01	0.000	0.97	0.96	0.98
2 adults, three or more dependent children	0.66	0.01	0.000	1.94	1.91	1.97
Other households with dependent children	0.22	0.01	0.000	1.25	1.23	1.26
Other household type	0.14	0.03	0.000	1.16	1.09	1.23
Thinly populated area	-0.79	0.00	0.000	0.45	0.45	0.46
Intermediate area	-0.59	0.01	0.000	0.55	0.54	0.57
3 indicators versus 0						
Intercept	-4.06	0.01	0.000			
Primary education	1.97	0.01	0.000	7.19	7.05	7.33
Lower secondary education	1.77	0.01	0.000	5.90	5.80	6.00

Upper secondary education	1.07	0.01	0.000	2.90	2.86	2.94
Post-secondary non-tertiary education	-0.26	0.01	0.000	0.77	0.75	0.79
Unemployed	0.99	0.01	0.000	2.68	2.65	2.71
Retired	-0.27	0.01	0.000	0.76	0.76	0.77
Chronic illness	0.74	0.00	0.000	2.10	2.08	2.12
Below poverty line	0.96	0.00	0.000	2.61	2.59	2.64
Apartment in building with >=10 units	-0.20	0.01	0.000	0.82	0.81	0.83
Apartment in building with <10 units	-1.68	0.02	0.000	0.19	0.18	0.19
Semi-detached house	1.36	0.01	0.000	3.89	3.82	3.97
Accommodation provided free	1.84	0.01	0.000	6.29	6.12	6.47
Tenant paying below market rate	2.33	0.02	0.000	10.23	9.93	10.54
Tenant paying market rate	1.65	0.01	0.000	5.22	5.09	5.36
One person household	0.61	0.01	0.000	1.84	1.81	1.87
2 adults, dependent children, at least one adult >=65 years	0.05	0.01	0.000	1.05	1.03	1.08
Other households without dependent children	0.91	0.01	0.000	2.48	2.44	2.52
Single parent household, one or more dependent children	1.06	0.01	0.000	2.89	2.81	2.98
2 adults, one dependent child	0.27	0.01	0.000	1.31	1.29	1.34
2 adults, two dependent children	0.44	0.01	0.000	1.55	1.52	1.57
2 adults, three or more dependent children	1.70	0.01	0.000	5.45	5.33	5.57
Other households with dependent children	1.06	0.01	0.000	2.88	2.84	2.93
Other household type	-23.74	9484.70	0.998	0.00	0.00	
Thinly populated area	-1.04	0.01	0.000	0.35	0.35	0.36
Intermediate area	-1.47	0.03	0.000	0.23	0.22	0.24

Note: Pseudo R^2=.12 (Cox & Snell), .13 (Nagelkerke). Model χ^2 (75)= 897909.39, p <.001. Percentage Correct Prediction 55.7%

Table 4-24 Multinomial logistic regression model of CIFP in Sweden. Data: EU-SILC 2010

Sweden	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-2.33	0.01	0.000			
Primary education	-0.20	0.01	0.000	0.82	0.81	0.83
Lower secondary education	0.36	0.01	0.000	1.43	1.41	1.45
Upper secondary education	0.10	0.00	0.000	1.10	1.10	1.11
Post-secondary non-tertiary education	-0.02	0.01	0.018	0.98	0.97	1.00
Unemployed	0.52	0.01	0.000	1.69	1.67	1.70
Retired	-0.38	0.01	0.000	0.68	0.67	0.69
Chronic illness	0.43	0.00	0.000	1.53	1.52	1.54
Below poverty line	0.36	0.00	0.000	1.44	1.43	1.45
Apartment in building with >=10 units	-0.39	0.00	0.000	0.68	0.67	0.69
Apartment in building with <10 units	-0.23	0.01	0.000	0.79	0.78	0.80
Semi-detached house	-0.25	0.01	0.000	0.78	0.77	0.79
Tenant paying below market rate	-0.68	0.03	0.000	0.51	0.47	0.54
Tenant paying market rate	0.68	0.00	0.000	1.98	1.96	1.99
One person household	0.03	0.00	0.000	1.03	1.02	1.04
2 adults, dependent children, at least one adult >=65 years	-0.17	0.01	0.000	0.84	0.83	0.86
Other households without dependent children	0.12	0.01	0.000	1.13	1.10	1.16
Single parent household, one or more dependent children	0.44	0.01	0.000	1.55	1.53	1.57
2 adults, one dependent child	0.16	0.01	0.000	1.17	1.16	1.19
2 adults, two dependent children	0.22	0.01	0.000	1.25	1.23	1.26
2 adults, three or more dependent children	0.30	0.01	0.000	1.35	1.33	1.37
Other households with dependent children	0.12	0.01	0.000	1.13	1.10	1.15
Other household type	0.78	0.02	0.000	2.18	2.11	2.25
Thinly populated area	-0.12	0.00	0.000	0.89	0.88	0.89
Intermediate area	-0.20	0.01	0.000	0.82	0.81	0.83
2 indicators versus 0						
Intercept	-4.51	0.02	0.000			
Primary education	-0.26	0.02	0.000	0.77	0.74	0.81
Lower secondary education	0.58	0.02	0.000	1.79	1.73	1.85
Upper secondary education	0.14	0.01	0.000	1.15	1.12	1.17
Post-secondary non-tertiary education	0.17	0.02	0.000	1.18	1.14	1.23
Unemployed	1.38	0.01	0.000	3.98	3.89	4.08
Retired	-0.32	0.01	0.000	0.73	0.71	0.75
Chronic illness	0.46	0.01	0.000	1.59	1.56	1.62
Below poverty line	0.70	0.01	0.000	2.02	1.98	2.06
Apartment in building with >=10 units	-2.17	0.01	0.000	0.11	0.11	0.12
Apartment in building with <10 units	-1.68	0.02	0.000	0.19	0.18	0.19
Semi-detached house	-1.66	0.03	0.000	0.19	0.18	0.20
Tenant paying below market rate	-21.04	1756.18	0.990	0.00	0.00	
Tenant paying market rate	0.83	0.01	0.000	2.29	2.24	2.35
One person household	1.37	0.02	0.000	3.94	3.81	4.07
2 adults, dependent children, at least one adult >=65 years	-0.13	0.03	0.000	0.88	0.83	0.93
Other households without dependent children	-0.03	0.04	0.384	0.97	0.89	1.04
Single parent household, one or more dependent children	1.51	0.02	0.000	4.53	4.36	4.71
2 adults, one dependent child	0.32	0.02	0.000	1.38	1.31	1.44
2 adults, two dependent children	0.38	0.02	0.000	1.47	1.41	1.53
2 adults, three or more dependent children	0.02	0.03	0.620	1.02	0.95	1.08
Other households with dependent children	0.27	0.03	0.000	1.30	1.22	1.39

Other household type	-19.84	1836.90	0.991	0.00	0.00	
Thinly populated area	-0.55	0.01	0.000	0.57	0.56	0.59
Intermediate area	-0.52	0.02	0.000	0.60	0.58	0.62
3 indicators versus 0						
Intercept	-25.95	0.06	0.000			
Primary education	-19.71	633.55	0.975	0.00	0.00	
Lower secondary education	0.34	0.04	0.000	1.41	1.30	1.53
Upper secondary education	-0.44	0.03	0.000	0.64	0.60	0.69
Post-secondary non-tertiary education	-19.22	602.92	0.975	0.00	0.00	
Unemployed	0.65	0.05	0.000	1.92	1.74	2.13
Retired	-0.91	0.04	0.000	0.40	0.37	0.43
Chronic illness	1.60	0.03	0.000	4.94	4.65	5.24
Below poverty line	0.35	0.03	0.000	1.42	1.33	1.51
Apartment in building with >=10 units	-2.79	0.04	0.000	0.06	0.06	0.07
Apartment in building with <10 units	-21.20	481.29	0.965	0.00	0.00	
Semi-detached house	-0.47	0.04	0.000	0.62	0.58	0.67
Tenant paying below market rate	-19.09	2838.55	0.995	0.00	0.00	
Tenant paying market rate	1.70	0.03	0.000	5.46	5.12	5.83
One person household	2.18	0.05	0.000	8.83	7.99	9.75
2 adults, dependent children, at least one adult >=65 years	-17.71	543.66	0.974	0.00	0.00	
Other households without dependent children	-18.90	1776.78	0.992	0.00	0.00	
Single parent household, one or more dependent children	1.47	0.06	0.000	4.35	3.83	4.93
2 adults, one dependent child	-18.63	776.33	0.981	0.00	0.00	
2 adults, two dependent children	-18.90	787.58	0.981	0.00	0.00	
2 adults, three or more dependent children	-19.20	1472.65	0.990	0.00	0.00	
Other households with dependent children	-18.74	1275.47	0.988	0.00	0.00	
Other household type	-18.47	2820.09	0.995	0.00	0.00	
Thinly populated area	18.18	0.03	0.000	78253666.98	73738274.84	83045560.92
Intermediate area	19.37	0.00		258060699.23	258060699.23	258060699.23
Note: Pseudo R^2=.05 (Cox & Snell), .08 (Nagelkerke). Model χ^2 (72)= 214506.35, *p* <.001. Percentage Correct Prediction 87.7%						

Table 4-25 Multinomial logistic regression model of CIFP in Slovenia. Data: EU-SILC 2010

