Regional Goods and Labour Markets in the UK: An Empirical Analysis

By

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To my father

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THESIS ABSTRACT

This thesis is an empirical investigation into the behaviour of regional unemployment, wages and prices for the UK economy over the period 1974-1996. It develops a measure for regional retail prices and regional retail price expectations with which to examine regional price behaviour and to develop a further understanding of the labour market adjustment processes that occur at the regional level.

Using regional prices and regional price expectations this thesis produces results which demonstrates a greater consistency with the predictions of regional wage determination models than either aggregate real wage modelling or the use of aggregate prices. The analysis of regional labour markets is developed alongside the dramatic change in regional unemployment relativities that occurred in the UK over the early 1990s and finds support for a clear north-south differential in regional real wage-adjustment processes consistent with contemporary models of wage determination. It is argued that the change in regional unemployment differentials was due to a combination of region-specific price expectational errors and the asymmetric impact of the economic shock. The narrowing of regional unemployment differentials occurred because real wage adjustment was slower in the south than in the north.

This thesis suggests that regional price expectations can be modelled as a function of the perceived regional economic climate. Due to the incidence of region-specific shocks and regional asymmetries in the response to such economic shocks, it is argued that aggregate modelling of the UK labour market leads to spurious results on estimated labour market relationships unless regional differences are explicitly modelled. It is argued that regional labour market modelling needs to incorporate a measure of regional prices with which to model the underlying processes.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This thesis is an empirical examination into the behaviour of UK regional unemployment, wages and prices. Its main innovation is the construction of regional retail price and regional retail price expectations variables with which to examine the behaviour of the regional labour market and test the predictions of regional models of wage determination.

Regional labour market models, from regional Phillips curves first suggested by Lipsey (1960), to the more recently developed regional wage curve model of Blanchflower and Oswald (1994) suggest that regional unemployment is either determined by or reflects changes in the rate or level of regional wages. Both theoretically and empirically, establishing region-specific labour market processes is, however, difficult to achieve. Essentially this is because the region is part of the national economy, extensive inter-regional trade and the impact of national economic policies upon the regional economy makes it difficult to disentangle what determines regional variables. In pooling regional relationships this inter-relatedness is picked up by the presence of cross-sectional correlation of the residuals. To get efficient coefficient estimates, this needs to be removed. Testing for and removing cross-sectional correlation lie at the heart of modelling of regional labour markets and is taken explicitly into account in regional labour market estimations.

Empirically regional labour market analysis has focused on the existence of persistent regional unemployment differences. Attempts at trying to understand the causes of such persistence (e.g. Thirwall (1966), Forrest and Naisbitt (1988), Bover, Muellbauer and Murphy (1989)), the possible problems such persistence might have

(Blackaby and Manning (1987), Blackaby and Murphy (1995)), and the consequent behaviour of the regional economy (Lispey (1960), Blackaby and Manning (1992) and Blanchflower and Oswald (1994)) dominate the regional economic literature. Very little empirical work has, however, been done on the incorporation of a robust measure of regional prices and no work at all on the incorporation of region-specific price expectations.

Government policy seeking to address the issue of regional unemployment differences has gone hand in hand in the literature with the notion that the UK economy is divided geographically into a prosperous, fast growing, low unemployment south, against a less prosperous, slow growing, high unemployment north. The division being some point around the Midlands is well-established. The division is, however, formally based on relative unemployment differences, (see Blackaby and Murphy (1995), p 492) and has been in existence for over 70 years (McCormick (1997) p. 582). This thesis explores regional labour market interaction and tests whether a clear north-south divide exists in the relationship between unemployment, wages and prices and whether it is stable through time. The motivation for this exploration is the particular regional impact of the national economic recession of the early 1990s which led to a dramatic shift in regional unemployment differentials. This thesis seeks to explain why this dramatic shift occurred.

1.2 Motivation of Thesis

The motivation of this thesis is in seeking to explain regional unemployment differentials within the context of regional labour market adjustments using a robust measure of regional prices and regional price expectations.

Implicit in the notion of regional labour market adjustment processes explaining unemployment differentials is that the regional labour market is significantly different from the national. The competitive / neo-classical model of wage determination argues that the existence of, at times large and persistent differences in, regional unemployment suggest that the source of such differences are economic characteristics particular to the region (see for instance Blackaby and Manning

(1987)). As a result it is predicted that differences in regional unemployment would be mirrored by regional differences in wages and prices. If these characteristics are not region-specific then regional unemployment differences would be competed away. Differences in regional unemployment wages, and prices are, however, consistent with the existence of a number of institutional factors (Blackaby and Manning (1987), p. 158). As a result current regional labour market literature supports the notion that regional labour markets do not operate according to the assumptions of the neo-classical model in particular with respect to housing and mobility of labour, (see for instance Bover, Muellbauer and Murphy (1989)). In challenging the neo-classical model a number of papers have attempted to incorporate a measure of regional cost of living differences, assumed important in regional labour market decision-making and hence unemployment. The incorporation of regional living costs has, however, been based purely on survey data which itself has not been thoroughly examined nor compared with the Retail Price Index. These failings suggest that if these regional cost of living estimates are not representative of the true regional cost of living they might produce potentially misleading and biased estimates in regional labour market estimation. This thesis re-examines the source of these regional living costs estimates and constructs a measure of regional prices that, in the aggregate are not significantly different from the behaviour of the published Retail Prices Index. Regional price behaviour and regional real wage estimates are therefore derived in examining the relationship between regional unemployment and regional real wages. Furthermore expected prices are constructed and examined in seeking to analyse the behaviour of the regional labour market. Regional price expectations are formulated at the regional level alone, and different price expectations hypotheses assumed with which to try and understand regional unemployment behaviour.

1.2 Contribution of Thesis

In the construction of regional price and regional price expectations estimates this thesis offers a more robust estimate of regional prices than alternative regional price specifications used in the literature. It also provides evidence of the regional price variable being superior to the use of the RPI in analysing the regional labour market. Wage determination models such as the wage curve model of Blanchflower and Oswald (1990) and regional Expectations-Augmented Phillips Curve (EAPC hereafter) estimates are based on the theoretical presumption that real wages and expected prices are significantly related to unemployment, with respect to these models this hypothesis is tested. More importantly the behaviour of regional prices against the RPI is examined, and the existence of regional price asymmetries tested. The issue of improved regional labour market estimates using a regional price variable over a national average is examined.

In regional labour market analysis this thesis attempts to unravel the deterministic processes of regional economic behaviour. It establishes that regions are driven by a number of factors that are both particular to the region and shared with other regions. The empirical estimates on regional labour markets at times fail to address this issue. In all regional labour market models examined in this thesis cross-sectional correlation is explicitly tested for. The inability to reject the presence of cross-sectional correlation suggests not only that estimated models without similarly testing for and removing it produce potentially inefficient estimates but also that regions despite economic differences are highly inter-related. Regression estimates of the regional labour market incorporating regional prices against the national average are used to measure the relationship between the region and the nation over time. It is found that in a number of cases, over certain time periods, the hypothesis that the regional labour market is not statistically, significantly different from the national average can be rejected.

1.3 Plan of Thesis

1.3.1 Chapter Two

This Chapter explores and analyses the behaviour of the 'claimant count' measure of regional unemployment, for all adults, all males and all females, for April of each year 1974-1996. Measures of dispersion combined with Figures and Tables on the changing regional unemployment rate chronicle the dramatic shift in the narrowing of regional unemployment differentials in the early 1990s which is supported by regression estimates and test statistics over this period. Chapter Two also examines the behaviour of regional nominal wages measured as Average Gross Weekly Earnings divided by the number of hours worked, for all adults, all males and all females, for April of each year, 1974-1996. Similar statistical analyses as unemployment, however, fail to pick up significant regional wage variations and only a weak relationship between regional wages and regional unemployment behaviour is identified.

1.3.2 Chapter Three

This Chapter focuses on the construction of a regional price index using a combination of official and unofficial data for each of the 11 Standard Statistical Regions of the UK. The technique adopted in combining this data to produce a retail price indices for each region, is determined by comparing the behaviour of constructed aggregate estimates of UK prices with the behaviour of the RPI. Regional prices were constructed to April of each year over the period 1974-1996. Analysis of regional price behaviour indicates a very high degree of correlation across all regions and with the RPI insignificant differences in regional price levels are found. Regional price variations, however, are estimated and variations in the variability of regional prices are found over the late 1980s and early 1990s period. This finding suggests that regional price variability might be correlated with the changing pattern of regional unemployment and that regional price asymmetries have occurred over the period.

1.3.3 Chapter Four

This Chapter constructs two measures of regional real wages, one using the regional price indices from Chapter Three and the other using the RPI. All values are to April of each year. This Chapter introduces the notion of pooling regional equations and estimation of the parameters using the Seemingly Unrelated Regression technique (SUR), or on smaller samples using the method of Generalised Least Squares (GLS) and then correcting for the presence of cross-sectional correlation.

Regional real wage variations are found to be more marked with regional price deflators than the RPI, and show stronger support for the predictions of wage determination models over the period 1975-1989. From 1990, however, the changing dispersion of regional unemployment is not matched by the predicted behaviour in the dispersion of regional real wages under the assumption of symmetrical adjustment in demand across all regions. This suggests that either the economic shock of the 1990s was not symmetrical in its impact or that regional wage processes differ across regions. Simple symmetrical tests on nominal wages and prices suggest that actual prices in the south of the UK differed from the north and as a result affected relative real wage growth.

1.3.4 Chapter Five

This Chapter examines the issue of regional EAPC estimates differing over time and across regions. Implicit in these estimates is the aggregation hypothesis of Lispey (1960) that regional Phillips curves, (interpreted as short-run EAPCs) are significantly different from each other. The modelling of the EAPC involves estimation of the regional price expectations coefficients. These expectations variables are constructed based on the assumptions of both the adaptive expectations hypothesis and the rational expectations hypothesis, for both the regional price indices and the RPI. Support for regional EAPCs in the short-run in which unemployment is found to be significantly related to wages and in the long-run in which unemployment is not significantly related to wages are found. Modelling changes in unemployment as determined by price expectational errors, the post-1990 period in which regional unemployment differential narrowed finds that such expectational errors are significantly related to movements in unemployment. The estimated coefficients on price errors are, however, poor for the RPI in terms of distinguishing between the north-south regional unemployment differentials and between the different price expectations hypotheses. Whilst the regional price expectational errors produce different coefficient estimates for the north and the south this is not the case for the different price-expectations hypotheses. Modelling price expectations as a function of the perceived economic climate, a switching regression model of price expectational errors on unemployment is produced. This provides superior estimated coefficients on the role of price errors, with such errors in the south having a greater impact on unemployment than in the north.

1.3.5 Chapter Six

Finally Chapter Six offers come concluding comments on the major findings of the thesis, it contains a summary of each Chapter and offers some areas for further research.

CHAPTER TWO

REGIONAL UNEMPLOYMENT AND WAGES

2.1 Introduction

This chapter examines the behaviour of both the "claimant count" measure of unemployment and the measured average gross hourly earnings of the labour force for each of the UK regions as well as the UK average, using annual data over the period 1974 to 1996. A distinction is made between examining the average totals in each case as well as segregating the labour market measures into total, male and female. The reason for the examination is in the main to chart the behaviour of these variables in the hope of identifying their major characteristics, and in particular to examine any relationships between wages and unemployment that would support the hypothesis that regional labour markets interact. The data are official and have been used in a number of studies in the past that have sought to characterise the labour market across the UK regions. The apparent paradox between the faith placed in the efficient operation of a market-based labour market and the existence of persistent and sometimes chronic unemployment differences across the regions has been at the centre of prior investigations into regional labour market analysis. This chapter explores and tests the regional behaviour of unemployment and wages.

2.2 Unemployment

The current government's definition of unemployment refers to the labour market 'claimant count' measure as defined by the Office for National Statistics (ONS). Either in its thousands or as a percentage of the registered workforce it refers to all individuals who are in receipt of unemployment-related benefits. As such it covers individuals who are registered as actively seeking work and who are able to provide, on request, evidence to that effect.[1] Given that the current measure is based on individuals who are not only registered as actively seeking work but who are also in receipt of benefits, the true number of persons being unemployed is difficult to ascertain; however, the 'claimant count' is the only official and consistent measure available over the time period.

The unemployment rate typically characterises the economic state of the national economy of the U.K. Although the unemployment rate typically lags the trade cycle it nonetheless demonstrates a clear inverse relationship with the economy's growth cycle of real Gross Domestic Product (GDP).

2.2.1 Regional Unemployment

Unemployment data are collected geographically, so the compilation of regional unemployment rates is not a difficult procedure.

For the seventy years up until 1990, UK regional unemployment has demonstrated a distinct regional pattern. Whilst regional unemployment rates exhibited a highly synchronous pattern through time there has been a clear high-low unemployment split between the north and south of the country respectively. Indeed this split is or has often been referred to in the context of there being a regional problem and has formed the basis of regional policy and analysis, (cf. Armstrong and Taylor (1993) Chapter 8). Regional policy, however, has concentrated on the regional labour market, in which regional unemployment forms only one part. Indeed the division of regional unemployment into varying types, the regional distribution of industries and occupations and the inter-relatedness of regional economies with the national economy makes the analysis of regions difficult. As such the analysis of regional unemployment involves a much deeper understanding of the behaviour of the regional labour markets. Studying the behaviour of regional unemployment offers a first insight into such regional markets.

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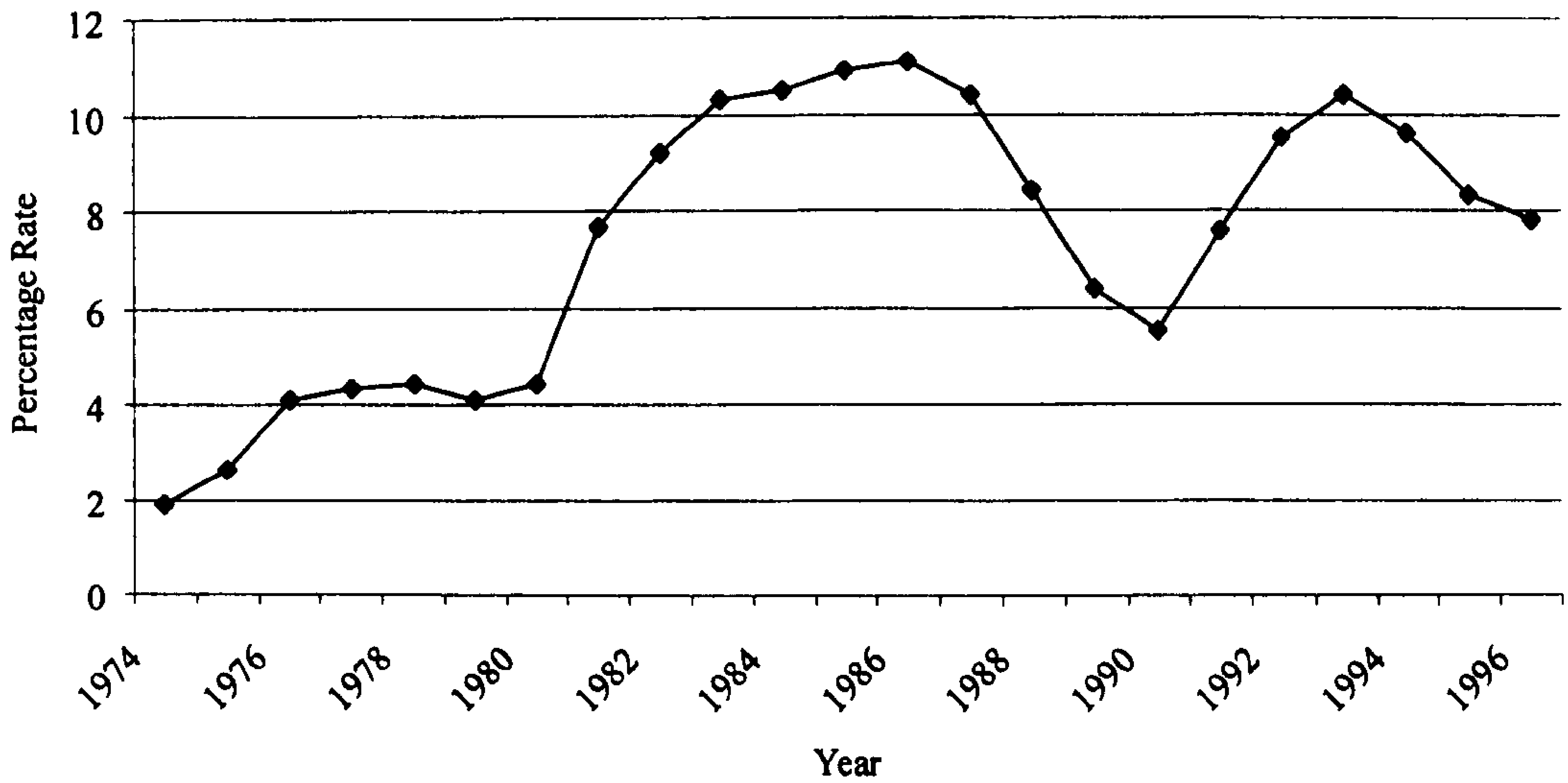
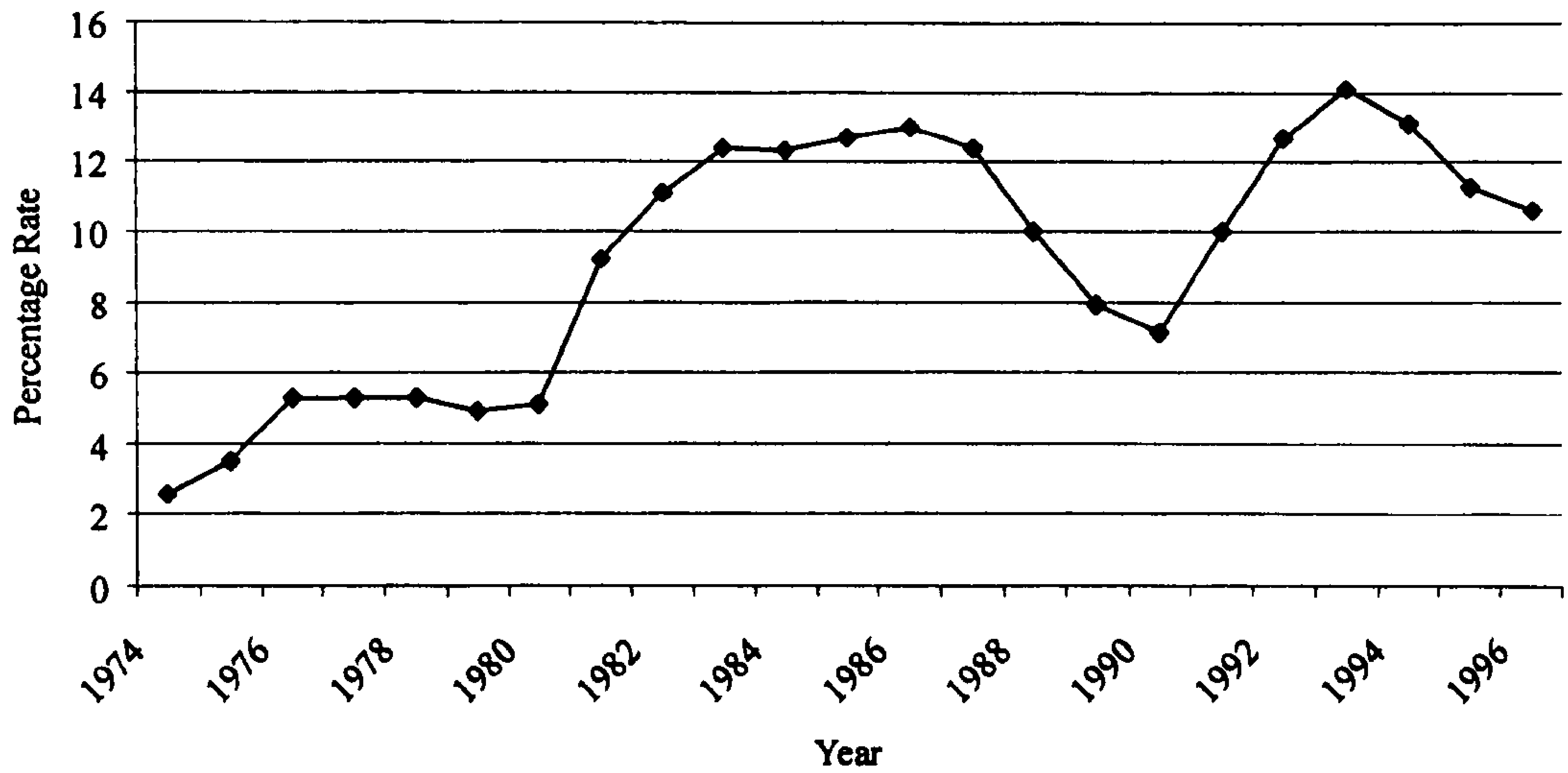
[1] A distinction is made between the economist's definition of unemployment and the government's. In particular the latter requires registration to that effect and proof of employment search At the time of, writing, over the 1974-1996 sample period the official unemployment measure has changed on 29 times occasions. Furthermore married women looking for employment are excluded from the 'claimant count' measure of unemployment.

Figure 2.1: Percentage Rate of Total Unemployment, 1974-1996



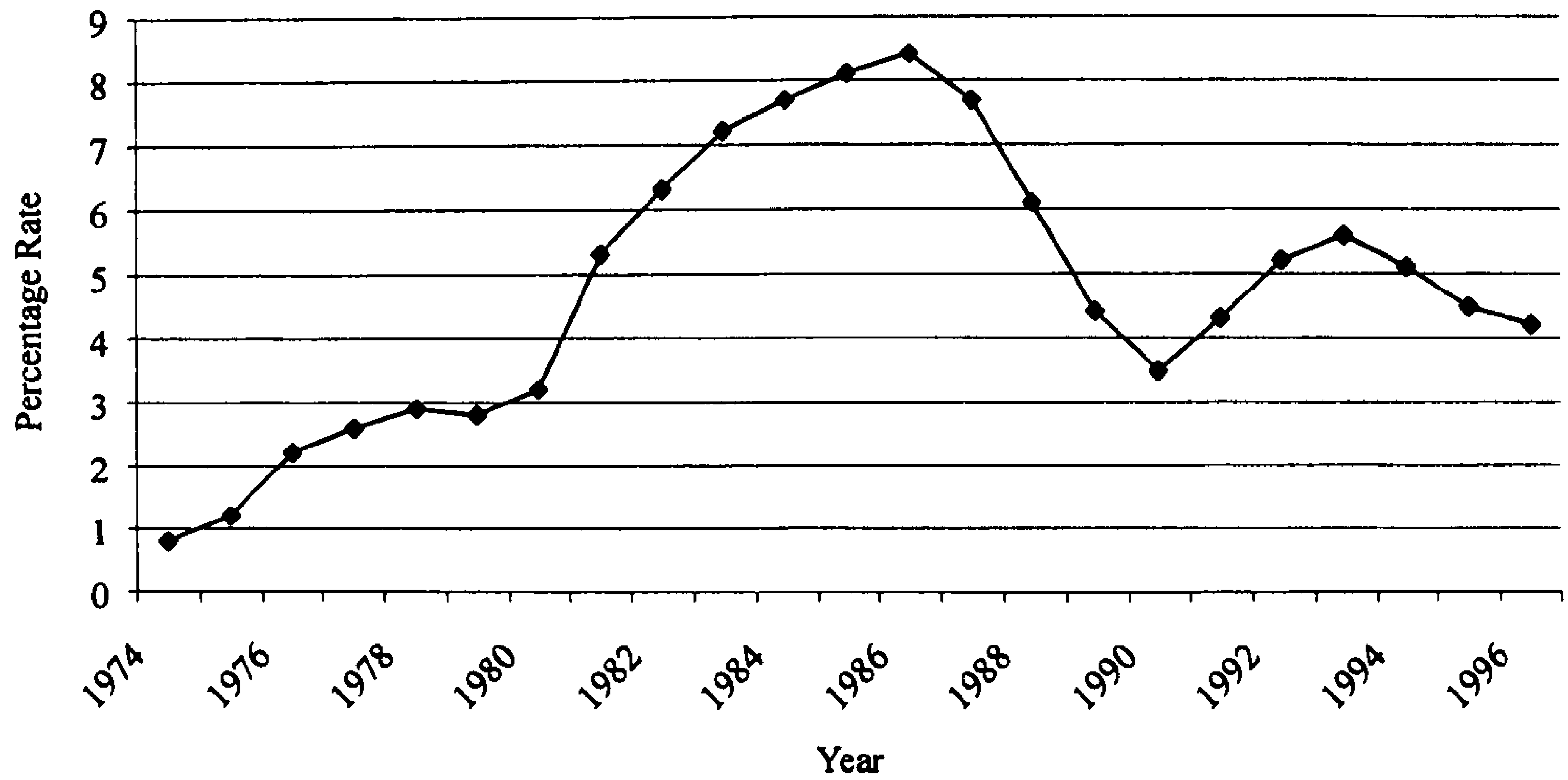
Source: DfEE: (1998), April Percentage Unemployment Rates, 1974-1996. Claimant Count Consistent Measure.