Slovenia	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-1.25	0.01	0.000			
Primary education	0.66	0.02	0.000	1.93	1.86	2.00
Lower secondary education	0.54	0.01	0.000	1.72	1.69	1.76
Upper secondary education	0.42	0.01	0.000	1.51	1.50	1.53
Unemployed	0.61	0.01	0.000	1.84	1.81	1.87
Retired	0.06	0.01	0.000	1.06	1.04	1.07
Chronic illness	0.28	0.01	0.000	1.32	1.30	1.33
Below poverty line	0.43	0.01	0.000	1.53	1.51	1.56
Apartment in building with >=10 units	-0.24	0.01	0.000	0.78	0.77	0.79
Apartment in building with <10 units	0.26	0.01	0.000	1.29	1.27	1.32
Semi-detached house	0.13	0.01	0.000	1.14	1.11	1.17
Accommodation provided free	-0.06	0.01	0.000	0.94	0.93	0.95
Tenant paying below market rate	0.41	0.02	0.000	1.50	1.45	1.55
Tenant paying market rate	0.39	0.01	0.000	1.48	1.44	1.52
One person household	0.03	0.01	0.000	1.04	1.02	1.05
2 adults, dependent children, at least one adult >=65 years	0.04	0.01	0.001	1.04	1.01	1.06
Other households without dependent children	0.06	0.01	0.000	1.06	1.04	1.09
Single parent household, one or more dependent children	0.35	0.02	0.000	1.41	1.37	1.46
2 adults, one dependent child	0.16	0.01	0.000	1.17	1.15	1.20
2 adults, two dependent children	0.11	0.01	0.000	1.12	1.09	1.14
2 adults, three or more dependent children	0.19	0.02	0.000	1.21	1.17	1.25
Other households with dependent children	0.29	0.01	0.000	1.33	1.30	1.36
2 indicators versus 0						
Intercept	-3.24	0.02	0.000			
Primary education	2.21	0.02	0.000	9.14	8.73	9.57
Lower secondary education	1.52	0.02	0.000	4.58	4.43	4.73
Upper secondary education	1.10	0.01	0.000	3.02	2.95	3.09
Unemployed	0.80	0.01	0.000	2.22	2.17	2.27
Retired	-0.42	0.01	0.000	0.66	0.64	0.67
Chronic illness	0.58	0.01	0.000	1.79	1.76	1.82
Below poverty line	0.53	0.01	0.000	1.70	1.67	1.74
Apartment in building with >=10 units	-0.19	0.01	0.000	0.83	0.81	0.85
Apartment in building with <10 units	0.50	0.01	0.000	1.64	1.60	1.69
Semi-detached house	-0.08	0.02	0.001	0.92	0.88	0.97
Accommodation provided free	0.14	0.01	0.000	1.15	1.12	1.17
Tenant paying below market rate	0.25	0.02	0.000	1.28	1.23	1.34
Tenant paying market rate	0.61	0.02	0.000	1.84	1.78	1.91
One person household	0.26	0.02	0.000	1.30	1.26	1.34
2 adults, dependent children, at least one adult >=65 years	-0.31	0.02	0.000	0.74	0.71	0.77
Other households without dependent children	0.36	0.02	0.000	1.43	1.39	1.48
Single parent household, one or more dependent children	0.98	0.02	0.000	2.66	2.55	2.78
2 adults, one dependent child	0.12	0.02	0.000	1.12	1.08	1.16
2 adults, two dependent children	-0.18	0.02	0.000	0.84	0.81	0.87
2 adults, three or more dependent children	0.30	0.02	0.000	1.35	1.29	1.42
Other households with dependent children	0.55	0.02	0.000	1.73	1.66	1.80
3 indicators versus 0						
Intercept	-4.99	0.04	0.000			
Primary education	-23.97	0.00		0.00	0.00	0.00
Lower secondary education	0.92	0.04	0.000	2.51	2.33	2.71
Upper secondary education	0.60	0.03	0.000	1.81	1.70	1.93
Unemployed	1.41	0.03	0.000	4.11	3.91	4.32
Retired	-0.51	0.03	0.000	0.60	0.57	0.64
Chronic illness	0.55	0.02	0.000	1.73	1.66	1.81
Below poverty line	1.67	0.02	0.000	5.29	5.04	5.56
Apartment in building with >=10 units	-1.13	0.03	0.000	0.32	0.30	0.34
Apartment in building with <10 units	-0.09	0.04	0.010	0.91	0.85	0.98
Semi-detached house	-0.80	0.07	0.000	0.45	0.39	0.51
Accommodation provided free	-0.87	0.04	0.000	0.42	0.39	0.45
Tenant paying below market rate	0.67	0.05	0.000	1.96	1.78	2.15

Tenant paying market rate	1.33	0.04	0.000	3.78	3.53	4.05
One person household	0.37	0.04	0.000	1.45	1.35	1.56
2 adults, dependent children, at least one adult >=65 years	0.13	0.05	0.007	1.14	1.04	1.26
Other households without dependent children	-0.04	0.05	0.363	0.96	0.88	1.05
Single parent household, one or more dependent children	1.21	0.05	0.000	3.34	3.05	3.66
2 adults, one dependent child	-0.19	0.05	0.000	0.82	0.75	0.91
2 adults, two dependent children	-0.69	0.05	0.000	0.50	0.45	0.55
2 adults, three or more dependent children	-0.09	0.06	0.136	0.91	0.81	1.03
Other households with dependent children	0.29	0.05	0.000	1.33	1.21	1.46
Note: Pseudo R^2=.11 (Cox & Snell), .13 (Nagelkerke). Model χ^2 (63)= 92237.67, *p* <.001. Percentage Correct Prediction 58.2%						

Table 4-26 Multinomial logistic regression model of CIFP in Slovakia. Data: EU-SILC 2010

Slovakia	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-2.04	0.01	0.000			
Pre-primary education	-19.25	2477.49	0.994	0.00	0.00	
Primary education	0.89	0.02	0.000	2.44	2.33	2.55
Lower secondary education	0.70	0.01	0.000	2.01	1.97	2.04
Upper secondary education	0.12	0.01	0.000	1.13	1.12	1.14
Post-secondary non-tertiary education	-0.06	0.02	0.000	0.94	0.91	0.97
Unemployed	0.71	0.01	0.000	2.04	2.01	2.06
Retired	-0.23	0.01	0.000	0.79	0.78	0.80
Chronic illness	0.42	0.00	0.000	1.52	1.51	1.54
Below poverty line	0.41	0.01	0.000	1.51	1.49	1.52
Apartment in building with >=10 units	-0.58	0.01	0.000	0.56	0.56	0.57
Apartment in building with <10 units	-0.33	0.01	0.000	0.72	0.71	0.73
Semi-detached house	-0.97	0.02	0.000	0.38	0.37	0.39
Accommodation provided free	-0.49	0.02	0.000	0.61	0.59	0.64
Tenant paying below market rate	0.10	0.03	0.000	1.11	1.05	1.17
Tenant paying market rate	0.95	0.01	0.000	2.59	2.56	2.63
One person household	0.20	0.01	0.000	1.22	1.20	1.24
2 adults, dependent children, at least one adult >=65 years	-0.12	0.01	0.000	0.89	0.87	0.90
Other households without dependent children	-0.34	0.01	0.000	0.71	0.70	0.72
Single parent household, one or more dependent children	0.60	0.01	0.000	1.82	1.77	1.86
2 adults, one dependent child	-0.17	0.01	0.000	0.84	0.83	0.86
2 adults, two dependent children	-0.07	0.01	0.000	0.94	0.92	0.95
2 adults, three or more dependent children	-0.50	0.02	0.000	0.60	0.59	0.62
Other households with dependent children	-0.07	0.01	0.000	0.93	0.91	0.94
Thinly populated area	0.10	0.01	0.000	1.11	1.09	1.12
Intermediate area	0.14	0.01	0.000	1.15	1.14	1.16
2 indicators versus 0						
Intercept	-5.14	0.03	0.000			
Pre-primary education	-17.93	6684.61	0.998	0.00	0.00	
Primary education	0.84	0.05	0.000	2.32	2.12	2.54
Lower secondary education	0.89	0.02	0.000	2.44	2.33	2.54
Upper secondary education	0.48	0.02	0.000	1.62	1.57	1.68
Post-secondary non-tertiary education	-0.79	0.06	0.000	0.46	0.40	0.52
Unemployed	1.17	0.01	0.000	3.22	3.13	3.31
Retired	-0.64	0.01	0.000	0.53	0.51	0.54
Chronic illness	1.25	0.01	0.000	3.50	3.41	3.59
Below poverty line	1.23	0.01	0.000	3.42	3.34	3.51
Apartment in building with >=10 units	-1.77	0.02	0.000	0.17	0.17	0.18
Apartment in building with <10 units	-0.83	0.02	0.000	0.43	0.41	0.46
Semi-detached house	-0.87	0.04	0.000	0.42	0.39	0.46
Accommodation provided free	-0.07	0.05	0.108	0.93	0.85	1.02
Tenant paying below market rate	-19.23	1002.73	0.985	0.00	0.00	
Tenant paying market rate	1.88	0.02	0.000	6.56	6.34	6.78
One person household	0.75	0.02	0.000	2.13	2.04	2.21
2 adults, dependent children, at least one adult >=65 years	0.23	0.03	0.000	1.26	1.19	1.33
Other households without dependent children	-0.55	0.02	0.000	0.58	0.55	0.60
Single parent household, one or more dependent children	1.37	0.03	0.000	3.93	3.73	4.15
2 adults, one dependent child	-0.41	0.03	0.000	0.67	0.63	0.70
2 adults, two dependent children	-1.47	0.04	0.000	0.23	0.21	0.25
2 adults, three or more dependent children	-0.14	0.03	0.000	0.87	0.82	0.93
Other households with dependent children	-0.41	0.02	0.000	0.66	0.63	0.69
Thinly populated area	0.19	0.02	0.000	1.21	1.17	1.26
Intermediate area	0.37	0.02	0.000	1.45	1.39	1.50
3 indicators versus 0						
Intercept	-7.22	0.07	0.000			
Pre-primary education	-16.48	0.00		0.00	0.00	0.00
Primary education	-18.75	1925.54	0.992	0.00	0.00	

Lower secondary education	1.97	0.05	0.000	7.19	6.51	7.95
Upper secondary education	0.78	0.05	0.000	2.18	1.99	2.39
Post-secondary non-tertiary education	-18.41	766.53	0.981	0.00	0.00	
Unemployed	2.40	0.03	0.000	11.08	10.38	11.83
Retired	-0.56	0.03	0.000	0.57	0.53	0.61
Chronic illness	1.71	0.03	0.000	5.54	5.21	5.89
Below poverty line	1.35	0.03	0.000	3.86	3.66	4.07
Apartment in building with >=10 units	-2.46	0.05	0.000	0.09	0.08	0.09
Apartment in building with <10 units	0.27	0.04	0.000	1.31	1.22	1.41
Semi-detached house	-18.80	761.16	0.980	0.00	0.00	
Accommodation provided free	-19.08	1106.00	0.986	0.00	0.00	
Tenant paying below market rate	-19.01	1379.35	0.989	0.00	0.00	
Tenant paying market rate	1.60	0.04	0.000	4.93	4.59	5.31
One person household	0.03	0.03	0.349	1.03	0.97	1.10
2 adults, dependent children, at least one adult >=65 years	-19.17	430.58	0.964	0.00	0.00	
Other households without dependent children	-1.66	0.04	0.000	0.19	0.18	0.21
Single parent household, one or more dependent children	-18.73	677.84	0.978	0.00	0.00	
2 adults, one dependent child	-0.34	0.04	0.000	0.71	0.66	0.78
2 adults, two dependent children	-19.14	361.92	0.958	0.00	0.00	
2 adults, three or more dependent children	-0.75	0.06	0.000	0.47	0.42	0.53
Other households with dependent children	-1.89	0.04	0.000	0.15	0.14	0.16
Thinly populated area	0.28	0.04	0.000	1.33	1.22	1.44
Intermediate area	-0.30	0.05	0.000	0.74	0.67	0.82
Note: Pseudo R^2=.11 (Cox & Snell), .16 (Nagelkerke). Model χ^2 (75)= 214714.11, p <.001. Percentage Correct Prediction 82.6%						

Table 4-27 Multinomial logistic regression model of CIFP in United Kingdom. Data: EU-SILC 2010