Figure 2.2: Percentage Rate of Male Unemployment, 1974-1996



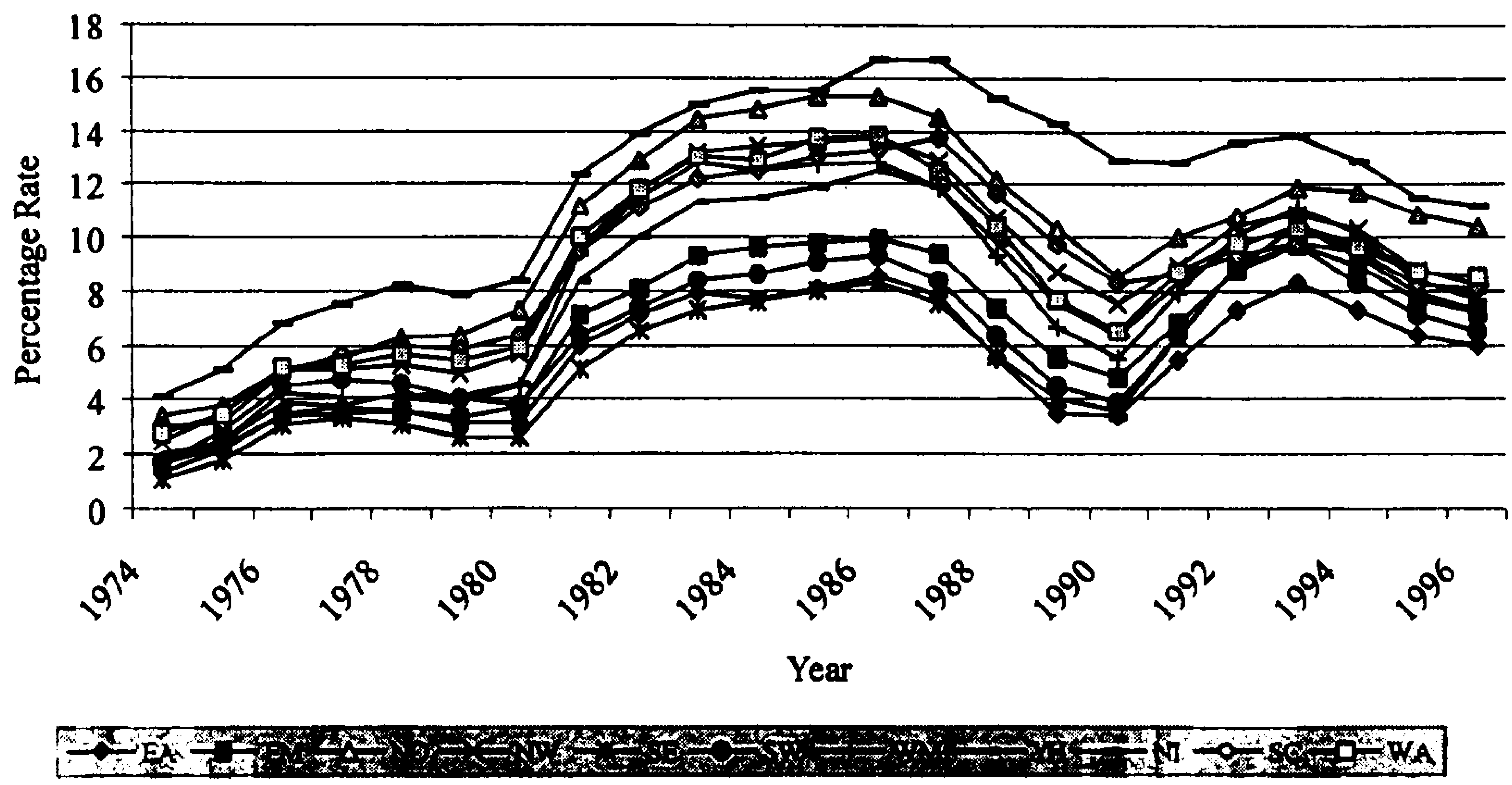
Source: DfEE: (1998), April Percentage Unemployment Rates, 1974-1996. Claimant Count Consistent Measure.

Figure 2.3: Percentage Rate of Female Unemployment, 1974-1996



Source: DfEE: (1998), April Percentage Unemployment Rates, 1974-1996. Claimant Count Consistent Measure.

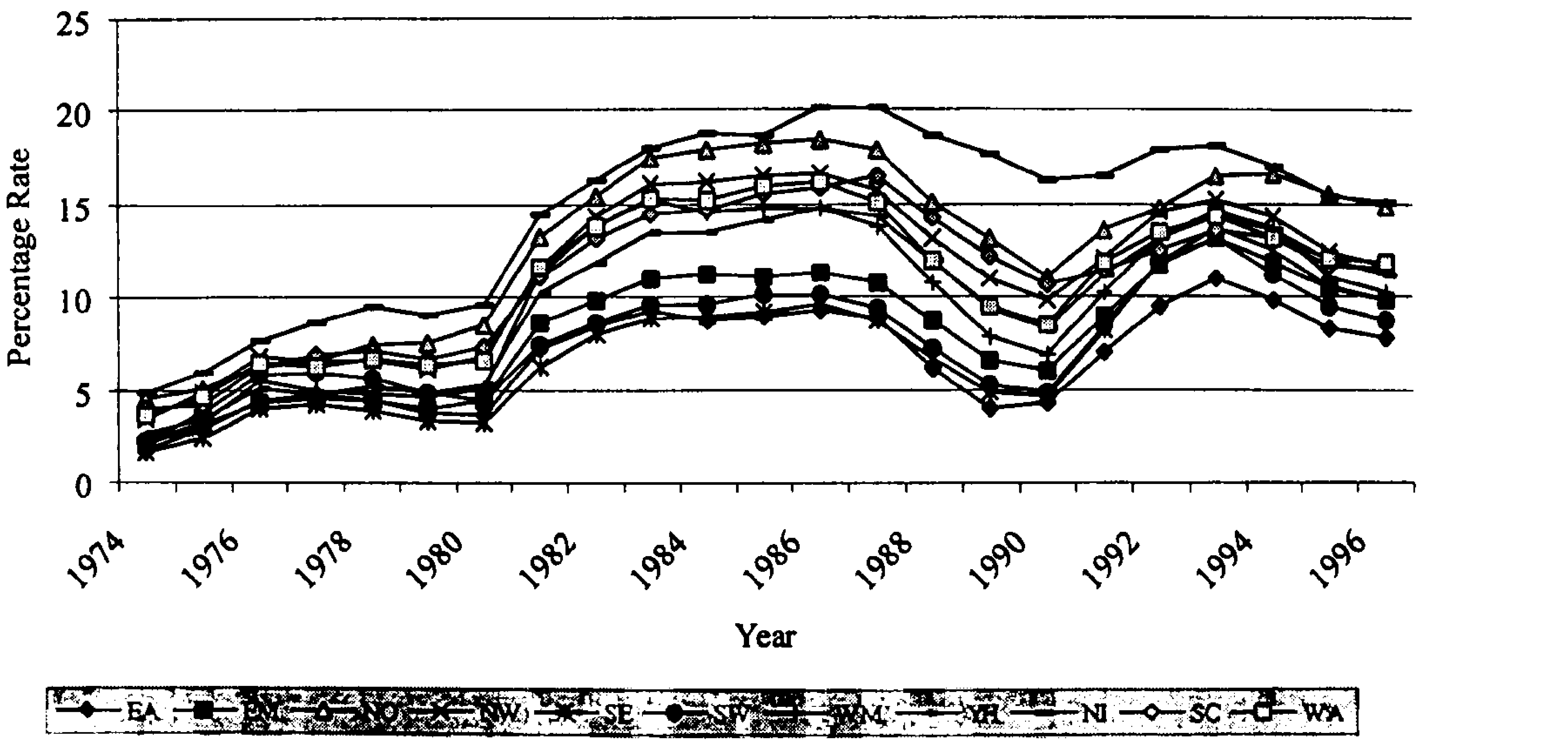
Figure 2.4: Percentage Rates of Regional Total Unemployment, 1974-1996



Source: DfEE: (1998), April Percentage Unemployment Rates, 1974-1996. Claimant Count Consistent Measure.[2]

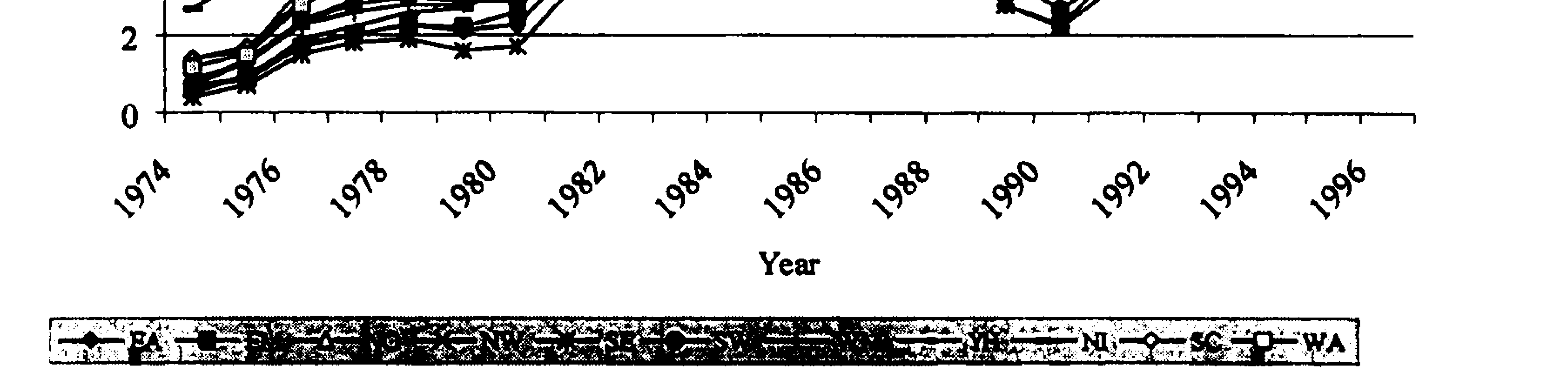
[2] Where EA = East Anglia, EM = East Midlands, NO = North, NW = North West, SE = South-East, SW = South West, WM = West Midlands, YH= Yorkshire & Humberside, NI = Northern Ireland, SC = Scotland and WA = Wales.

Figure 2.5: Percentage Rates of Regional Male Unemployment, 1974-1996



Source: DfEE: (1998) April Percentage Unemployment Rates, 1974-1996. Claimant Count Consistent Measure.[3]

Figure 2.6: Percentage Rates of Regional Female Unemployment, 1974-1996



Source: DfEE: (1998), April Percentage Unemployment Rates, 1974-1996. Claimant Count Consistent Measure.

[3] For regional identifiers see footnote on previous page.

Figures 2.1 to 2.3 illustrate the unemployment rate for the UK, using the official annual data from the Department for Education and Employment (DfEE hereafter), for April of each year 1974-1996 inclusive. Whilst the unemployment rate is given for the total and male / female split a similar rise and fall of the unemployment rate is pictured clearly in all three graphs. The economic recessions of the early 1980s and 1990s exhibit the familiar rise and fall of unemployment. The pattern of the early 1990s, however, is different from that of the early 1980s. Not only does the unemployment rate reach its peak much earlier from the start of the rise in unemployment than in the 1980s, (see Morgan (1996) for a discussion on this) but male unemployment appears to have risen by far more than female unemployment. Why this is the case is, however, not clear. It is perhaps due to the relative shares of the workforce population by males and females[4], combined with the recording of female unemployment, in which unemployed married women are excluded from the 'claimant count' figures. Nonetheless from the 1990s at least the overall pattern of unemployment is dominated by the pattern of male unemployment.

Figures 2.4 to 2.6 graph the regional unemployment rates for all three measures of unemployment. As is evident the aggregate pattern is similar to that of each of the individual regions over the period with a similar rise and fall in the unemployment rates over the period. However, the regional unemployment pattern in the 1990 period onwards differs with evidence of a narrowing of unemployment differentials. Comparing male regional unemployment behaviour with the UK national average, a larger rise in male unemployment over the early 1990s is marked by a much greater symmetry in regional unemployment behaviour. The regional behaviour of male unemployment changed in the early 1990s. In particular there appears to have been a relatively larger rise in unemployment in the traditionally lower unemployment regions of the south.[5]

[4] Over the sample period the official measure of female participation in the labour market has risen from 38% to 46%, a pattern that is similar across all regions. Analysis of the female labour market has also raised interest because of the large growth in part-time workers who are predominantly female, and with the way in which part-time employment as well as unemployed married women are treated in the construction of unemployment figures (see Martin (1996)). The differing treatment of the measured unemployment rate makes it difficult to draw direct comparisons across the two groups of male and female unemployment.