United Kingdom	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
1 indicator versus 0						
Intercept	-2.22	0.00	0.000			
Lower secondary education	-0.13	0.00	0.000	0.88	0.88	0.88
Upper secondary education	-0.07	0.00	0.000	0.94	0.93	0.94
Post-secondary non-tertiary education	-20.97	381.30	0.956	0.00	0.00	
Unemployed	0.30	0.00	0.000	1.35	1.34	1.35
Retired	-0.44	0.00	0.000	0.64	0.64	0.65
Chronic illness	0.40	0.00	0.000	1.49	1.49	1.49
Below poverty line	0.43	0.00	0.000	1.54	1.53	1.54
Apartment in building with >=10 units	0.39	0.00	0.000	1.48	1.47	1.48
Apartment in building with <10 units	0.42	0.00	0.000	1.52	1.51	1.53
Semi-detached house	0.25	0.00	0.000	1.28	1.28	1.29
Accommodation provided free	-0.04	0.01	0.000	0.96	0.95	0.98
Tenant paying below market rate	0.70	0.00	0.000	2.02	2.01	2.03
Tenant paying market rate	0.92	0.00	0.000	2.51	2.50	2.52
One person household	-0.16	0.00	0.000	0.85	0.85	0.86
2 adults, dependent children, at least one adult >=65 years	-0.11	0.00	0.000	0.90	0.89	0.90
Other households without dependent children	-0.09	0.00	0.000	0.91	0.91	0.91
Single parent household, one or more dependent children	0.39	0.00	0.000	1.48	1.47	1.49
2 adults, one dependent child	-0.10	0.00	0.000	0.90	0.90	0.91
2 adults, two dependent children	0.32	0.00	0.000	1.38	1.37	1.39
2 adults, three or more dependent children	0.36	0.00	0.000	1.43	1.42	1.44
Other households with dependent children	0.22	0.00	0.000	1.25	1.24	1.26
Other household type	-20.23	270.08	0.940	0.00	0.00	
Thinly populated area	-0.02	0.00	0.000	0.98	0.98	0.99
Intermediate area	-0.03	0.00	0.000	0.97	0.96	0.97
2 indicators versus 0						
Intercept	-4.97	0.01	0.000			
Lower secondary education	0.08	0.00	0.000	1.08	1.08	1.09
Upper secondary education	0.51	0.00	0.000	1.67	1.66	1.68
Post-secondary non-tertiary education	-20.62	635.62	0.974	0.00	0.00	
Unemployed	0.80	0.00	0.000	2.24	2.22	2.25
Retired	-1.09	0.00	0.000	0.34	0.33	0.34
Chronic illness	0.70	0.00	0.000	2.02	2.01	2.03
Below poverty line	0.83	0.00	0.000	2.29	2.28	2.30
Apartment in building with >=10 units	-0.22	0.01	0.000	0.80	0.79	0.81
Apartment in building with <10 units	0.25	0.01	0.000	1.29	1.27	1.30
Semi-detached house	0.14	0.00	0.000	1.15	1.14	1.16
Accommodation provided free	1.42	0.01	0.000	4.14	4.07	4.22
Tenant paying below market rate	1.73	0.00	0.000	5.64	5.60	5.68
Tenant paying market rate	1.78	0.00	0.000	5.94	5.90	5.98
One person household	0.46	0.00	0.000	1.59	1.58	1.60
2 adults, dependent children, at least one adult >=65 years	-1.10	0.01	0.000	0.33	0.33	0.34
Other households without dependent children	-0.15	0.01	0.000	0.86	0.85	0.87
Single parent household, one or more dependent children	0.76	0.00	0.000	2.14	2.12	2.15
2 adults, one dependent child	0.37	0.00	0.000	1.44	1.43	1.46
2 adults, two dependent children	-0.18	0.01	0.000	0.84	0.83	0.85
2 adults, three or more dependent children	-0.02	0.01	0.004	0.98	0.97	0.99

Other households with dependent children	-0.04	0.01	0.000	0.96	0.95	0.98
Other household type	-19.51	491.52	0.968	0.00	0.00	
Thinly populated area	-0.03	0.00	0.000	0.97	0.96	0.97
Intermediate area	-0.21	0.00	0.000	0.81	0.80	0.81
3 indicators versus 0						
Intercept	-25.58	0.02	0.000			
Lower secondary education	0.59	0.01	0.000	1.80	1.76	1.84
Upper secondary education	0.80	0.01	0.000	2.21	2.18	2.25
Post-secondary non-tertiary education	-19.92	1611.75	0.990	0.00	0.00	
Unemployed	1.22	0.01	0.000	3.40	3.35	3.44
Retired	-1.76	0.02	0.000	0.17	0.17	0.18
Chronic illness	0.88	0.01	0.000	2.40	2.37	2.43
Below poverty line	0.79	0.01	0.000	2.20	2.17	2.22
Apartment in building with >=10 units	16.96	0.01	0.000	23094988.75	22666639.83	23531432.50
Apartment in building with <10 units	17.33	0.01	0.000	33456219.90	32995184.31	33923697.45
Semi-detached house	16.79	0.00		19506798.50	19506798.50	19506798.50
Accommodation provided free	4.02	0.02	0.000	55.83	53.27	58.51
Tenant paying below market rate	3.28	0.01	0.000	26.56	25.80	27.34
Tenant paying market rate	3.51	0.01	0.000	33.59	32.62	34.59
One person household	-0.17	0.01	0.000	0.84	0.83	0.86
2 adults, dependent children, at least one adult >=65 years	-16.59	92.03	0.857	0.00	0.00	
Other households without dependent children	-17.21	82.58	0.835	0.00	0.00	
Single parent household, one or more dependent children	0.98	0.01	0.000	2.67	2.61	2.73
2 adults, one dependent child	0.36	0.01	0.000	1.43	1.39	1.47
2 adults, two dependent children	1.12	0.01	0.000	3.07	3.00	3.14
2 adults, three or more dependent children	1.25	0.01	0.000	3.47	3.39	3.56
Other households with dependent children	1.31	0.01	0.000	3.70	3.60	3.80
Other household type	-18.20	961.47	0.985	0.00	0.00	
Thinly populated area	-0.60	0.01	0.000	0.55	0.53	0.56
Intermediate area	-0.56	0.01	0.000	0.57	0.56	0.58
Note: Pseudo R^2=.12 (Cox & Snell), .17 (Nagelkerke). Model χ^2 (72)= 3102695.67, *p* <.001. Percentage Correct Prediction 79.5%						

Abbreviations

CAQDAS	Computer Assisted Qualitative Data Analysis
CIFP	Core EU-SILC Index of Fuel Poverty
CoR	Committee of the Regions
DECC	Department of Energy and Climate Change
EBRD	European Bank for Reconstruction and Development
ECHP	European Community Household Panel
ECSC	European Coal and Steel Community Consultative Committee
EESC	European Economic and Social Committee
EFA	Exploratory factor analysis
EIFP	Expanded EU-SILC Index of Fuel Poverty
EPEE	European Fuel Poverty and Energy Efficiency
EQLS	European Quality of Life Survey
EU	European Union
EU-SILC	European Union Statistics on Income and Living Conditions
EWM	Excess winter mortality
FES	Family Expenditure Survey
FPRI	EU Fuel Poverty Risk Index
GGP	Generations and Gender Programme Survey
HBS	Household Budget Survey
ISCED	International Standard Classification of Education
ISO	International Organization for Standardization
LIHC	Low Income High Costs indicator
MEP	Member of the European Parliament
MIS	Minimum Income Standard
OECD	Organisation for Economic Co-operation and Development
PSU	Primary sampling units
SOEP	German socio-economic panel
VCWG	Vulnerable Consumer Working Group

Bibliography

Agence nationale de l'habitat (2009). *Analyse de la précarité énergétique à partir des résultats de l'Enquête Logement 2006 de l'Insee*. Paris: Agence nationale de l'habitat.

Anderson, W., White, V., and Finney, A. (2010). *"You just have to get by" Coping with low incomes and cold homes*. Bristol: Centre for Sustainable Energy.

Awesti, A. (2007). The European Union, New Institutionalism and Types of Multi-Level Governance. *Political Perspectives*, 1 (2): 1-23.

Baker, W., Starling, G., and Gordon, D. (2003). *Predicting fuel poverty at the local level: Final report on the development of the Fuel Poverty Indicator*. Bristol: Centre for Sustainable Energy.

Baker, W. (2006). *Social tariffs – a solution to fuel poverty?* Bristol: Centre for Sustainable Energy.

Baker, W., White, V., and Preston, I. (2008). *Quantifying rural fuel poverty: Final report*. Bristol: Centre for Sustainable Energy.

Barnes, M., McKnight, A., Kotecha, M., Green, K., Morrell, G., Swales, K., Toomse-Smith, M., and Wood, M. (2014). *Understanding the behaviours of households in fuel poverty: A review of research evidence*. London: Department of Energy and Climate Change.

Barnes, M., Butt, S., and Tomaszewski, W. (2008). *The Dynamics of Bad Housing: The impact of bad housing on the living standards of children*. London: National Centre for Social Research.

Bartiaux, F., Day, R., and Vandeschrick, C. (2014). '*Energy poverty in Belgium: context and associated vulnerabilities (first results)*', presented at the Energy Vulnerability in Europe workshop, Brussels, 27th February 2014.

Bartz, A.E. (1999). *Basic Statistical Concepts*. 4th Ed. Upper Saddle River, NJ: Merrill.

Bazilian, B., Sagar, A., Detchon, R., and Yumkella, K. (2010). More heat and light. *Energy Policy*, 38: 5409-5412.

Becker, S., Kouschil, K., and Naumann, M. (2014). Armut und Infrastruktur: das Beispiel Energiearmut. *Geographische Rundschau*, 10: 10-17.

Béland, D. (2005). Ideas and Social Policy: An Institutionalist Perspective. *Social Policy & Administration*, 39: 1–18.

Benke, G., and Varga, M. (2012). *Energieverbrauch und Geräteausstattung in einkommensschwachen Haushalten*. Wien: e7 Energie Markt Analyse GmbH.

Benke, G., Varga, M., Appel, M., Fernández de la Hoz, P., Leutgöb, K., and Amann, S. (2012). *Fuel Poverty in Österreich*. Wien: e7 Energie Markt Analyse GmbH.

Berger, T. (2012). *Energy poverty – from a global perspective to Austria*. 15th European Roundtable on Sustainable Consumption and Production, May 2 – 4, Bregenz, Austria.

Bhattacharya, J., DeLeire, T., Haider, S., and Currie, J. (2003). Heat or Eat? Cold-Weather Shocks and Nutrition in Poor American Families. *American Journal of Public Health*, 93(7): 1149-1154.

Birol, F. (2007). Energy Economics: A Place for Energy Poverty in the Agenda? *The Energy Journal*, 28(3): 1–6.

Boardman, B. (2012). Fuel poverty synthesis: Lessons learnt, actions needed. *Energy Policy*, 49: 143-148.

Boardman, B. (2011). *Participant benefits and quality of life: the challenge of hard to measure benefits*. Presented at the IEA workshop "Evaluating the Co-Benefits of Low-Income Weatherisation Programmes". January 27-28, 2011, Dublin, Ireland.

Boardman, B. (2010a). *Fixing Fuel Poverty: Challenges and Solutions*. London: Earthscan.

Boardman, B. (2010b). Liberalisation and fuel poverty. In I. Rutledge and P. Wright, (Eds.). *UK Energy Policy and The End of Market Fundamentalism*. Oxford: Oxford University Press, pp. 225-280.

Boardman, B. (1991). *Fuel poverty: from cold homes to affordable warmth*. London: Belhaven Press.

Bosseboeuf, D., Lapillonne, B., Pollier, K., Eichhammer, W., Schlomann, B., and Piccioni, N. (2014). *Indicators and policy facilities – a user friendly way to access the ODYSSEE-MURE databases*. Presentation at CA EED, 16th-17th October 2014, Milano.

Bouzarovski, S. and Petrova, S. (2015). The EU Energy Poverty and Vulnerability Agenda: An Emergent Domain of Transnational Action. In J. Tosun, S. Biesenbender, and K. Schulze, (Eds.). *Energy Policy Making in the EU: Building the Agenda*. Berlin: Springer, pp. 129-144.

Bouzarovski, S., Petrova, S., and Tirado-Herrero, S. (2014). *From Fuel Poverty to Energy Vulnerability: The Importance of Services, Needs and Practices*. Science Policy Research Unit, SWPS 2014-25.

Bouzarovski, S. (2013). Energy poverty in the European Union: landscapes of vulnerability. *WIREs Energy Environ*, 3(3): 276–289.

Bouzarovski, S., Petrova, S., and Sarlamanov, R. (2012). Energy poverty policies in the EU: A critical perspective. *Energy Policy*, 49: 76–82.

Bradshaw, J., and Hutton, S. (1983). Social policy options and fuel poverty. *Journal of Economic Psychology*, 3: 249-266.

Bradshaw, J., and Richardson, D. (2009). An Index of Child Well-Being in Europe. *Child Indicators Research*, 2(3): 319-351.

Braubach, M., Jacobs, D.E., Ormandy, D. (2011) *Environmental burden of disease associated with inadequate housing*. Denmark: WHO Regional Office for Europe.

Brunner, K-M., Spitzer, M., and Christanell, A. (2012). Experiencing fuel poverty. Coping strategies of low- income households in Vienna/Austria. *Energy Policy*, 49: 53–59.

Bryman, A. (2008). *Social Research Methods*. 3rd ed. Oxford: Oxford University Press.

Buchan, D. (2010). From liberalisation to intervention: Europe, the UK, and the changing agenda. In I. Rutledge and P. Wright, (Eds.). *UK Energy Policy and The End of Market Fundamentalism*. Oxford: Oxford University Press, pp. 401-420.

Bulmer, S.J. (1998). New institutionalism and the governance of the Single European Market. *Journal of European Public Policy*, 5: 365-386.

Burchardt, T., Le Grand, J., and Piachaud, D. (1999). Social Exclusion in Britain 1991-1995. *Social Policy and Administration*, 33(3): 227-244.

Buzar, S. (2007a). *Energy Poverty in Eastern Europe: Hidden Geographies of Deprivation*. Aldershot: Ashgate.

Buzar, S. (2007b). The 'hidden' geographies of energy poverty in post-socialism: between institutions and households. *Geoforum*, 38: 224-240.

Buzar, S. (2007c). When homes become prisons: the relational spaces of post-socialist energy poverty. *Environment and Planning A*, 39: 1908-1925.

Chappells, H. and Shove, E. (2004). Comfort: A review of philosophies and paradigms. Lancaster: Centre for Science Studies, Lancaster University.

Chilton, P., and Schäffner, C. (2002). Introduction: Themes and principles in the analysis of political discourse. In P. Chilton, and C. Schäffner, (Eds.). *Politics as Text and Talk: Analytic approaches to political discourse.* Philadelphia: John Benjamins Publishing Company, pp. 1-41.

Clemenceau, A., and Museux, J-M. (2007). *EU-SILC (community statistics on income and living conditions: general presentation of the instrument)*. In: Comparative EU statistics on Income and Living Conditions: Issues and Challenges. Proceedings of the EU-SILC Conference, Helsinki, 6–8 November 2006. Luxembourg: Office for Official Publications of the European Communities.

Coffey, A., and Atkinson, P. (2004). Analysing documentary realities. In D. Silverman, (Eds.). *Qualitative Research: Theory, Method and Practice*. 2nd ed. London: SAGE, pp. 56-75.

Committee of the Regions (2014). *Opinion of the Committee of the Regions — Affordable Energy for All.* Official Journal of the European Union, C 174/15.

Committee of the Regions (2013). *Opinion of the Committee of the Regions on 'Making the internal energy market work'*. Official Journal of the European Union, C 280/38.

Committee of the Regions (2012). *Opinion of the Committee of the Regions on 'Towards a European agenda for social housing'*. Official Journal of the European Union, C 9/4.

Committee of the Regions (2008). *Opinion of the Committee of the Regions on the 'Third legislative package on European electricity and gas markets'*. Official Journal of the European Union, C 172/55.

Committee of the Regions (2007). *Opinion of the Committee of the Regions on 'The energy package'*. Official Journal of the European Union, C 305/1.

Committee of the Regions (2002). *Opinion of the Committee of the Regions on the 'Proposal for a Directive of the European Parliament and of the Council on the energy performance of buildings'*. Official Journal of the European Communities, C 107/76.

Consolidated Version of the Treaty on the Functioning of the European Union (2008). Official Journal of the European Union, C 115/01.

Consolidated versions of the Treaty on European Union and the Treaty on the Functioning of the European Union (2010). Official Journal of the European Union, C 83/01.

Consumer Focus (2012). *Consumer Focus response to DECC consultation on fuel poverty measurement*. London: Consumer Focus.

Consumer Futures (2013). *Collective switching: Exploring opportunities for low income energy consumers in Wales*. Cardiff: Consumer Futures.

Cooke, D., Ferrari, A., Giulietti, M., Sharratt, D and Waddams Price, C. (2001). *Affording Gas and Electricity: Self Disconnection and Rationing by Prepayment and Low Income Credit Consumers and Company attitudes to Social Action*. Electricity Association.

Costello, A.B., and Osborne, J.W. (2005). Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most From Your Analysis. *Practical Assessment, Research & Evaluation*, 10: 1-9.

Critchley, R., Gilbertson, J., Grimsley, M., Green, G. and Warm Front Study Group (2007). Living in cold homes after heating improvements: Evidence from Warm-Front, England's Home Energy Efficiency Scheme. *Applied Energy*, 84: 147-158.

Dagoumas, A., and Kitsios, F. (2014). Assessing the impact of the economic crisis on energy poverty in Greece. *Sustainable Cities and Society*, 13: 267–278.

Dale, A. (2006). Quality Issues with Survey Research. *International Journal of Social Research Methodology*, 9(2): 143-158.

Darby, S. (2012). Metering: EU policy and implications for fuel poor households. *Energy Policy*, 49: 98-106.

Day, R., and Hitchings, R. (2011). ‘Only old ladies would do that’: Age stigma and older people’s strategies for dealing with winter cold. *Health & Place*, 17: 885–894.

Deguen, S., Fiestas, L.I., and Zmirou-Navier, D. (2012). Housing-Related Inequalities. In World Health Organization, (Eds.). *Environmental Health Inequalities in Europe*. Copenhagen: WHO Regional Office for Europe, pp. 22-52.

Department of Communications, Energy and Natural Resources (2011). *Warmer Homes: A Strategy for Affordable Energy in Ireland*. Dublin: Department of Communications, Energy and Natural Resources.

Department of Energy and Climate Change (2015a). *Annual Fuel Poverty Statistics Report*. London: HMSO.

Department of Energy and Climate Change (2015b). *Fuel poverty statistics* [online]. Available at: https://www.gov.uk/government/collections/fuel-poverty-statistics. (Last accessed 2nd May 2015).

Department of Energy and Climate Change (2014). *Annual Fuel Poverty Statistics Report*. London: HMSO.

Department of Energy and Climate Change (2013a). *Annual Report on Fuel Poverty Statistics 2013*. London: HMSO.

Department of Energy and Climate Change (2013b). *Fuel Poverty Report – Updated August 2013*. London: HMSO.

Department of Energy and Climate Change (2012). *Annual Report on Fuel Poverty Statistics 2012*. London, HMSO.

Department of Energy and Climate Change (2011). *Annual report on fuel poverty statistics 2011*. London: HMSO.

Department of Energy and Climate Change (2010). *Fuel Poverty Methodology Handbook*. London, HMSO.

Department of Trade and Industry (2001). *UK Fuel Poverty Strategy*. London: HMSO.

Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC. Official Journal of the European Union L 315/1.

Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast). Official Journal of the European Union L 153/13.

Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC. Official Journal of the European Union L 211/94.

Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC. Official Journal of the European Union L 211/55.

Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in natural gas and repealing Directive 98/30/EC. Official Journal of the European Union L 176/57.

Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in electricity and repealing Directive 96/92/EC. Official Journal of the European Union L 176/37.

Directive 98/30/EC of the European Parliament and of the Council of 22 June 1998 concerning common rules for the internal market in natural gas. Official Journal of the European Union L 176/57.

Directive 96/92/EC of the European Parliament and of the Council of 19 December 1996 concerning common rules for the internal market in electricity. Official Journal of the European Union L 027.

Dobbie, M.J., and Dail, D. (2013). Robustness and sensitivity of weighting and aggregation in constructing composite indices. *Ecological Indicators*, 29: 270-277.

Donders, A.R.T., van der Heijden, G.J.M.G., Stijnen, T., and Moons, K.G.M. (2006). Review: A gentle introduction to imputation of missing values. *Journal of Clinical Epidemiology*, 59(10): 1087–1091.

Dubois, U. (2012). From targeting to implementation: The role of identification of fuel poor households. *Energy Policy*, 49: 107-115.

Edgar, B., Filipović, M., and Dandolova, I. (2007). Home Ownership and Marginalisation. *European Journal of Homelessness*, 1: 141-160.

Ekamper, P., van Poppel, F., van Duin, C., and Garssen, J. (2009). 150 Years of temperature-related excess mortality in the Netherlands. *Demographic Research*, 21(14): 385-426.

Ekström, J. (2008). *The Phi-coefficient, the Tetrachoric Correlation Coefficient, and the Pearson-Yule Debate*. Los Angeles: UCLA Department of Statistics.

El Ansari, W., and El-Silimy, S. (2008). Are fuel poverty reduction schemes associated with decreased excess winter mortality in elders? A case study from London, UK. *Chronic Illness,* 4: 289.

Elliott, K., and Oxley, S. (2013). *International comparisons of energy efficiency indicators*. London: Department of Energy and Climate Change.

Elo, S., and Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, 62(1): 107-15.