[5] Where the south represents the regions of East Anglia, East Midlands, the South East and the South West, the north is taken as the remaining seven regions, see later.

Overall the six Figures illustrate the familiar story of the 1970s and 1980s as that characterising a fairly long run steady increase in the percentage rate of unemployment within the notable cycles associated with the economic recessions and boom periods of the mid 1970s, early 1980s late 1980s and early 1990s. This picture of a steadily rising trend rate of unemployment is common across all the main European economies and has been the subject of fierce debate as to the exact root causes and consequences of such a stark rise (for a full review see Bean (1994)).

Focusing on the regional comparisons, the overall pattern of unemployment in all three figures is similar across all regions as shown in Figures 2.4, 2.5 and 2.6. However, it is the behaviour of regional unemployment in the early 1990s that is of special interest. Whereas in all economic cycles prior to the 1990s regional unemployment differentials widened in the context of a national economic recession. (see Thirwall (1966), Brechling (1967), Taylor and Bradley (1994) and McCormick (1997)), the economic recession of the early 1990s appears to have reversed this trend. However, this is not only a curiosity in its own right but is also of interest in the context of growing regional unemployment disparities of the early 1980s that prompted a number articles warning of a severe north-south split re-emerging in the UK, (see Blackaby and Murphy (1995), p. 487). The events of the 1990s, however, appear to have quelled such concerns.

2.2.2 Regional Unemployment: North versus South

Whilst the issue of a region being modelled as an economic entity is controversial, the argument that the UK economy divides into a clear geographical split between a high unemployment north and a low unemployment south fuels the debate.

As a precursor to examining the behaviour of regional unemployment more formally, Tables 2.1-2.3 provide measures of the unemployment rate for the total, male and female categories for selected years. The numbers demonstrate more accurately the pattern of unemployment, but it is the relatively large change in the unemployment rate which is of interest. Over the 1974-1989 period the relative positions of the regions have remained constant; however, this appears to have changed in the early 1990s.

Table 2.1: Unemployment Rates: Regional Totals: Percentage of Workforce, Selected Years

Region	1974	1980	1982	1986	1990	1992	1996
East Anglia	1.3	3.2	7.1	8.5	3.4	7.3	6.0
East Midlands	1.6	3.7	8.1	9.9	4.8	8.8	7.2
North	3.4	7.3	12.9	15.3	8.5	10.8	10.4
North-West	2.5	5.7	11.7	13.7	7.5	10.5	8.2
South-East	1.1	2.6	6.5	8.3	3.6	8.9	7.3
South-West	1.7	3.8	7.4	9.3	3.9	8.9	6.5
West Midlands	1.7	4.5	11.5	12.8	5.5	10.1	7.7
Yorkshire & Humberside	2.0	4.6	10.0	12.5	6.4	9.7	8.2
Northern Ireland	4.1	8.4	13.9	16.7	12.9	13.6	11.2
Scotland	3.0	6.4	11.1	13.3	8.3	9.3	8.1
Wales	2.8	5.9	11.8	13.8	6.5	9.8	8.5
UK Average	1.9	4.4	9.2	11.1	5.5	9.5	7.8

Source: DfEE: (1998) April Percentage Unemployment Rates, 1974-1996. Claimant Count Consistent Measure.

Table 2.2: Unemployment Rates: Regional Males: Percentage of Workforce, Selected Years

Region	1974	1980	1982	1986	1990	1992	1996
East Anglia	1.7	3.7	8.4	9.3	4.3	9.5	7.8
East Midlands	2.1	4.4	9.8	11.3	6.0	11.7	9.8
North	4.5	8.5	15.4	18.4	11.1	14.8	14.9
North-West	3.5	6.8	14.3	16.6	9.8	14.5	11.6
South-East	1.6	3.2	8.0	9.6	4.6	11.8	9.8
South-West	2.3	4.4	8.6	10.1	4.8	11.9	8.7
West Midlands	2.3	5.1	13.8	14.8	6.9	13.2	10.2
Yorkshire & Humberside	2.7	5.3	11.9	14.8	8.3	13.2	11.2
Northern Ireland	4.8	9.6	16.3	20.2	16.3	17.9	15.1
Scotland	4.0	7.3	13.2	15.8	10.7	12.5	11.5
Wales	3.7	6.6	13.8	16.2	8.5	13.5	11.8
UK Average	2.6	5.1	11.1	13.0	7.1	12.7	10.6

Source: DfEE: (1998) April Percentage Unemployment Rates, 1974-1996. Claimant Count Consistent Measure.

Table 2.3: Unemployment Rates, Regional Females: Percentage of Workforce, Selected Years

Region	1974	1980	1982	1986	1990	1992	1996
East Anglia	0.5	2.3	4.9	7.3	2.2	4.3	3.6
East Midlands	0.6	2.6	5.6	7.9	3.2	4.9	3.9
North	1.4	5.5	8.9	10.8	4.9	5.5	4.8
North-West	0.9	4.1	7.8	9.7	4.5	5.4	4.1
South-East	0.4	1.7	4.2	6.4	2.3	5.0	4.2
South-West	0.7	2.9	5.5	8.0	2.7	4.9	3.7
West Midlands	0.7	3.5	7.9	9.8	3.7	5.7	4.4
Yorkshire & Humberside	0.7	3.4	6.8	9.0	3.9	5.0	4.3
Northern Ireland	2.7	6.6	10.1	11.2	7.8	7.5	5.9
Scotland	1.4	5.1	8.1	9.8	5.1	5.1	4.1
Wales	1.2	4.7	8.4	10.2	3.8	4.9	4.3
UK Average	0.8	3.2	6.3	8.4	3.5	5.2	4.2

Source: DfEE: (1998) April Percentage Unemployment Rates, 1974-1996. Claimant Count Consistent Measure.

A closer examination of the regional and UK average unemployment rates are provided in Tables 2.1-2.3. Selected years over the sample period for each of the unemployment categories present a clearer picture of regional unemployment relativities. Here the large rise in unemployment in the early 1980s and 1990s is compared with the consequent recovery comparisons of 1986 and 1996 respectively. What the Tables add to the analysis is a clearer idea of the relative movement in regional unemployment.

Defining the two recessionary periods of 1980-1983 and 1990-1993 in which unemployment consistently rises, relative unemployment behaviour can be examined across all regions. Attention is directed toward any possible north-south differential in regional unemployment movement over the two periods. From the Tables there does appear to be evidence of a larger north-based rise in unemployment over the 1980-1983 period leading to a widening of regional unemployment differences. The 1990-1993 period, however, appears to have reversed this trend with the south experiencing a much larger rise in unemployment, particularly amongst males. Indeed over 1990-1993 male unemployment rose in the regions of North, Yorkshire and Humberside, and Scotland by approximately 130% against a South-East increase of 247%.

This changing geographical pattern of regional unemployment relativities needs to be examined more closely to try and identify the possible causes for such an apparent change in the north-south divide.

2.2.3 Regional Absolute and Relative Unemployment Dispersions

Regional unemployment disparities changed in the context of the economic recession of the early 1990s. The tendency for regional unemployment differences to widen during a national recession has been reversed, and the cause and extent of this has been the subject of a number of papers (e.g. Taylor and Bradley (1994)).

Examining the behaviour of regional unemployment disparities is, however, controversial not least because the dispersion of unemployment can be measured in one of two ways, both of which yield different results. The subject is explored by Martin (1996).

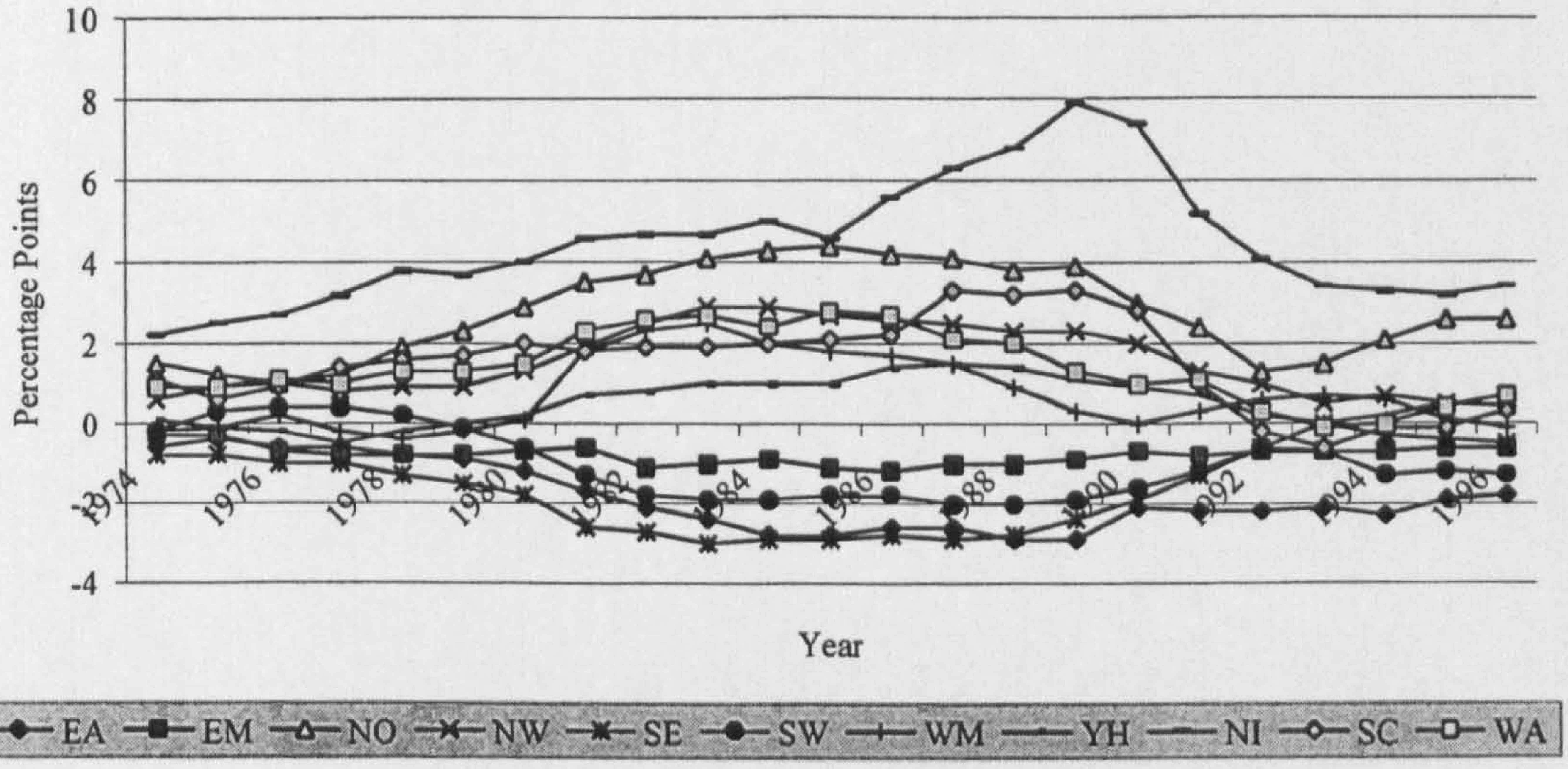
The absolute measure of regional unemployment $(U_i - U_{UK})$, is based on the percentage point differential between the region and the UK average and relies on the absolute values of the regional rate. If all regional unemployment rates move by the same amount then the percentage point differential between the region and the national average will remain the same (see Lever (1987), Taylor (1991), Martin (1993)). Using regional unemployment relativities as a measure of dispersion will, however, produce a different result (see Gleave (1987), and Green et al. (1998)). Measuring regional unemployment disparities as a ratio of the region against the national average means that equal percentage rate changes in regional unemployment rates will change regional relativities.

Changes in regional unemployment disparities are therefore a function of the relationship between changes in the regional unemployment rate and the measure adopted. For regions with different unemployment rates, the absolute dispersion of unemployment will narrow only if relative unemployment differences fall e.g. all unemployment rates halve. The relative dispersion, however, will only narrow through absolute changes in the regional unemployment, e.g. regional unemployment rates fall by the same percentage rate. The problem with these two measures, is that changes in unemployment will affect each measure differently (for a discussion of the contrast between ratio and level-based measures of disparities see Devens (1988)).

Which index to choose is subjective. Martin, (1996) believes that the absolute dispersion measure is the one individuals most likely respond to in the evaluation of employment opportunities, with its emphasis on the individual region, as opposed to the relative measure which depends implicitly on the national average. (p. 241).