Energiaklub (2011). *Methodology of the Statistical Sampling*. Budapest: Energiaklub.

EUR-Lex (n.d.) *About EUR-Lex* [online]. Available at: http://eur-lex.europa.eu/content/welcome/about.html. (Last accessed 16th October 2014).

Europa (2014). *EU treaties* [online]. Available at: http://europa.eu/eu-law/decision-making/treaties/index_en.htm. (Last accessed 20th November 2014).

European Anti-Poverty Network (2010). *EAPN Working Paper on Energy Poverty*. Brussels: European Anti-Poverty Network.

European Bank for Reconstruction and Development (EBRD) (2003). *Can the Poor Pay for Power? The Affordability of Electricity in South East Europe.* London: EBRD.

European Coal and Steel Community Consultative Committee (2001). *Opinion of the ECSC consultative Committee on the European climate change programme and emissions trading*. Official Journal of the European Communities, C 170/8.

European Commission (2015). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank: A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy*. Brussels: COM/2015/080 final.

European Commission (2013) *Eurobarometer 74.1 August-September 2010* [computer file]. Cologne: GESIS Data Archive [distributor] ZA 5237 Version 4.2.0.

European Commission (2012a) *Eurobarometer 72.1 August-September 2009* [computer file]. Cologne: GESIS Data Archive [distributor] ZA4975 Version 3.0.0.

European Commission (2012b) *Eurobarometer 73.2 + 73.3 February – March 2010* [computer file]. Cologne: GESIS Data Archive [distributor] ZA 5236 Version 2.0.0.

European Commission (2011a). Proposal for a Directive of the European Parliament and of the Council on energy efficiency and repealing Directives 2004/8/EC and 2006/32/EC. Brussels: COM (2011) 370 final.

European Commission (2011b). *Commission Staff Working Document: Impact Assessment, Accompanying Document to the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Energy Efficiency Plan 2011.* Brussels: COM (2011) 109 final.

European Commission (2010a). *Commission Staff Working Paper: An Energy Policy for Consumers*. Luxembourg: Publications Office of the European Union.

European Commission (2010b). *Communication from the commission to the European Parliament, the Council, the European economic and social committee and the committee of the regions. The European Platform against Poverty and Social Exclusion: A European Framework for social and territorial cohesion*. COM. 16.12.2010. Luxembourg: Office for the Official Publications of the European Communities.

European Commission (2010c) *Communication from the Commission Europe 2020: A strategy for smart, sustainable and inclusive growth*. COM. 3.3.2010. Luxembourg: Office for the Official Publications of the European Communities.

European Commission (2008a). *Communication from the Commission to the European Parliament pursuant to the second subparagraph of Article 251(2) of the EC Treaty concerning the common position of the Council on the adoption of a Directive of the European Parliament and of the Council concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC*. Brussels: COM (2008)906 final.

European Commission (2008b). *Communication from the Commission to the European Parliament pursuant to the second subparagraph of Article 251(2) of the EC Treaty concerning the common position of the Council on the adoption of a Directive of the European Parliament and of the Council repealing Directive 2003/55/EC concerning common rules for the internal market in natural gas.* Brussels: COM (2008) 907 final.

European Commission (2007a). *Communication from the Commission to the Council and the European Parliament: Prospects for the internal gas and electricity market.* Brussels: COM (2006) 841 final.

European Commission (2007b). *Commission staff working document - Accompanying the legislative package on the internal market for electricity and gas - Impact Assessment* [online]. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52007SC1180:EN:HTML. (Last accessed March 2013).

European Commission (2007c). *Communication from the Commission to the European Council and the European Parliament: An Energy Policy for Europe.* Brussels: COM (2007) 1 final.

European Commission (2007d). *Communication from the Commission: Towards a European Charter on the Rights of Energy Consumers*. Brussels: COM (2007)386 final.

European Commission (2002). *Communication from the Commission to the Council and the European Parliament: Energy cooperation with the developing countries.* Brussels: COM (2002) 408 final.

European Economic and Social Committee (2013). *Opinion of the European Economic and Social Committee on 'For coordinated European measures to prevent and combat energy poverty' (own-initiative opinion)*. Official Journal of the European Union, C 341/21.

European Economic and Social Committee (2011a). *Opinion of the European Economic and Social Committee on 'Energy poverty in the context of liberalisation and the economic crisis' (exploratory opinion).* Official Journal of the European Union, C 44/53.

European Economic and Social Committee (2011b). *Opinion of the European Economic and Social Committee on the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions — Energy Efficiency Plan 2011.* Official Journal of the European Union C 318/155.

European Economic and Social Committee (2008a). *Opinion of the European Economic and Social Committee on the*

— 'Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/54/EC concerning common rules for the internal market in electricity'

— *'Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/55/EC concerning common rules for the internal market in natural gas'*

— *'Proposal for a Regulation of the European Parliament and of the Council establishing an Agency for the cooperation of energy regulators'*

— *'Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EC) No 1228/2003 on conditions for access to the network for cross-border exchanges in electricity'*

— *'Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EC) No 1775/2005 on conditions for access to the network for cross-border exchanges in natural gas'*. Official Journal of the European Union, C 211/23.

European Economic and Social Committee (2008b). *Opinion of the European Economic and Social Committee on the Communication from the Commission: Towards a European Charter on the Rights of Energy Consumers*. Official Journal of the European Union, C 151/27.

European Foundation for the Improvement of Living and Working Conditions (2014). *European Quality of Life Survey, 2011-2012* [computer file]. 2nd Edition. Essex: UK Data Archive [distributor], January 2014. SN: 7316, http://dx.doi.org/10.5255/UKDA-SN-7316-2.

European Foundation for the Improvement of Living and Working Conditions (Eurofound) (2009a). *Second European Quality of Life Survey: Overview*. Luxembourg: Office for Official Publications of the European Communities

European Foundation for the Improvement of Living and Working Conditions (2009b). *European Quality of Life Survey, 2007* [computer file]. Essex: UK Data Archive [distributor], October 2009. SN: 6299.

European Fuel Poverty and Energy Efficiency Project (EPEE) (2009a). *Definition and Evaluation of fuel poverty in Belgium, Spain, France, Italy and the United Kingdom*. WP2 – Deliverable 7.

European Fuel Poverty and Energy Efficiency Project (EPEE) (2009b). *Diagnosis of causes and consequences of fuel poverty in Belgium, France, Italy, Spain and United Kingdom*. WP2 – Deliverable 5.

European Fuel Poverty and Energy Efficiency Project (EPEE) (2009c). *Evaluation of fuel poverty in Belgium, Spain, France, Italy and the United Kingdom*. WP2 - Deliverable 6.

European Parliament (2010a). European Parliament resolution of 15 December 2010 on Revision of the Energy Efficiency Action Plan. Official Journal of the European Union, C 169 E/66.

European Parliament (2010b). European Parliament resolution of 25 November 2010 on Towards a new Energy Strategy for Europe 2011-2020. Official Journal of the European Union, C 99 E/64.

European Parliament (2009). European Parliament legislative resolution of 23 April 2009 on the proposal for a directive of the European Parliament and of the Council on the energy performance of buildings (recast). Official Journal of the European Union, C 184 E/263.

European Parliament (2008a). *Position of the European Parliament adopted at first reading on 9 July 2008 with a view to the adoption of Directive 2008/…/EC of the European Parliament and of the Council amending Directive 2003/55/EC concerning common rules for the internal market in natural gas*. Official Journal of the European Union, C 294 E/142.

European Parliament (2008b). *Position of the European Parliament adopted at first reading on 18 June 2008 with a view to the adoption of Directive 2008/…/EC of the European Parliament and of the Council amending Directive 2003/54/EC concerning common rules for the internal market in electricity*. Official Journal of the European Union, C 286 E/106.

European Parliament (2008c). *Resolution of 19 June 2008 on Towards a European Charter on the Rights of Energy Consumers*. Official Journal of the European Union, C 286 E/24.

Eurostat (2015). *EU statistics on income and living conditions (EU-SILC) methodology - housing conditions* [online]. Available at: http://ec.europa.eu/eurostat/statistics-explained/index.php/EU_statistics_on_income_and_living_conditions_%28EU-SILC%29_methodology_-_housing_conditions#. (Last accessed 19th March 2015).

Eurostat (2014a) *Glossary: Household budget survey (HBS)*. [online] Available: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Household_budget_survey_(HBS). (Last accessed 10th November 2014).

Eurostat (2014b). *Energy statistics - heating degree days (nrg_esdgr)* [online]. Available at: http://ec.europa.eu/eurostat/cache/metadata/en/nrg_esdgr_esms.htm. (Last accessed 17th April 2015).

Eurostat (2012a) *4th MEETING OF THE TASK-FORCE ON THE REVISION OF THE EU-SILC LEGAL BASIS*. Doc. LC- LEGAL/36.2/12/EN. Luxembourg: Publications Office of the European Union.

Eurostat (2012b) *Ad-hoc modules*. [online] Available: http://epp.eurostat.ec.europa.eu/portal/page/portal/income_social_inclusion_living_conditions/data/ad_hoc_modules. (Last accessed 18th November 2014).

Eurostat (2012c) *2012 EU-SILC MODULE ON HOUSING CONDITIONS: Assessment of the implementation*. Luxembourg: Publications Office of the European Union.

Eurostat (2010a). *Household Budget Surveys: Introduction* [online]. Available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/household_budget_surveys/introduction. (Last accessed 4th March 2013).

Eurostat (2010b). *Description of Target Variables: Cross-sectional and Longitudinal*. EU-SILC 065/08. Luxembourg: Publications Office of the European Union.

Eurostat (2010c). *European Community Household Panel (ECHP)* [online]. Available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/microdata/echp. (Last accessed 11th August 2011).

Eurostat (2009a). *Improving data comparability for the next HBS round (2010).* Luxembourg: Publications Office of the European Union.

Eurostat (2009b). *EU-SILC MODULE 2007 ON HOUSING CONDITIONS: Assessment of the implementation*. Luxembourg: Publications Office of the European Union.

Eurostat (2006). *EU-SILC User Database Description*. Luxembourg: Publications Office of the European Union.

Evans, J., Hyndman, S., Stewart-Brown, S., Smith, D., and Petersen, S. (2000). An epidemiological study of the relative importance of damp housing in relation to adult health. *Journal of Epidemiology and Community Health*, 54: 677-686.

Fabrigar, L.R., Wegener, D.T., MacCallum, R.C., and Strahan, E.J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods*, 4(3): 272-299.

Fahmy, E. (2011). *The definition and measurement of fuel poverty: A Briefing Paper to inform Consumer Focus' submission to the Hills fuel poverty review*. London: Consumer Focus.

Fahmy, E., Gordon, D., and Patsios, D. (2011). Predicting fuel poverty at a small-area level in England. *Energy Policy*, 39: 4370-4377.

Fairclough, N. (2003). *Analysing Discourse: Textual analysis for social research*. London: Routledge.

Faulk, A. (2009). *Switching Off: Attitudes to switching energy suppliers among disadvantaged consumers.* Glasgow: Consumer Focus Scotland.

Fellegi, D., and Fülöp, O. (2012). *Poverty or Fuel Poverty? Defining fuel poverty in Europe and Hungary*. Budapest: ENERGIAKLUB.

Fereday, J., and Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International Journal of Qualitative Methods*, 5(1): 2-11.

Field, A. (2009). *Discovering Statistics using SPSS*. 3rd ed. London: SAGE.

Free, S., Howden-Chapman, P., Pierse, N., Viggers, H., and the Housing, Heating and Health Study Research Team (2010). More effective home heating reduces school absences for children with asthma. *Journal of Epidemiology and Community Health*, 64: 379-386.

Freeworldmaps.net (n.d.) *Countries of the European Union* [online]. Available at: http://www.freeworldmaps.net/printable/europe/european-union-countries.gif. (Last accessed 02/06/15).

George, M., Graham, C., and Lennard, L. (2011). *Too many hurdles: information and advice barriers in the energy market.* University of Leicester, Centre for Consumers and Essential Services.

GESIS (2012a). *Eurobarometer 72.1 - Variable Report*. Mannheim: GESIS.

GESIS (2012b). *Eurobarometer 73.2+73.3 - Variable Report*. Mannheim: GESIS.

GESIS (2013). *Eurobarometer 74.1 - Variable Report*. Mannheim: GESIS.

Gibbons, D. and Singler, R. (2008). *Cold Comfort: A Review of Coping Strategies Employed by Households in Fuel Poverty*. London: Centre for Economic and Social Inclusion.

Gordon, D., Adelman, L., Ashworth, K., Bradshaw, J., Levitas, R., Middleton, S., Pantazis, C., Patsios, D., Payne, S., Townsend, P., and Williams, J. (2000). *Poverty and social exclusion in Britain*. York: Joseph Rowntree Foundation.

Gough, I., Meadowcroft, J., Dryzek, J., Gerhards, J., Lengfeld, Markandya, A., Ortiz, R., (2008). JESP symposium: climate change and social policy. *Journal of European Social Policy* 18(4), 325–344.

Greer, S.L. (2008). Choosing paths in European Union health services policy: a political analysis of a critical juncture. *Journal of European Social Policy*, 18: 219-231.

Grubbauer, M. (2012). Toward a More Comprehensive Notion of Urban Change: Linking Post-Socialist Urbanism and Urban Theory. In M. Grubbauer, and J. Kusiak, (Eds.). *Chasing Warsaw: Socio-Material Dynamics of Urban Change since 1990*. University of Chicago Press, pp. 35-60.

Guba, E. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Technology Research and Development*, 29: 75-91.

Haffner, M., and Boumeester, H. (2014). Housing affordability in the Netherlands: the impact of rent and energy costs. *Journal of Housing and the Built Environment*, DOI 10.1007/s10901-014-9409-2.

Hales, S., Blakely, T., Foster, R.H., Baker, M.G., and Howden-Chapman, P. (2012). Seasonal patterns of mortality in relation to social factors. *Journal of Epidemiology and Community Health*, 66: 379-384.

Hall, P.A., and Taylor, R.C.R (1996). Political Science and the Three New Institutionalisms. *Political Studies*, 44 (5): 936-957.

Hallerberg, M. (2011). Empirical Applications of Veto Player Analysis and Institutional Effectiveness. In T. König, M. Debus and G. Tsebelis, (Eds.). *Reform Processes and Policy Change: Veto Players and Decision-Making in Modern Democracies*. New York: Springer, pp. 21-42.

Harrington, B.E, Heyman, B., Merleau-Ponty, N., Stockton, H., Ritchie, N., Heyman, A. (2005). Keeping warm and staying well: findings from the qualitative arm of the Warm Homes Project. *Health and Social Care in the Community*, 13: 259-267.

Healy, J.D. (2004). *Housing, Fuel Poverty and Health: A Pan-European Analysis*. Aldershot: Ashgate.

Healy, J.D. (2003). Excess winter mortality in Europe: a cross country analysis identifying key risk factors. *Journal of Epidemiology and Community Health*, 57: 784-789.

Healy, J.D., and Clinch, P. (2002a). *Fuel poverty in Europe: A cross-country analysis using a new composite measure*. Dublin: Environmental Studies Research Series, University College Dublin.

Healy, J.D. and Clinch, J.P. (2002b). Fuel poverty, thermal comfort and occupancy: results of a national household-survey in Ireland. *Applied Energy*, 73: 329-343.

Heindl, P. (2013). *Measuring fuel poverty: General considerations and application to German household data*. ZEW Discussion Papers, No. 13-046.

Hills, J. (2012). *Getting the measure of fuel poverty: Final Report of the Fuel Poverty Review*. London: Centre for Analysis of Social Exclusion, Report 72.

Hills, J. (2011). *Fuel Poverty: The problem and its measurement - Interim Report of the Fuel Poverty Review*. London: Centre for Analysis of Social Exclusion, Report 69.

Hirsch, D., Preston, I., and White, V. (2011). *Understanding fuel expenditure: Fuel poverty and spending on fuel*. London: Consumer Focus.

Househam, I., and Musatescu, V. (2012). *Improving Energy Efficiency in Low-Income Households and Communities in Romania: Fuel Poverty Draft assessment report*. Bucharest: UNDP Romania.

Howden-Chapman, P., Viggers, H., Chapman, R., O'Sullivan, K., Telfar Barnard, L., and Lloyd, B. (2012). Tackling cold housing and fuel poverty in New Zealand: A review of policies, research, and health impacts. *Energy policy,* 49: 134–142.

Howell, D.C. (2008). The analysis of missing data. In W. Outhwaite and S.Turner, (Eds.). *Handbook of Social Science Methodology*. London: Sage.

Hsieh, H-F., and Shannon, S.E. (2005). Three Approaches to Qualitative Content Analysis. *Qualitative Health Research*, 15: 1277-1288.

Hudson, J., and Lowe, S. (2006). *Understanding the Policy Process: Analysing Welfare Policy and Practice*. Bristol: Policy Press.

Hutchinson, E., Wilkinson, P., Hong, S.H., Oreszczyn, T. and the Warm Front Study Group (2006). Can we improve the identification of cold homes for targeted home energy-efficiency improvements? *Applied Energy*, 83: 1198-1209.

Huybrechs, F., Meyer, S., and Vranken, J. (2012). *La Précarité Energétique en Belgique*. Université libre de Bruxelles.

Iacovou, M., Kaminska, O., and Levy, H. (2012). *Using EU-SILC data for cross-national analysis: strengths, problems and recommendations*. Essex: Institute for Social and Economic Research.

Immergut, E.M. (1990). Institutions, Veto Points, and Policy Results: A Comparative Analysis of Health Care. *Journal of Public Policy*, 10 (4): 391-416.

Insee (n.d.) *Statistical operation: Housing survey in 2006* [online]. Available at: http://www.insee.fr/en/methodes/default.asp?page=sources/ope-enq-logement.htm. (Last accessed 2nd April 2015).

Institute for European Environmental Policy (2014) *EU Climate and Energy policies: opportunities and challenges in Southern European Member States*. Brussels: Institute for European Environmental Policy.

International Energy Agency (2012). *The Energy Development Index* [online]. Available at: http://www.worldenergyoutlook.org/resources/energydevelopment/theenergydevelopmentindex/. (Last accessed 25th March 2015).

Isherwood, B.C., and Hancock, R.M. (1979). *Household Expenditure on Fuel: Distributional Aspects*. London: Economic Adviser's Office, DHSS.

Jacobs, R., Smith, P., and Goddard, M. (2004). *Measuring performance: An examination of composite performance indicators*. York: CHE Technical Paper Series 29.

Jeffery, C. (2002). Social and Regional Interests: ESC and Committee of the Regions. In J. Peterson and M. Shackleton, (Eds.). *The Institutions of the European Union*. Oxford University Press, pp. 326-346.

Jusot, F., and Lacroix, E. (2014). *Fuel Poverty is it harmful for health? Evidence from French health survey data.* European Health Economics Association Conference, 1-3 September 2014, Manchester.

Kaiser, H.F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement*, 20: 141-151.

Kalliauer, J., and Moser, J. (2011). *Energiearmut: In immer mehr Haushalten fehlt das Geld für Strom und Heizung!* [online]. Available at: http://www.ots.at/presseaussendung/OTS_20110706_OTS0128/energiearmut-in-immer-mehr-haushalten-fehlt-das-geld-fuer-strom-und-heizung. (Last accessed 2nd April 2015).

Katsoulakos, N. (2011). Combating Energy Poverty in Mountainous Areas Through Energy-saving Interventions. *Mountain Research and Development*, 31(4): 284-292.

Keatinge, W.R., Coleshaw, S.R.K., and Holmes, J. (1989). Changes in seasonal mortalities with improvement in home heating in England and Wales from 1964 to 1984. *International Journal of Biometeorology*, 33: 71-76.

Krippendorff, K. (2004). *Content analysis: an introduction to its methodology*. London: SAGE.

Lambert, P. (2010). *Dealing with variables: Resources and topics in enhancing secondary survey data* [PowerPoint presentation]. 4th ESRC Research Methods Festival, 5th-8th July 2010, Oxford.

Lambie-Mumford, H., Snell, C., and Dowler, E. (2015). *Heat or Eat: Food and Austerity in Rural England Interim Report*. Working Papers of the Communities & Culture Network+ Vol.5.

Lampietti, J., and Meyer, A. (2002). *When Heat is a Luxury: Helping the Urban Poor of Europe and Central Asia Cope with the Cold*. Washington: World Bank.

Lapillonne, B., Pollier, K., and Samci, N. (2015). *Energy Efficiency Trends for households in the EU*. Grenoble: Enerdata.

Laursen, F. (2012). The Treaty of Maastricht. In E. Jones, A. Menon, and S. Weatherill, (Eds.). *The Oxford Handbook of The European Union*. Oxford University Press, pp. 121-134.

Lawlor, D.A., Maxwell, R., and Wheeler, B.W. (2002). Rurality, deprivation, and excess winter mortality: an ecological study. *Journal of Epidemiology and Community Health*, 56: 373-374.

Leach, J. (2003). Rhetorical Analysis. In M.W. Bauer and G. Gaskell, (Eds.). *Qualitative Researching with Text, Image and Sound*. London: SAGE, pp. 207-226.

Lee, R.M., and Fielding, N.G. (1991). Computing for Qualitative Research: Options, Problems and Potential. In N.G. Fielding and R.M. Lee, (Eds.). *Using Computers in Qualitative Research*. London: SAGE, pp. 1-13.

Legendre, B., and Ricci, O. (2015). Measuring fuel poverty in France: Which households are the most fuel vulnerable? *Energy Economics*, doi:10.1016/j.eneco.2015.01.022.