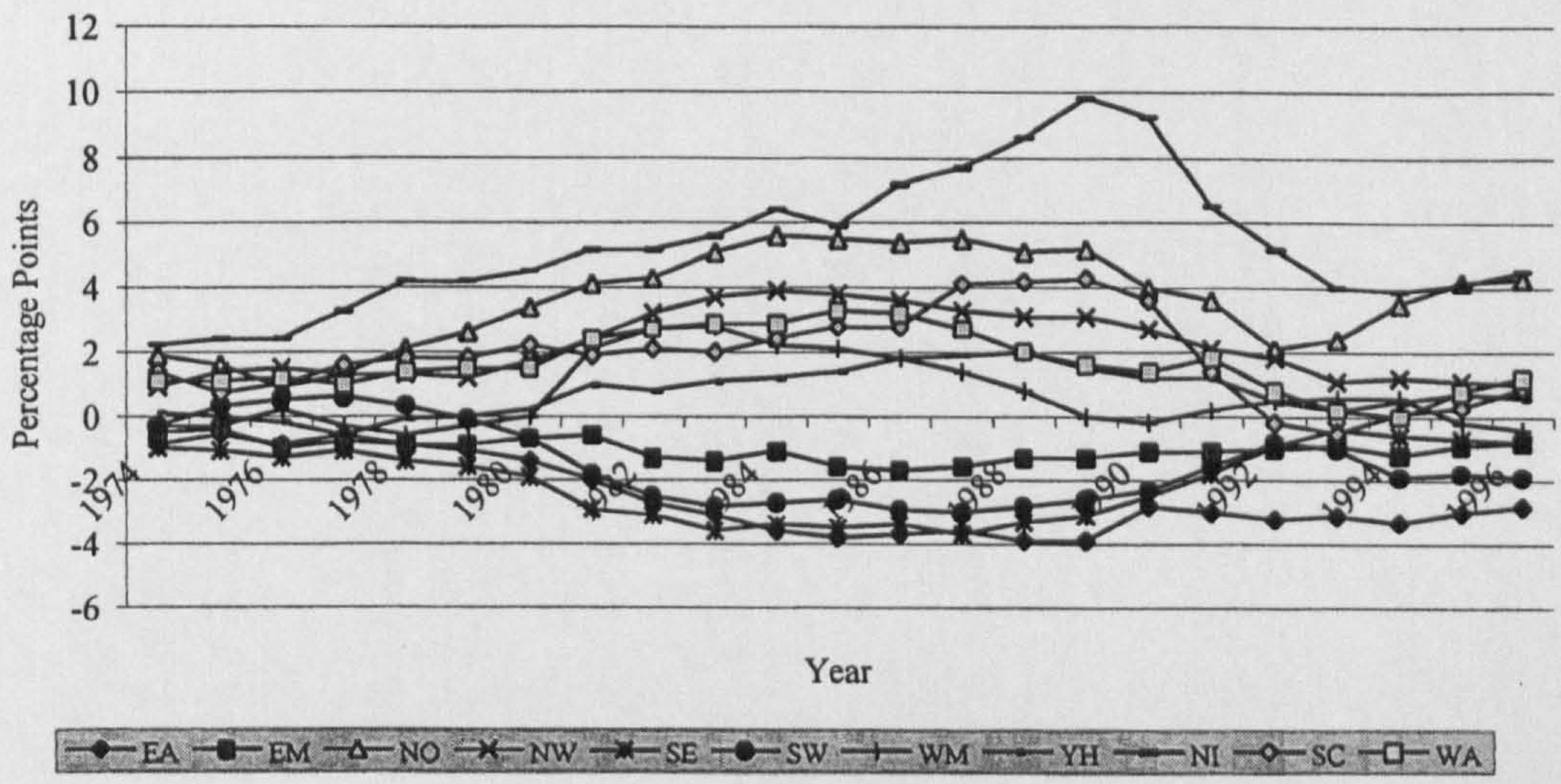
Regional unemployment rate disparities for total, male and female unemployment are shown in Figures 2.7-2.12., whilst the absolute and relative dispersion measures are reserved for Figures 2.13-2.15.

Figure 2.7: Absolute Regional Unemployment Differentials, 1974-1996 $(U_i - U_{UK})$: Totals



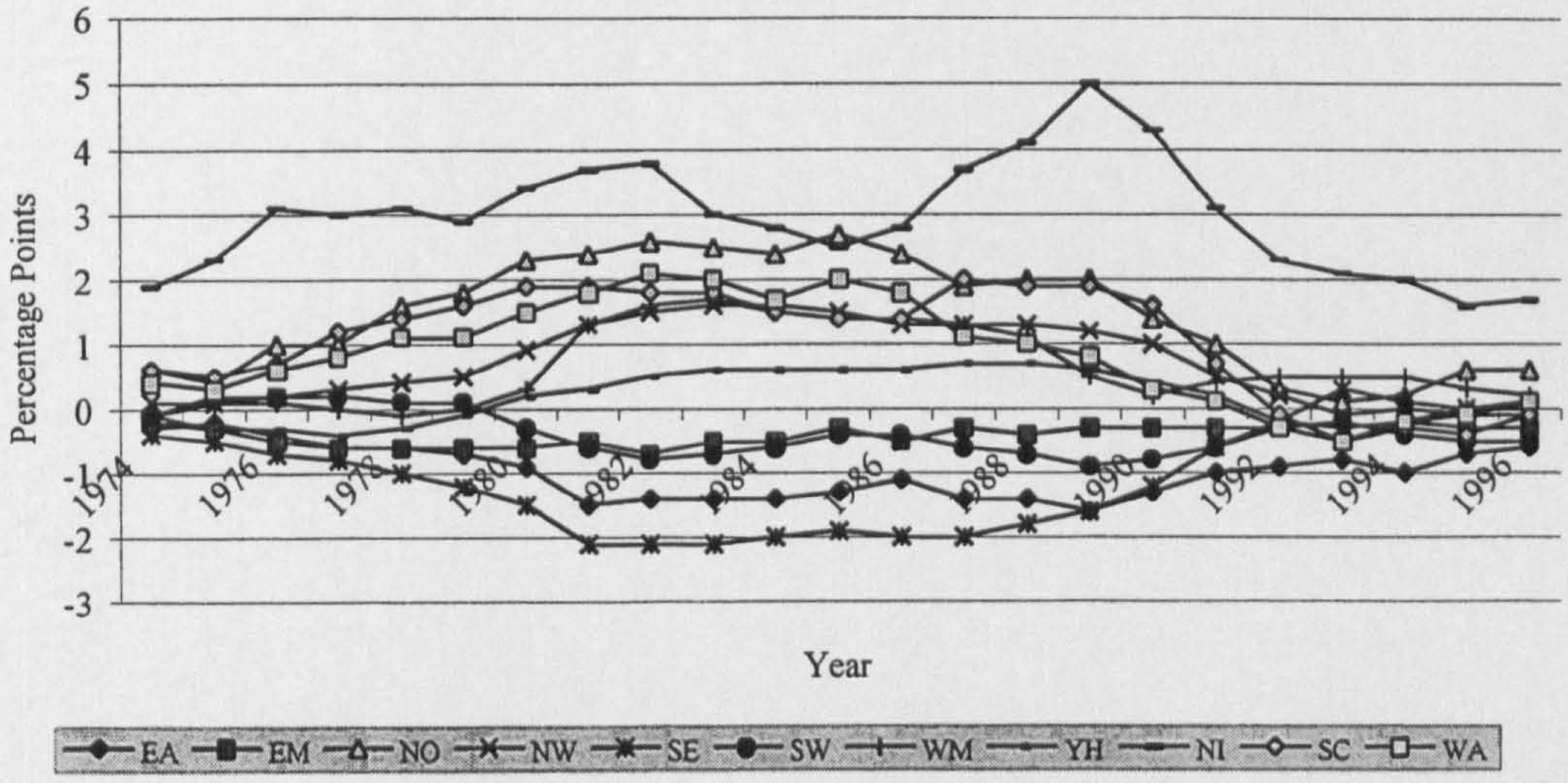
Source: DfEE: (1998) April Percentage Unemployment Rates, 1974-1996. Claimant Count Consistent Measure.

Figure 2.8: Absolute Regional Unemployment Differentials, 1974-1996 $(U_i - U_{UK})$: Males



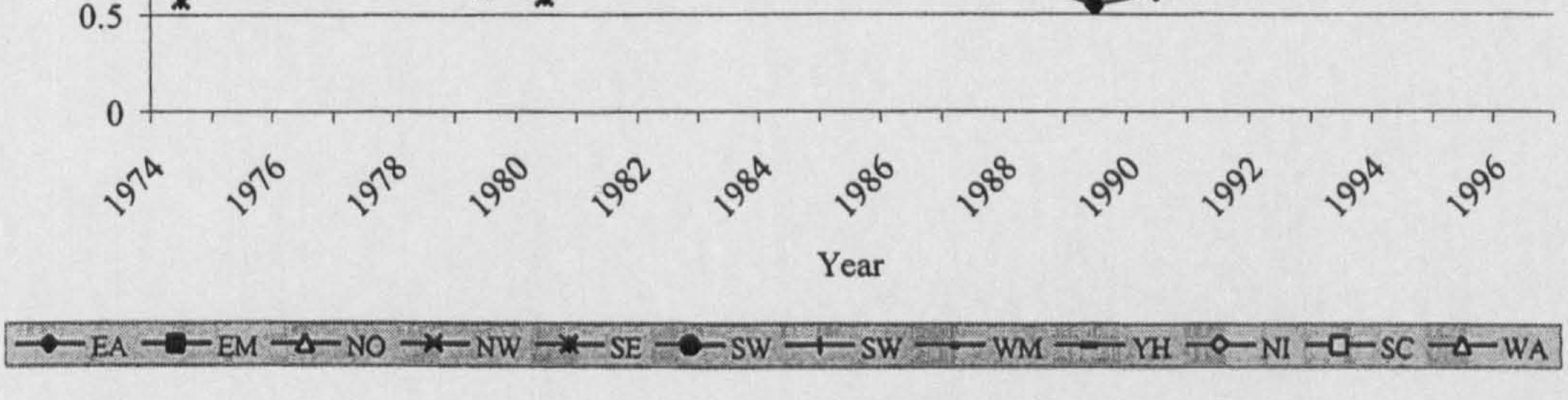
Source: DfEE: (1998) April Percentage Unemployment Rates, 1974-1996. Claimant Count Consistent Measure.

Figure 2.9: Absolute Regional Unemployment Differentials, 1974-1996 $\left(U_i - U_{UK}\right)$: Females



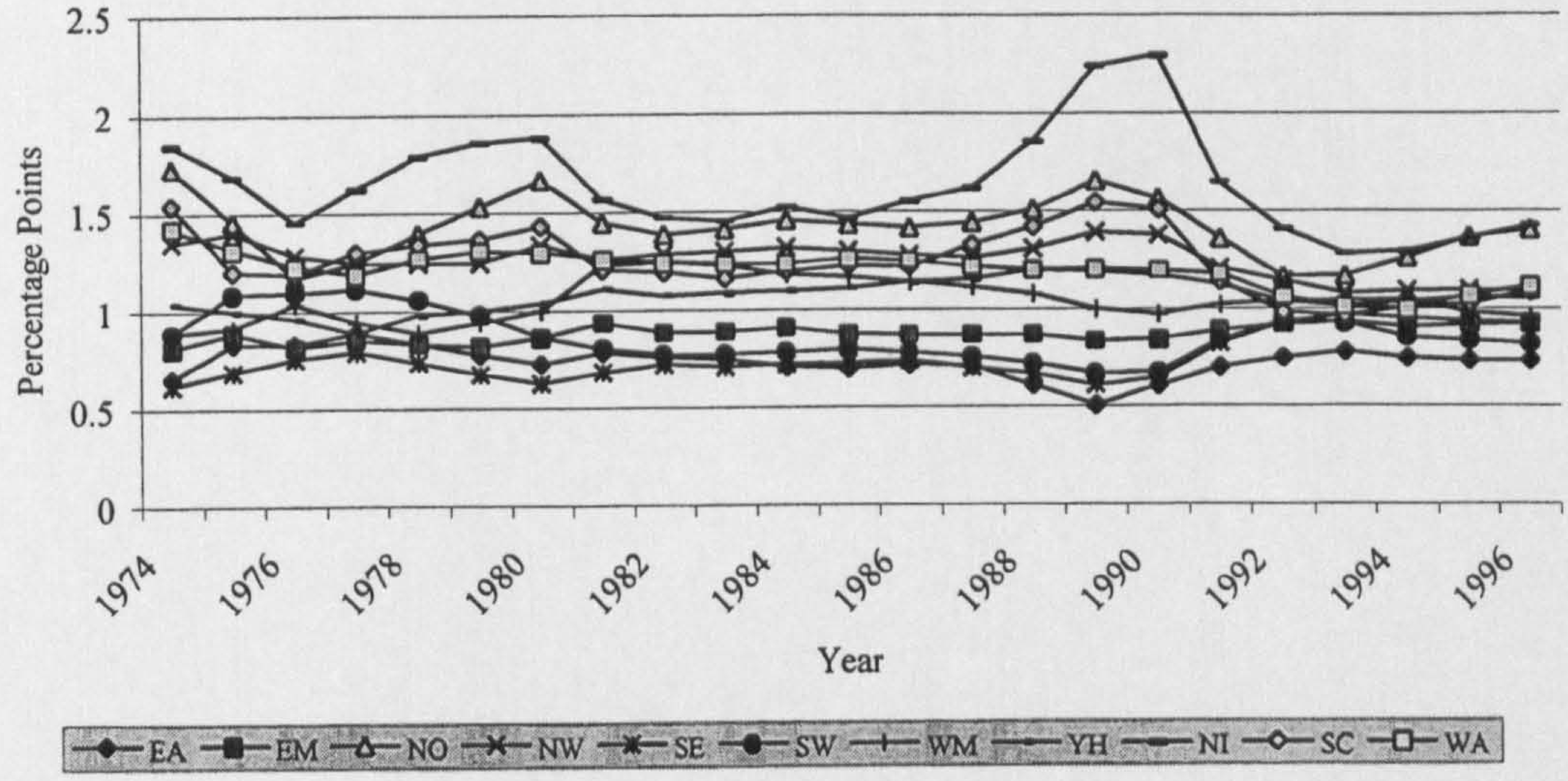
Source: DfEE: (1998) April Percentage Unemployment Rates, 1974-1996. Claimant Count Consistent Measure.