Lewis, J. (2002). National Interests: Coreper. In J. Peterson and M. Shackleton, (Eds.). *The Institutions of the European Union*. Oxford University Press, pp. 277-298.

Liddell, C., Morris, C., Thomson, H., and Guiney, C. (2016). Excess winter deaths in 32 European countries 1980- 2013: a critical review of methods. *Journal of Public Health*, forthcoming 2016.

Liddell, C., and Guiney, C. (2014). Living in a cold and damp home: frameworks for understanding impacts on mental well-being. *Public Health*, 26: 1-9.

Liddell, C., Morris, C., McKenzie, S.J.P. and Rae, G. (2012). Measuring and monitoring fuel poverty in the UK: National and regional perspectives. *Energy Policy*, 49: 27-32.

Liddell, C., Morris, C., McKenzie, P., and Rae, G. (2011). *Defining Fuel Poverty in Northern Ireland: A preliminary review*. Belfast: DSDNI.

Liddell, C., and Morris, C. (2010). Fuel poverty and human health: A review of recent evidence. *Energy Policy*, 38: 2988-2997.

Liddell, C. (2008). *The impact of Fuel Poverty on Children*. Belfast: Save the Children.

Lincoln, Y.S., and Guba, E.G. (1985). *Naturalistic Inquiry*. London: SAGE

Lorenzo-Seva, U., and Ferrando, P.J. (2012). TETRA-COM: A comprehensive SPSS program for estimating the tetrachoric correlation. *Behavior Research Methods*, 44(4): 1191-6.

Lusambili, A.M., Tod, A.M., Homer, C., Abbott, J., Cooke, J., and McDaid, K.A. (2011). Keeping Warm: Social Connectedness and Technology - A Case Study of Rotherham, England 'Technology and Health in the Elderly'. *The International Journal of Health, Wellness and Society*, 1: 27-42.

Mack J., and Lansley, S. (1985). *Poor Britain*, London: Allen and Unwin.

Marmot review team (2011). *The health impacts of cold homes and fuel poverty*. Friends of the Earth and the Marmot Review Team.

Mays, N., and Pope, C. (2000). Assessing quality in qualitative research. *British Medical Journal*, 320: 50-52.

McCann, E., and Ward, K. (2012). Policy Assemblages, Mobilities and Mutations: Toward a Multidisciplinary Conversation. *Political Studies Review*, 10: 325–332.

McCormick, J. (2008). *Understanding the European Union: A Concise Introduction*. Basingstoke: Palgrave Macmillan.

McKay, S. (2004). Poverty or Preference: What Do 'Consensual Deprivation Indicators' Really Measure? *Fiscal Studies*, 25: 201-223.

Miles, M., and Huberman, A. (1994). *Qualitative data analysis: an expanded sourcebook*. 2nd ed. London: SAGE.

Milne, G., and Boardman, B. (2000). Making cold homes warmer: the effect of energy efficiency improvements in low-income homes. *Energy Policy*, 28: 411-424.

Miniaci, R., Scarpa, C., and Valbonesi, P. (2014). Energy affordability and the benefits system in Italy. *Energy Policy*, 75: 289–300.

Moore, R. (2012). Definitions of fuel poverty: Implications for policy. *Energy Policy*, 49: 19-26.

Morgan, E. (2008). *Energy poverty in the EU*. Cardiff: Labour European Office.

Morris, G., and Braubach, M. (2012). The concept of environmental health inequalities. In World Health Organization, (Eds.). *Environmental Health Inequalities in Europe*. Copenhagen: WHO Regional Office for Europe, pp. 14-21.

Morrison, C. and Shortt, N. (2008). Fuel poverty in Scotland: Refining spatial resolution in the Scottish Fuel Poverty Indicator using a GIS-based multiple risk index. *Health and Place*, 14: 702-717.

Nierop, S. (2014). *Energy poverty in Denmark?* Aalborg University: Master Thesis.

Noeninckx, M. (2011). *Fighting Energy Poverty - the Belgian Experience*. Presented at the 4th Social Forum of the Energy Community, Chisinau [online]. Available at: http://www.energy-community.org/pls/portal/docs/1136183.PDF (Last accessed 9th November 2012).

Nussbaumer, P., Bazilian, M., and Modi, V. (2012). Measuring energy poverty: focusing on what matters. *Renewable and Sustainable Energy Reviews*, 16: 231– 243.

NVivo (n.d.) *Keep a project event log* [online]. Available at: http://help-nv10.qsrinternational.com/desktop/procedures/keep_a_project_event_log.htm#MiniTOCBookMark3 (Last accessed 5th August 2013).

OECD (2013). *What are Equivalence Scales?* [online]. Available at: http://www.oecd.org/els/soc/OECD-Note-EquivalenceScales.pdf (Last accessed 5th May 2015).

OECD (2009). *Methodology for Deriving the STRI*. OECD Experts Meeting on the Services Trade Restrictiveness Index (STRI), Paris, 2nd to 3rd July 2009.

OECD (2008). *Handbook on Constructing Composite Indicators: Methodology and User Guide*. Paris: OECD.

OECD (2001). *Glossary of Statistical Terms: Panel Surveys* [online]. Available at: http://stats.oecd.org/glossary/detail.asp?ID=2002 (last accessed 26th April 2013).

O'Leary, F., Howley, M., and Gallachóir, O. (2008). *Energy in the Residential Sector*. Dublin: Sustainable Energy Ireland.

Office for Social Inclusion (2007). *National Action Plan for Social Inclusion 2007 – 2016*. Dublin: Stationery Office.

Ormandy, D., and Ezratty, V. (2012). Health and thermal comfort: From WHO guidance to housing strategies. *Energy Policy,* 49: 116-121.

Osbaldeston, J. (1984). Fuel poverty in UK cities. *Cities*, 1(4): 366-373.

O'Sullivan, K.C., Howden-Chapman, P.L., and Fougere, G. (2011). Making the connection: The relationship between fuel poverty, electricity disconnection, and prepayment metering. *Energy Policy*, 39: 733–741.

Palmer, G., MacInnes, T., and Kenway, P. (2008). *Cold and Poor: An analysis of the link between fuel poverty and low income*. London: New Policy Institute.

Perry, M., Williams, R.L., and Waitzkin, H. (2008). Social Capital and Health Care Experiences Among Low-Income Individuals. *American Journal of Public Health*, 98: 330-336.

Peters, B.G. (2005). *Institutional Theory in Political Science: The 'New Institutionalism'*. 2nd Ed. London: Continuum.

Peterson, J. (2002). The College of Commissioners. In J. Peterson and M. Shackleton, (Eds.). *The Institutions of the European Union*. Oxford University Press, pp.71-94.

Peterson, J., and Shackleton, M. (2002). The EU's Institutions: An Overview. In J. Peterson and M. Shackleton, (Eds.) *The Institutions of the European Union*. Oxford University Press, pp. 1-18.

Petrova, S., Gentile, M., Mäkinen, I.H., Bouzarovski, S. (2013). Perceptions of thermal comfort and housing quality: exploring the microgeographies of energy poverty in Stakhanov, Ukraine. *Environment and Planning A*, 45(5): 1240-1257.

Phillips, N., and Hardy, C. (2002). *Discourse analysis: Investigating processes of social construction*. London: SAGE.

Pierson, P. (2004). *Politics in time: history, institutions, and social analysis*. Princeton University Press.

Plan Bâtiment Grenelle (2009). Groupe de travail Précarité énergétique Rapport. Paris: Plan Bâtiment Grenelle.

Poggi, A., and Florio, M. (2010). Energy deprivation dynamics and regulatory reforms in Europe: Evidence from household panel data. *Energy Policy*, 38(1): 253-264.

Pollitt, M.G. (2012). The role of policy in energy transitions: Lessons from the energy liberalisation era. *Energy Policy*, 50: 128–137.

Porritt, S.M., Cropper, P.C., Shao, L., and Goodier, C.I. (2012). Ranking of interventions to reduce dwelling overheating during heat waves. *Energy and Buildings*, 55: 16-27.

Potter, J. (2004). Discourse analysis as a way of analysing naturally-occurring talk. In D. Silverman, (Eds.). *Qualitative Research: Theory, Method and Practice*. 2nd ed. London: SAGE, pp. 200-21.

Potter, W.J., and Levine-Donnerstein, D. (1999). Rethinking Validity and Reliability in Content Analysis. *Journal of Applied Communication Research*, 27: 258-284.

Proidl, H. (2009). *E-Control & Caritas – Pilotprojekt "Energieberatungen von einkommensschwachen Haushalten".* Vienna: E-Control.

Quilgars, D. and Jones, A. (2010). Housing wealth: A safety net of last resort? Findings from a European study. In S.J. Smith and B.A. Searle, (Ed.). *The Blackwell Companion to the Economics of Housing: The Housing Wealth of Nations*. London: Blackwell, pp. 295 – 315.

Rappel (2011). Précarité Energétique: Etat des lieux et propositions d'actions. Montreuil: Project Rappel.

Reise, S.P., Moore, T.M., Haviland, M.G. (2010). Bifactor Models and Rotations: Exploring the Extent to Which Multidimensional Data Yield Univocal Scale Scores. *Journal of Personality Assessment*, 92(6), 544–559.

Richards, L. (2008). *Handling Qualitative Data: A Practical Guide*. London: SAGE.

Richardson, J. (2006). Policy-making in the EU: interests, ideas and garbage cans of primeval soup. In J. Richardson, (Ed.). *European Union: Power and Policy-making*. London: Routledge, pp. 3–30.

Robine, J-M., Cheung, S.L., Le Roy, S., Van Oyen, H., Griffiths, C., Michel, J.P., and Herrmann, F.R. (2008). Death toll exceeded 70,000 in Europe during the summer of 2003. *Comptes Rendus Biologies*, 331: 171-178.

Sagar, A.D. (2005). Alleviating energy poverty for the world's poor. *Energy Policy*, 33: 1367–1372.

Sailer-Fliege, U. (1999). Characteristics of post-socialist urban transformation in East Central Europe. *GeoJournal*, 49: 7–16.

Sampson, N.R., Gronlund, C.J., Buxton, M.A., Catalano, L., White-Newsome, J.L., Conlon, K.C., O'Neill, M.S., McCormick, S., and Parker, E.A. (2013). Staying cool in a changing climate: Reaching vulnerable populations during heat events. *Global Environmental Change*, 23: 475-484.

Sánchez-Guevara, C., Sanz Fernández, A., and Hernández Aja, A. (2014). Income, energy expenditure and housing in Madrid: retrofitting policy implications. *Building Research & Information*, DOI: 10.1080/09613218.2014.984573.

Santamouris, M., Alevizos, S.M., Aslanoglou, L., Mantzios, D., Milonas, P., Sarelli, I., Karatasou, S., Cartalis, K., and Paravantis, J.A. (2014). Freezing the poor—Indoor environmental quality in low and very low income households during the winter period in Athens. *Energy and Buildings*, 70: 61–70.