Figure 2.10: Relative Regional Unemployment Differentials, 1974-1996, $\left(U_i / U_{UK}\right)$: Totals



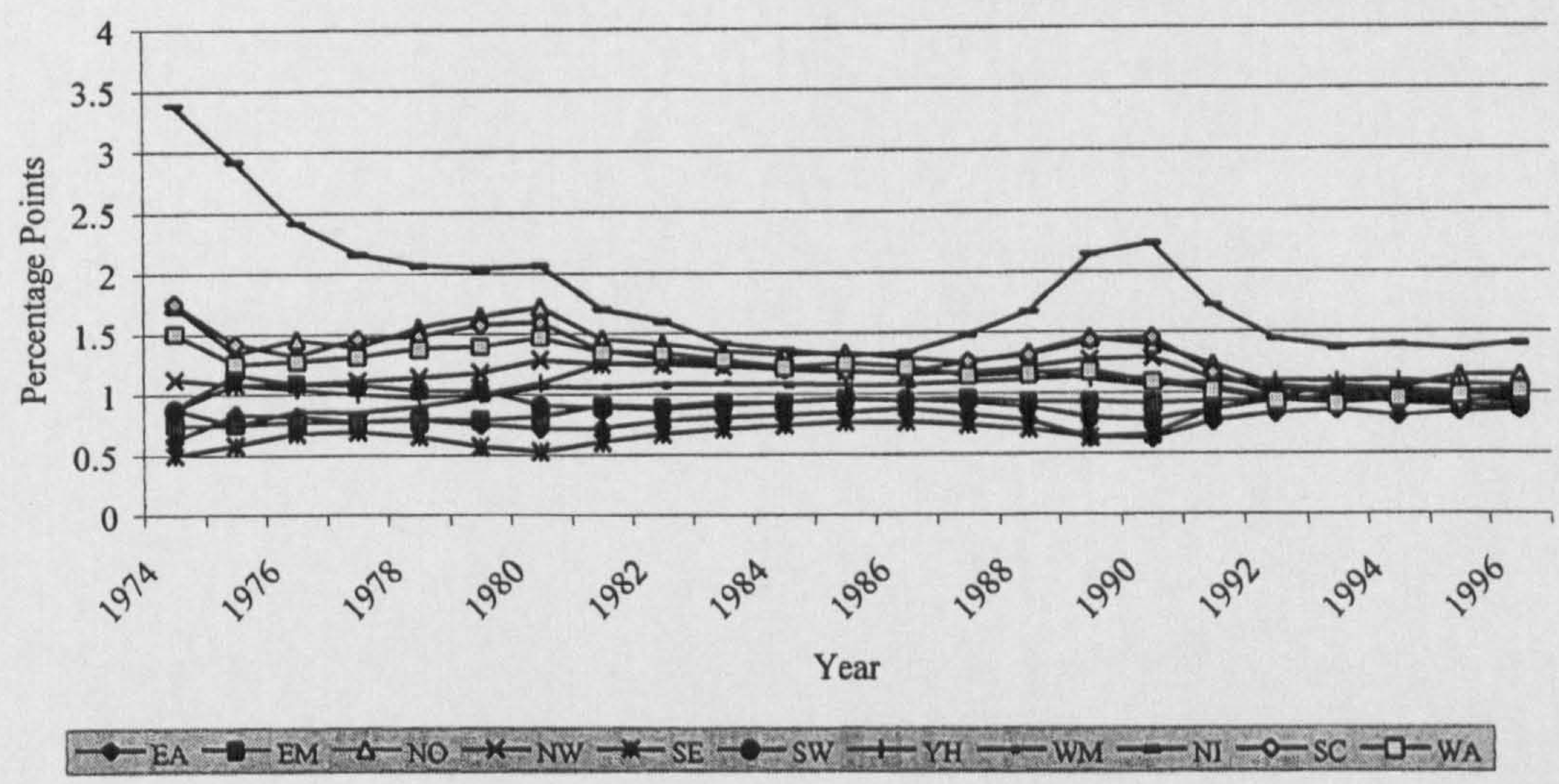
Source: DfEE: (1998) April Percentage Unemployment Rates, 1974-1996. Claimant Count Consistent Measure.

Figure 2.11: Relative Regional Unemployment Differentials, 1974-1996, (U_i/U_{UK}): Males



Source: DfEE: (1998) April Percentage Unemployment Rates, 1974-1996. Claimant Count Consistent Measure.

Figure 2.12: Relative Regional Unemployment Differentials, 1974-1996, (U_i/U_{UK}): Females



Source: DfEE: (1998) April Percentage Unemployment Rates, 1974-1996. Claimant Count Consistent Measure.

The pattern of regional unemployment disparities provided by Figures 2.7-2.12 illustrate regional differences according to which measure is adopted. The absolute percentage point differentials given in Figures 2.7-2.9 provide the clearest picture of regional unemployment differences across the regions. These differences grew throughout the 1980s and then sharply narrowed by the early 1990s. Until the 1990s these changes are indicative of the high unemployment regions experiencing greater percentage rate changes in their unemployment rate. The absolute measure thus chronicles the established pattern of regional unemployment differences narrowing when the national unemployment rate is falling. However, this relationship changes post-1990. Here the absolute differences narrow as unemployment rates rise. What is remarkable, however, is that this pattern of narrowing unemployment differences is also captured by the relative measure of regional unemployment disparities in Figures 2.10-2.12. These Figures indicate that the changes in unemployment are inversely related to the level of unemployment, i.e. the relatively lower unemployment regions experienced a relatively larger rise in unemployment.

Closer examination of Figures 2.7-2.12 seem to support the notion that the pattern of unemployment dispersion has a clear north-south dimension to it. Taking the south to represent the regions of East Anglia, East Midlands, the South-East and the South-West in which regional unemployment rates have consistently been below the national average, and the north taken to be the remainder with above average unemployment rates, then the changing regional pattern of unemployment post-1990 appears to be a north-south phenomenon. Cross-referencing Figures 2.7-2.12 with Tables 2.1-2.3 the absolute and relative dispersions of unemployment appear to have narrowed in the post-1990 period because the south experienced a relatively larger rise in unemployment to the north as regional unemployment rate differences narrowed.

Examining the changing pattern in regional unemployment differences it is possible to summarise each measure of unemployment dispersion. Figures 2.13–2.15 present the standard deviation of regional unemployment rates (A_{it}) and the relative dispersion of regional unemployment (R_{it}) for all registered unemployed, male and female. The first measure is the combined deviation of each region's own unemployment rate relative to the national, whilst the second is the standard deviation divided by the mean and is therefore a measure of the regional rates against the average.

From Martin (1996) the regional and national unemployment rates are defined as:

$$u_i = U_i / L_i \text{ and } u_{UK} = U_{UK} / L_{UK} = \sum (L_i / L_{UK}) u_i \tag{2.1}$$

where U is the number of unemployed, and L represents the size of the labour force, subscripts i and UK represent the regional and national values respectively.

If each region has the same unemployment rate, which will thus be equal to the national average $(u_i = u_{UK})$, then each region's share of total unemployment will be equal to its share of the total labour force i.e. $U_i / U_{UK} = L_i / L_{UK}$. A region's share of total national unemployment can thus be expressed as:

$$U_i / U_{UK} = (u_i / u_{UK})(L_i / L_{UK}) \tag{2.2}$$

As a result a region's unemployment disparity can be written as:

$$|(U_i / U_{UK})| - (L_i / L_{UK}) = |(u_i / u_{UK})(L_i / L_{UK})| - (L_i / L_{UK})$$

$$= (L_i / L_{UK}) |(u_i / u_{UK}) - 1|$$

$$= (L_i / L_{UK}) |(u_i / u_{UK}) / u_{UK}| \tag{2.3}$$

If the differences between a region's share of total unemployment and its share of the total labour force are summed over regions without regard to the sign then the following is obtained:

$$\sum_i |(U_i / U_{UK}) - (L_i / L_{UK})| = \sum_i |(L_i / L_{UK})[(u_r - u_{UK} / u_{UK}) / u_{UK}]|$$

$$= (1/u_{UK}) \sum |(L_i / L_{UK})(u_i - u_{UK})|$$

$$A_U = \sum \left| (L_i / L_{UK})(u_i - u_{UK}) \right|$$

$$= A_u / u_{UK} = R_u \qquad (2.4)$$

where A_u is the absolute dispersion of regional unemployment around the national unemployment rate and R_u the relative dispersion of regional unemployment relative to the national rate. That is the dispersion of regional unemployment relativities is equivalent to the dispersion of regional unemployment differentials divided by the national rate of unemployment.

Figure 2.13: The Absolute and Relative Dispersion of Regional Unemployment Rates; Totals, 1974-1996

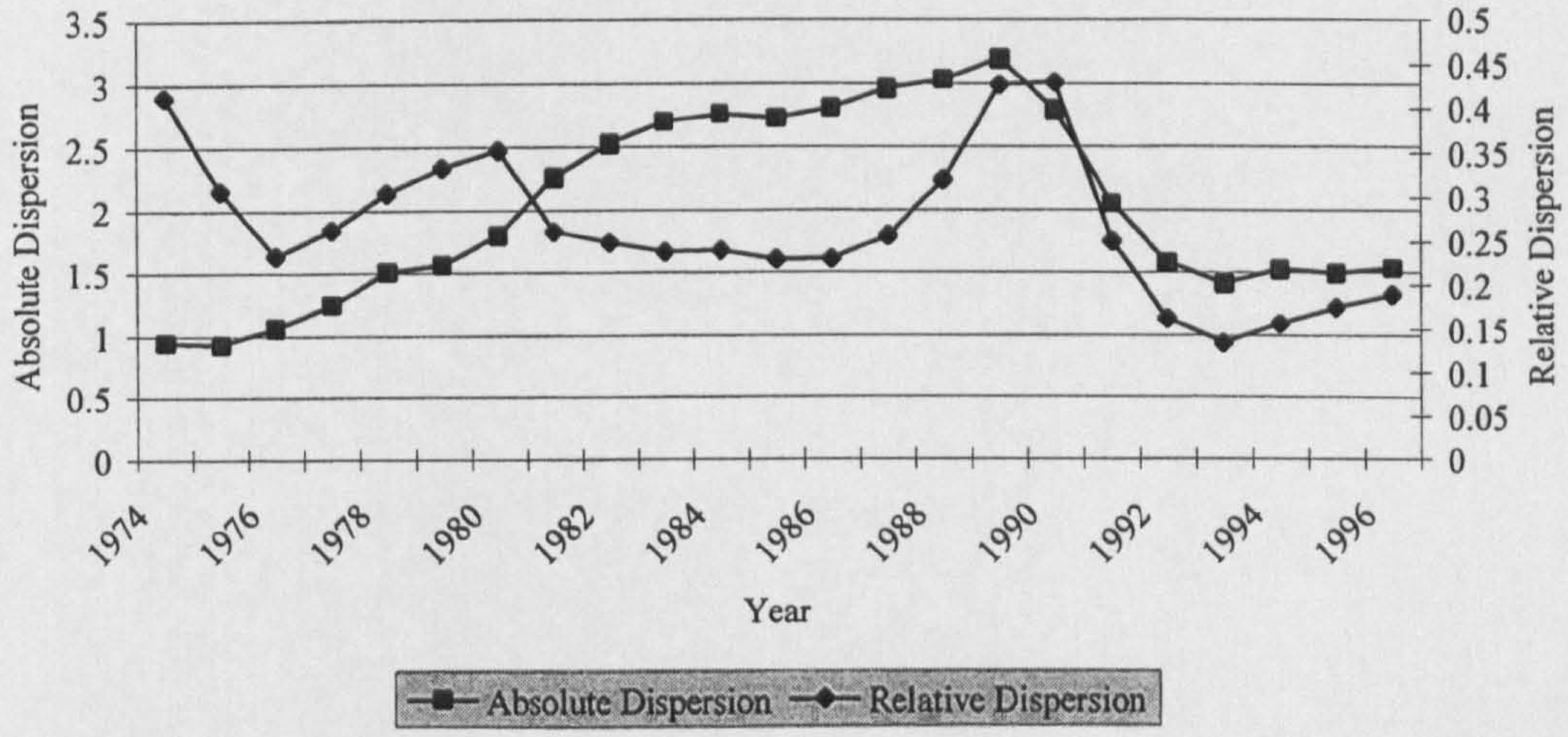


Figure 2.14: The Absolute and Relative Dispersion of Regional Unemployment Rates; Males, 1974-1996

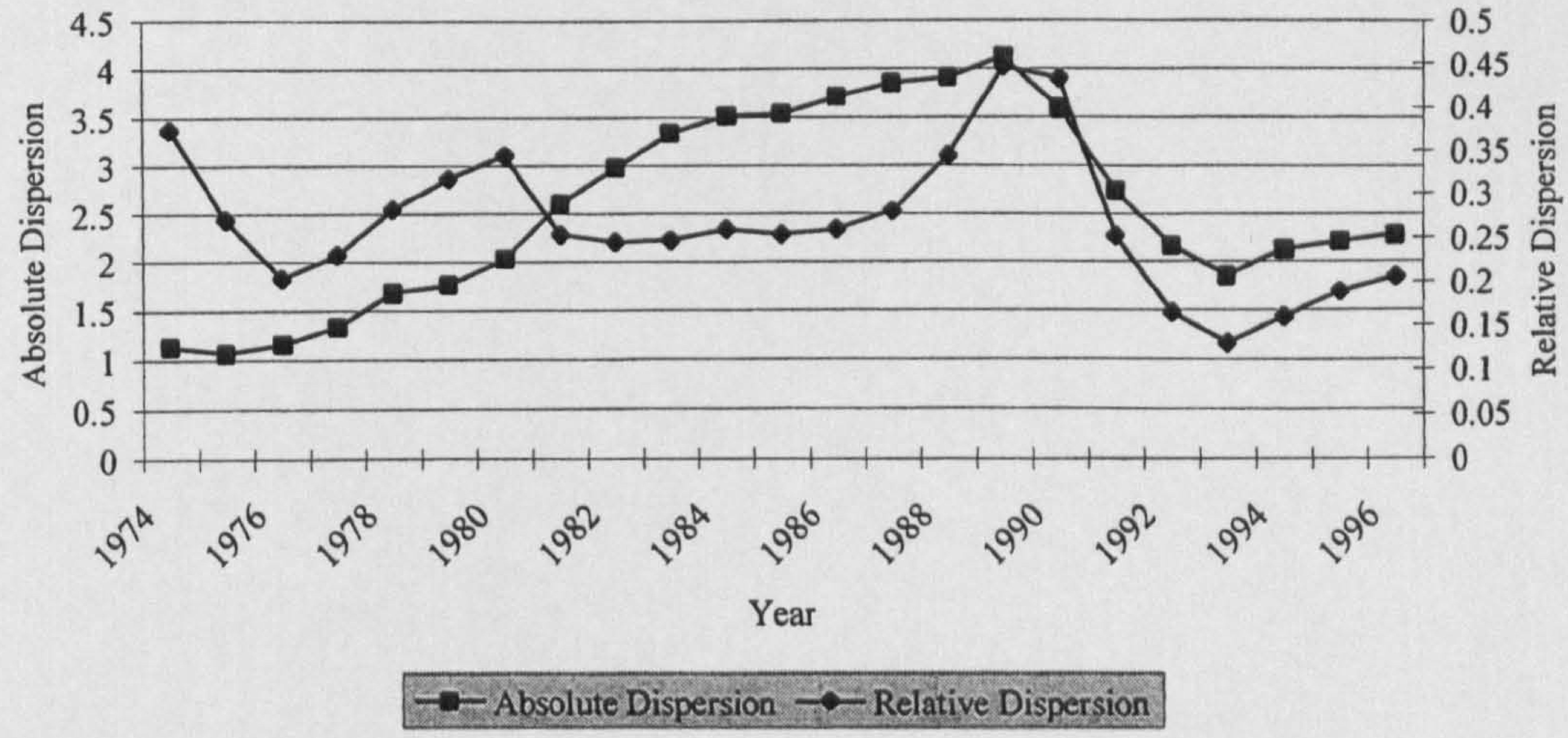
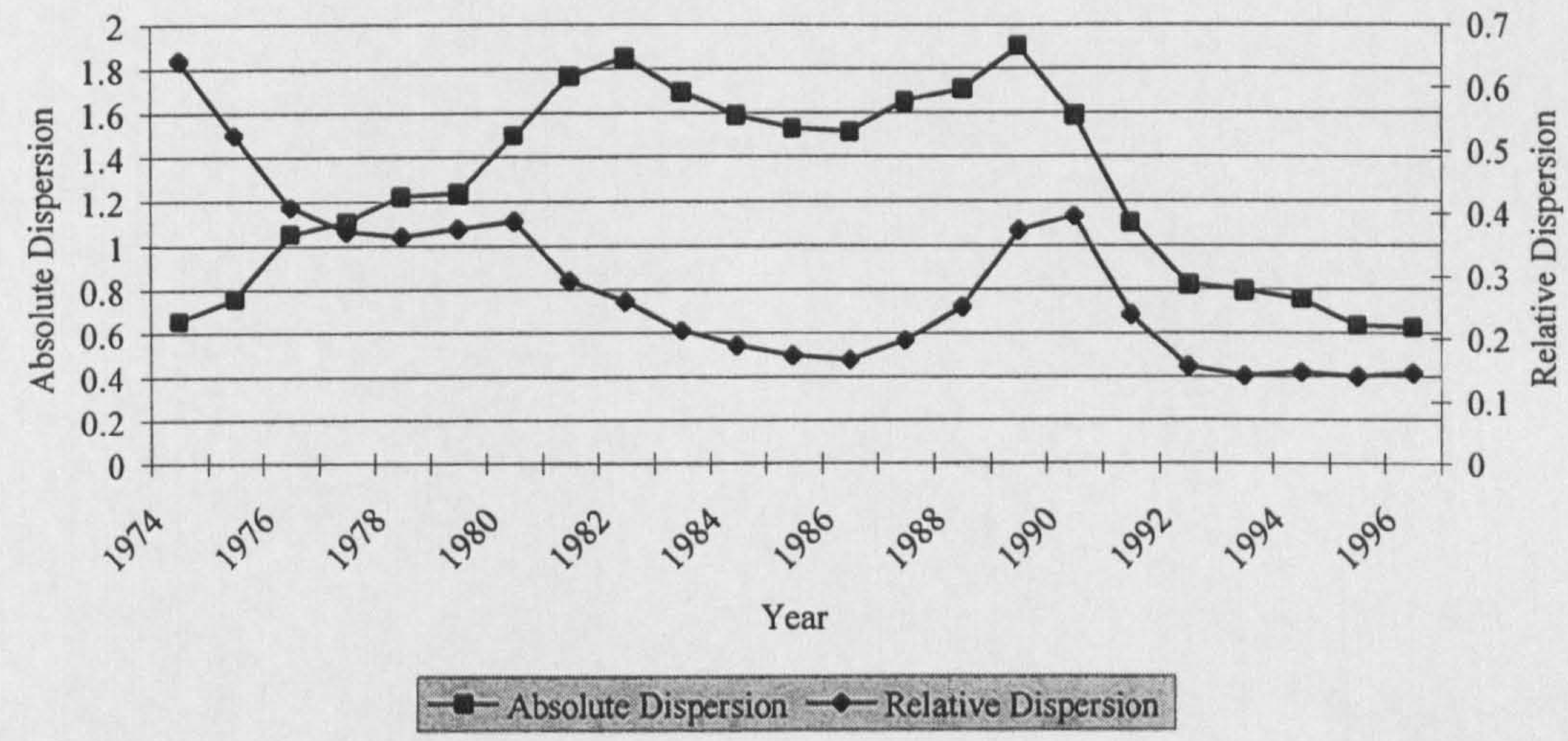


Figure 2.15: The Absolute and Relative Dispersion of Regional Unemployment Rates; Females, 1974-1996



Figures 2.13-2.15 present the absolute and relative dispersion of regional unemployment rates for total, male and female measures of unemployment.

Each of the three Figures chronicles the behaviour of regional unemployment rates. Growing differences in the standard deviation of regional unemployment is consistent with growing absolute differences in regional unemployment from the national average, whilst growing differences in the relative dispersion is consistent with high unemployment regions experiencing relatively higher rises in unemployment and vice versa.

Figures 2.13-2.15 provide a clearer summary of regional unemployment behaviour. Particular attention is drawn to the narrowing of unemployment disparities across both measures for all types of unemployment. The graphs confirm the findings from Tables 2.1-2.3 and Figures 2.7-2.12. Absolute and relative changes in regional unemployment rates differ over the sample period, but a narrowing in both measures is identified from 1990 onwards. Figures 2.13-2.15, however, also present evidence of there being a male / female split in the behaviour of regional unemployment. In particular up until 1990, the behaviour of the female absolute and relative dispersions are consistent with absolute unemployment rate changes being similar across all regions. As a proportion of each regions own unemployment rate, this represents a relatively larger rise in unemployment in the lower unemployment regions, but a relatively smaller rise in unemployment in the high unemployment regions, hence relativities narrow. Quite as to why this is the case is not certain, though there are the problems of measurement mentioned earlier. What does seem evident, however, is that the behaviour of total unemployment appears to be driven more by male unemployment behaviour which exhibits a much greater regional variation than female.

2.2.4 Explaining Regional Unemployment Patterns

Thirwall (1966) and Brechling (1967) were the first to try and document the behaviour of regional unemployment differences, establish some stylised facts and then try to explain them. Each of the authors adopted a different measure of unemployment differences, Thirwall working in absolute differences and Brechling in relativities. Adopting the absolute and relative measures of unemployment respectively the authors' findings are similar when examining each regions unemployment rate against the national.[6]

Thirlwall (1966) was curious about the behaviour of regional unemployment differentials, in particular the stylised fact that regional unemployment differentials widened in times of rising national unemployment and narrowed in times of falling national unemployment. He argued that it would be possible to measure such cyclical sensitivity by estimating the slope coefficient in the regression of a region's change in the unemployment rate against the change in the national unemployment rate. Thirlwall estimated this relationship for regions of the UK using annual data over the period 1949-1964. His findings supported the hypothesis that regions with higher than average unemployment exhibited a greater cyclical variation in unemployment. He found that regions with higher unemployment rates than the average typically had a slope coefficient greater than one, whilst those with lower than average unemployment rates less than one. These results confirmed his suspicions that the reason why regional unemployment differences grew as unemployment rose was because the relatively high unemployment regions experienced a relatively larger rise in unemployment than the low unemployment regions, and similarly for falling unemployment. Thirlwall suspected that it was the industrial make-up of a region which determined its cyclical sensitivity and tested the hypothesis that such regional sensitivity could be linked to the industrial structure and the sensitivity of industrial unemployment. Whilst he found his results to be significant, the low reported correlation coefficient between the sensitivity of regions and their weighted industrial composition argued that unemployment sensitivity was driven by other factors within each region (p. 210-214). Thirlwall tried to explain the result by suggesting that an industries unemployment sensitivity rating might differ from region to region.

Thirlwall's (1966) paper spurred on a number of others, but it was the recession of the early 1980s which brought about a strong revival of interest in regional economics and led to further developments in the analysis of regional unemployment behaviour, (e.g. Bell (1981), Gordon (1985a), Forrest and Naisbitt (1988) and

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[6] Despite adopting different measures; Thirwall (1966) using first-differences and Brechling (1967) logarithms, their results are very similar. They both found that relatively high unemployment regions

Armstrong and Taylor (1993)). Whilst Thirlwall's cyclical sensitivity analysis has its critics, (see e.g. Chapman (1991), p. 1060) it seemed to offer at least some supporting statistical analysis of regional unemployment rate behaviour. Regional unemployment behaviour seemed to exhibit a stable and consistent stylised fact. However, whilst support for Thirwall's findings was found throughout the 1980s, (e.g. Forrest and Naisbitt (1988)), the changing regional unemployment landscape for the post-1990 period provides a challenge to Thirlwall's work. More importantly, however, is the fact that the inability to explain the stylised fact, makes explanations to how it has changed more difficult.