Santamouris, M., Kapsis, K., Korres, D., Livada, I., Pavlou, C., Assimakopoulos, M.N. (2007). On the relation between the energy and social characteristics of the residential sector. *Energy and Buildings*, 39: 893–905.

Santamouris, M., Paravantis, J.A., Founda, D., Kolokotsa, D., Michalakakou, P., Papadopoulos, A.M., Kontoulis, N., Tzavali, A., Stigka, E. K., Ioannidis, Z., Mehilli, A., Matthiessen, A., and Servou, E. (2013). Financial crisis and energy consumption: A household survey in Greece. *Energy and Buildings*, 65: 477–487.

Scott, S., Lyons, S., Keane, C., McCarthy, D. and Tol, R.S.J. (2008). *Fuel Poverty in Ireland: Extent, Affected Groups and Policy Issues*. Dublin: The Economic and Social Research Institute.

Seale, C. (2010). Using Computers to Analyse Qualitative Data. In D. Silverman, (Ed.). *Doing Qualitative Research: A Practical Handbook*. 3rd ed. London: SAGE, pp. 251-267.

Shackleton, M. (2002). The European Parliament. In J. Peterson and M. Shackleton, (Eds.). *The Institutions of the European Union*. Oxford University Press, pp. 95-117.

Shah, S., and Peacock, J. (1999). Deprivation and excess winter mortality. *Journal of Epidemiology and Community Health*, 53: 499-502.

Shucksmith, M., Cameron, S., Merridew, T., and Pichler, F. (2009). Urban–Rural Differences in Quality of Life across the European Union. *Regional Studies*, 43: 1275-1289.

Silverman, D. (2006). *Interpreting Qualitative Data*: *Methods for Analyzing Talk, Text and Interaction*. 3rd ed. London: SAGE.

Smith, J. (2004). Reliability and Validity in Qualitative Research. In M.S. Lewis-Beck, A.E. Bryman, and T.F. Liao, (Eds.). *The SAGE Encyclopedia of Social Science Research Methods.* London: SAGE, pp. 958-959.

Smith, A.K., Ayanian, J.Z., Covinsky, K.E., Landon, B.E., McCarthy, E.P., Wee, C.C., and Steinman, M.A. (2011). Conducting High-Value Secondary Dataset Analysis: An Introductory Guide and Resources. *Journal of General Internal Medicine*, 26(8): 920–929.

Snell, C., and Bevan, M. (2014). *Annex A - Fuel poverty and disability: a review of existing knowledge conducted for Eaga Charitable Trust.* University of York.

Snell, C., and Thomson, H. (2013). Reconciling fuel poverty and climate change policy under the Coalition government: Green deal or no deal? In G. Ramia and K. Farnsworth, (Eds.). *Social Policy Review 25: Analysis and debate in social policy*. Bristol: The Policy Press, pp.23-45.

Somerville, M., Mackenzie, I., Owen, P., and Miles, D. (2000). Housing and health: does installing heating in their homes improve the health of children with asthma? *Public Health*, 114: 434-439.

Starks, H., and Trinidad, S.B. (2007). Choose Your Method: A Comparison of Phenomenology, Discourse Analysis, and Grounded Theory. *Qualitative Health Research*, 17: 1372-1380.

Sterne, J.A., White, I.R., Carlin, J.B., Spratt, M., Royston, P., Kenward, M.G., Wood, A.M., and Carpenter, J.R. (2009). Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. *BMJ*, 338:b2393.

Stockton, H., and Campbell, R. (2011). *Time to reconsider UK energy and fuel poverty policies?* York: Joseph Rowntree Foundation.

Sustainable Energy Ireland (2003). *A Review of Fuel Poverty and Low Income Housing*. Dublin: Sustainable Energy Ireland.

Sýkora, L. and Bouzarovski, S. (2012). Multiple Transformations: Conceptualising the Post-communist Urban Transition. *Urban Studies*, 49(1): 43–60.

Tarantola, S., Saisana, M., and Saltelli, A. (2002). *Internal Market Index 2002: Technical details of the methodology*. Italy: Joint Research Centre, European Commission.

Tavakol, M., and Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, 2: 53-55.

The Consumer Council (2013). *Comparative Domestic Cost of Gas v Oil Report.* Belfast: The Consumer Council.

Thelen, K., and Steinmo, S. (1998). Historical Institutionalism in Comparative Politics. In S. Steinmo, K. Thelen and F. Longstreth, (Eds.). *Structuring Politics: Historical Institutionalism in Comparative Analysis*. New York: Cambridge University Press, pp. 1-32.

Thomson, H. (2011). *Qualifying and quantifying fuel poverty across the 27 EU member states*. University of York: Master's dissertation.

Thomson, H., and Snell, C. (2014). *Fuel Poverty Measurement in Europe: a Pilot Study*. University of York.

Thomson, H., and Snell, C. (2013). Quantifying the prevalence of fuel poverty across the European Union. *Energy Policy*, 52: 563-572.

Thomson, H., Snell, C., and Bevan, M. (2013). *Fuel Poverty and Disability: a statistical analysis of the English Housing Survey - Deliverable 1*. University of York.

Tirado Herrero, S., Jiménez Meneses, L., López Fernández, J.L., and Martín García, J. (2014). *Pobreza energética en España. Análisis de tendencias*. Madrid: Asociación de Ciencias Ambientales.

Tirado Herrero, S. López, J.L., and Martín, P. (2012). *Estudio de Pobreza Energética. Potencial de generación de empleo derivado de la rehabilitación energética de viviendas*. Madrid: Asociación de Ciencias Ambientales.

Tirado Herrero, S. and Ürge-Vorsatz, D. (2012). Trapped in the heat: A post-communist type of fuel poverty. *Energy Policy*, 49: 60-68.

Tirado Herrero, S. and Ürge-Vorsatz, D. (2010). *Fuel Poverty in Hungary: A first assessment*. Budapest: Central European University.

Titler, M.G., Herr, K., Xie, X.J., Brooks, J.M., Schilling, M.L., and Marsh, J.L. (2009). Summative index: Acute pain management in older adults. *Applied Nursing Research*, 22: 264–273.

Todd, S., and Steele, A. (2006). Modelling a culturally sensitive approach to fuel poverty. *Structural Survey*, 24(4): 300 – 310.

Townsend, P. (1979). *Poverty in the United Kingdom: A Survey of Household Resources and Standards of Living*. London: Penguin Books.

Tracy, S.J. (2010). Qualitative Quality: Eight ''Big-Tent'' Criteria for Excellent Qualitative Research. *Qualitative Inquiry*, 16: 837-851.

Tsebelis, G. (1999). *Institutional Analyses of European Union*. European Community Studies Association Newsletter, Spring 1999.

United Nations Economic Commission for Europe (2011) *Generations and Gender Survey Wave 1 2008 – 2010* [computer file]. Paris: Institut national des études démographiques [distributor] Version 4.2

United Nations Economic Commission for Europe (2007). *Generations & Gender Programme: Concepts and Guidelines*. Geneva: United Nations Economic Commission for Europe.

United Nations Statistical Commission and Economic Commission for Europe (2000). "*Terminology on Statistical Metadata*", Conference of European Statisticians Statistical Standards and Studies, No. 53, Geneva.

Ürge-Vorsatz, S. and Tirado Herrero, D. (2012). Building synergies between climate change mitigation and energy poverty alleviation. *Energy Policy*, 49: 83-90.

Ürge-Vorsatz, D., Miladinova, G., and Paizs, L. (2006). Energy in transition: From the iron curtain to the European Union. *Energy Policy*, 34 (15): 2279-2297.

Vartanian, T.P. (2010). *Secondary Data Analysis*. New York: Oxford University Press USA.

Vulnerable Consumer Working Group (2013). *Vulnerable Consumer Working Group Guidance Document on Vulnerable Consumers*. Brussels: European Commission.

Waddams Price, C., Brazier, K., and Wang, W. (2012). Objective and subjective measures of fuel poverty. *Energy Policy*, 49: 33-39.

Walker, G. and Day, R. (2012). Fuel poverty as injustice: Integrating distribution, recognition and procedure in the struggle for affordable warmth. *Energy Policy*, 49: 69-75.

Walker, R., Liddell, C., McKenzie, P., Morris, C., and Lagdon, S. (2014). Fuel poverty in Northern Ireland: Humanizing the plight of vulnerable households. *Energy Research & Social Science*, 4: 89–99.

Walker, R., McKenzie, P., Liddell, C., and Morris, C. (2012). Area-based targeting of fuel poverty in Northern Ireland: An evidenced-based approach. *Applied Geography*, 34: 639-649.

Wallace, H. (2010). An Institutional Anatomy and Five Policy Modes. In H. Wallace, M.A. Pollack, and A.R. Young., (Eds.). *Policy-Making in the European Union*, 6th ed. Oxford University Press, pp. 69-104.

Wallace, H., Pollack, M.A., and Young, A.R. (2010). Institutions, Process, and Analytical Approaches: An Overview. In H. Wallace, M.A. Pollack, and A.R. Young., (Eds.). *Policy-Making in the European Union*, 6th ed. Oxford University Press, pp. 3-13.

Wallenborn, G., and Wilhite, H. (2014). Rethinking embodied knowledge and household consumption. *Energy Research & Social Science*, 1: 56–64.

Watson, D., and Maitre, B. (2014). *Is fuel poverty in Ireland a distinct type of deprivation?* Dublin: Economic and Social Research Institute.

Whyley, C., and Callender, C. (1997). *Fuel poverty in Europe: evidence from the European Household Panel Survey*. Newcastle upon Tyne: National Energy Action.

Wier, M., Birr-Pedersen, K., Jacobsen, H.K., and Klok, J. (2005). Are CO2 taxes regressive? Evidence from the Danish experience. *Ecological Economics,* 52: 239–251.

Wodak, R. (2008). Introduction: Discourse Studies – Important Concepts and Terms. In R. Wodak, and M. Krzyżanowski, (Eds.). *Qualitative Discourse Analysis in the Social Sciences*. Basingstoke: Palgrave Macmillan, pp. 1-29.

World Health Organization Regional Office for Europe (2007). *Housing, Energy and Thermal Comfort: A review of 10 countries within the WHO European region*. Copenhagen: WHO Regional Office for Europe.

World Health Organization (1987). *Health impact of low indoor temperatures*. Copenhagen: WHO Regional Office for Europe.

Wright, A. (2008). What is the relationship between built form and energy use in dwellings? *Energy Policy*, 36 (12): 4544–4547.

Xiao-jing, G. (2012). The Influence of Low-carbon Economy on Global Trade Pattern. *Physics Procedia*, 25: 1676 – 1681.

Young, A.R. (2010). The European Policy Process in Comparative Perspective. In H. Wallace, M.A. Pollack, and A.R. Young., (Eds.). *Policy-Making in the European Union*, 6th ed. Oxford University Press, pp.45-68.

Zahariadis, N. (2013). Building better theoretical frameworks of the European Union's policy process. *Journal of European Public Policy*, 20 (6): 807-816.