The post-1990 recessionary period in which regional unemployment rate differences narrowed as unemployment rates rose challenges the hitherto apparent stable relationship between the absolute dispersion of regional unemployment and the national unemployment rate. The relationship appears to have broken down and a number of authors have sought to re-examine the evidence (e.g. Armstrong and Taylor (1993), Taylor and Bradley (1994), Martin (1996), Morgan (1996), McCormick (1997)). These papers combined with the findings of Tables 2.1-2.3 and Figures 2.7-2.15 point out that the narrowing of regional unemployment differences as unemployment rose over the 1990-1993 period, was due to relatively low unemployment regions, identified earlier as being in the south of the UK, experiencing disproportionately larger rises in unemployment than in the north. As a hypothesis this can be tested. Repeating Thirwall's regression of a region's own unemployment rate against the national average the estimated value of the slope coefficient can be examined against the hypothesis that regions with unemployment rates above the national average will exhibit a slope coefficient greater than one.

2.2.5 The Cyclical Sensitivity of Regional Unemployment.

Thirlwall's (1966) paper on regional unemployment sensitivities is based on the regression:

$$\Delta U_{it} = \alpha_{0i} + \alpha_{1i}\Delta U_{UK,t} + \varepsilon_{it} \qquad (2.5)$$

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experienced relatively larger changes in unemployment rates than the low unemployment regions.

where U_{it} represents the unemployment rate in region i at time t, UK represents the national average and ε_{it} is a random error.

Thirlwall argued that the coefficient on the national unemployment rate α_{1it} in an OLS regression could be interpreted as a measure of the relative cyclical sensitivity of the region's own unemployment rate with respect to the national. A value in excess of one would indicate that over the sample period the region's own unemployment rate has moved more than the national, and vice versa.

Thirlwall's hypothesis is that regions with relatively higher unemployment rates exhibit a greater cyclical variation in unemployment against the national average than regions with lower unemployment rates. Using the UK data over the period 1974-1996 it is possible to test this hypothesis for each of the three unemployment categories to try and not only determine whether the hypothesis holds but also to examine in greater detail the apparent shift in the regional unemployment relation in the early 1990s. This shift in regional unemployment relativities, however, suggests the presence of a structural break in regional unemployment behaviour. Before this is examined, however, the data have to be tested for stationarity (c.f. Phillips (1986), Byers (1989)).

2.2.5.1 Testing for Unit Roots

Each of the unemployment series over the sample period was tested for the presence of a unit root at the 10% level using the Augmented Dickey Fuller test, (ADF hereafter). In levels it was not possible to reject the null hypothesis of the presence of a unit root and so the data were transformed to stationarity by taking first-differences (see Granger and Newbold (1974), Engle and Granger (1987)).

2.2.5.2 Testing for Stability

Given the relative change in regional unemployment behaviour it was important to test for structural stability of the model over the sample period. Two test procedures were adopted, based on the regression results of equation (2.5), the first was the method of recursive residuals and the second the Chow test.

The method of recursive residuals offered an indication over the sample period as to the years in which there might be a higher probability attached to rejecting the null hypothesis that the parameters of the model are stable through time. Identified periods were checked with the Chow test.

The addition of first-order autoregressive (AR(1)) processes is based on the Cochrane-Orcutt procedure for the removal of [first-order] serial correlation, as a result the method of recursive residuals was not applied to the South-West, the West Midlands and Scotland regions. However, the results on the remaining regions indicated a high probability rejection of parameter stability over the 1989-1992 period,. Applying the Chow test, whilst it was not possible to reject the null of no break in 1989, it was possible for a number in 1990. The probability values of rejection of the null hypothesis are presented in Table 2.4.

Table 2.4: Chow Test Results of the Hypothesis of No Structural Break in 1990

Region	Total Unemployment	Male Unemployment	Female Unemployment
East Anglia	0.05**	0.03**	0.18
East Midlands	0.70	0.45	0.68
North	0.40	0.56	0.35
North-West	0.04**	0.11	0.01***
South-East	0.05**	0.05**	0.14
South-West	0.11	0.00***	0.33
West Midlands	0.89	0.51	0.95
Yorkshire & Humberside	0.13	0.17	0.22
Northern Ireland	0.00***	0.00***	0.00***
Scotland	0.02**	0.08*	0.13
Wales	0.40	0.44	1.00

*** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.

Given the Chow test results, dummy variable correction was adopted for the various measures of unemployment in the post-1990 period for the regions of East Anglia, the North-West, the South-East, South-West, Northern Ireland and Scotland.

In conjunction with the Tables and Figures from Sections 2.2.1-2.2.3 chronicling regional unemployment behaviour, the results of Table 2.4 indicate strong evidence for rejecting the hypothesis of no structural break occurring in regional unemployment behaviour for a number of regions in 1990. The results are, however, mixed with respect to which regional group is the cause of the changing unemployment picture. Work by Taylor and Bradley (1994) and Martin (1996) for instance argue in favour of changing regional unemployment dispersion as a south-based phenomenon, which these results do not clearly come out in favour of. The results do, however, support the notion that relative female disparities have been stable over the full sample period and that total unemployment changes are dominated by male unemployment patterns.

Thirlwall's hypothesis that regions with relatively higher unemployment rates exhibit a relatively higher cyclical relationship with the national average, captured by the estimated slope coefficient in equation (2.5), was tested using the OLS estimates on total unemployment but over two sample periods. Whilst dummy variable correction of the 1989-1992 period based on the results of the recursive residuals proved significant, it was felt that single-equation estimates of equation (2.5) could be compared over the two periods of 1975-1989 and 1975-1996. Estimation over the two periods enabled a direct comparison of what changes if any the changing regional unemployment picture has on the estimated parameters over time. The results are presented in Table 2.5.

Table 2.5: Regional Unemployment Cyclical Sensitivity Analysis: Totals,

$$\Delta U_{it} = \alpha_{0i} + \alpha_{1i}\Delta U_{UK} + \varepsilon_{it}$$

Region	1974-1989			1974-1996		
	α_{oi}	α_{1i}	R^2	α_{oi}	α_{1i}	R^2
East Anglia	-0.07	0.90	0.94	-0.08	0.89	0.97‡
	(-0.94)	(15.4)***		(-1.51)	(21.92)***	
East Midlands	-0.01	0.95	0.98#	-0.002	0.96	0.98
	(-0.31)	(19.81)***		(-0.06)	(34.69)***	
North	0.06	1.13	0.94†	0.24	1.04	0.97†
	(0.65)	(14.62)***		(2.11)	(18.12)***	
North-West	0.05	1.16	0.98†	-0.04	1.09	0.97‡
	(0.98)	(28.20)***		(-0.71)	(24.00)***	
South-East	-0.03	0.82	0.97†	-0.07	0.92	0.96‡
	(-0.57)	(20.82)***		(-1.09)	(20.40)***	
South-West	-0.07	0.94	0.99†	-0.11	0.99	0.96†
	(-0.54)	(23.71)***		(-0.81)	(17.84)***	
West Midlands	-0.04	1.44	0.98†	-0.08	1.34	0.98†#
	(-0.23)	(22.29)***		(-0.80)	(16.93)***	
Yorkshire & Humberside	0.03	1.10	0.98	0.04	1.06	0.98‡
	(0.52)	(26.21)***		(0.87)	(25.86)***	
Northern Ireland	0.34	0.95	0.89	0.28	0.88	0.88‡
	(2.92)***	(10.62)***		(2.48)***	(10.49)***	
Scotland	0.11	0.97	0.92	0.19	0.90	0.94†
	(1.16)	(12.80)***		(3.79)***	(22.17)***	
Wales	-0.04	1.23	0.98	0.02	1.13	0.95‡
	(-0.75)	(26.45)***		(0.29)	(19.23)***	

t-statistics are in parentheses, *** indicates significance at the 1% level ** at the 5% level, * at the 10% level, † signifies Cochrane-Orcutt first-order autoregessive process (AR(1) hereafter) correction for first-order serial correlation, # signifies White's correction for heteroscedasticity, and ‡ indicates the inclusion of a dummy variable.

The residuals from the OLS estimates were tested for the presence of first-order serial correlation, heteroscedasticity and normality[7]. In a number of cases it was necessary to correct for the rejection of the null hypotheses, for serial correlation the Cochrane-Orcutt procedure was adopted and for heteroscedasticity Whites procedure was adopted.. However, the results have to be interpreted with care due to possible small-sample bias given the limited data points.

To test the hypothesis that higher unemployment regions exhibit greater cyclical sensitivity of unemployment than the national average based on the results of Table 2.5, it is first necessary to define regions into high and low unemployment groupings. The results from Figures 2.7-2.12 offer support for a clear north-south split based on regional unemployment relativities. In the case of total unemployment, the regions of East Anglia, East Midlands, the South-East and the South-West all consistently exhibit below average unemployment rates throughout the sample period and hereafter are termed the south, against the remaining regions termed the north. Such a regional grouping is not uncommon in the literature (see Blackaby and Murphy (1995), p. 492), and it enables an analysis of the Thirlwall hypothesis in light of the estimated regressions. If Thirwall's hypothesis holds it would be expected that the regions of the south will have estimated slope coefficients below unity, whilst those of the north above unity.

Until 1990 the results from Table 2.5 confirm Thirwall's hypothesis that regions with relatively lower unemployment rates (the south) are estimated as having a lower cyclical variation in unemployment than the national average. Coefficients greater than one, indicating greater cyclical variation than the national average are found for the regions of the North, the North-West Yorkshire and Humberside, West Midlands and Wales again supporting earlier estimates from pervious studies. Furthermore the relatively large coefficient on West Midlands is found to be in common with these earlier works, (see for example Gordon (1985a), Forrest and Naisbitt (1988), Armstrong and Taylor (1993)).

[7] The tests used were the Breusch-Godfrey LM test for the presence of serial correlation, White's test for the presence of heteroscedasticity and the Jarque-Bera test for normality.

The estimated parameter values over the full sample period, which now incorporates the changing unemployment relativities in the post-1990 period produces similar results to that of the sub-sample period. However, there is a marked reduction in relative unemployment cyclicality as a the north-south split, the parameter values on the regions of the south are measured as having higher values whilst those of the north have declined. The full sample period estimates are also distinguishable from the estimates of the 1975-1989 period with the latter similar patterns in the behaviour of regional unemployment.

Changes in the cyclical sensitivity of regional unemployment appear to capture the changing regional relativities of the post-1990 period. However, this is only as far as this analysis can go. Cyclical sensitivity offers no economic insight into the relationships between the regions and the national average. According to Chapman (1991) this estimation is merely one of data description (p. 1060). Whilst the method is criticised in the literature for failing to offer anything more than a reduced-form relationship (Gordon (1985a)), with various potential aggregate and simultaneous problems that need to be considered (Johnstone (1979), Gordon (1985a)[8]), it nonetheless offers the opportunity to verify what has come to be a stylised fact in regional unemployment studies. As a result it is the attempts to explain this 'fact' that has been the focus of a number of regional economic papers.

Some supporting evidence has been offered in the literature to explain the cyclical sensitivity of regional unemployment. Understanding the behaviour of regional unemployment post-1990 can then be used to examine the validity of these suggestions. This issue is, however, more complicated. Suggestions that it is the industrial make-up of the region, or more accurately the region's industries cyclical sensitivity (Thirlwall (1966), Forrest and Naisbitt (1988) and Armstrong and Taylor, (1993) p. 181)) have gained some support but their results are not conclusive. Neither are the findings on considerations of the socio-economic make-up of regions and patterns of migration (Gordon (1985b)). Indeed more recently regional unemployment analysis has typically been viewed in the context of regional labour

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[8]Gordon (1985a) examined the possibility of simultaneity existing in estimations of (2.5). As a result he compared estimates of equation (2.5) using both 2SLS and OLS. He found only a marginal difference which he interpreted as meaning that regional unemployment had a positive effect on national unemployment, that causality ran in only one direction.

market adjustment processes. In this way attempts at understanding why regional unemployment dispersion changed after 1990 have looked at the behaviour of the regional economies themselves, regional labour dynamics and labour market flexibility (see Martin (1996) p, 237-238). However, quite why the more cyclically sensitive unemployment regions also share the feature of having persistently higher unemployment rates and why this would undergo a significant change in the context of a national recession without any obvious structural readjustment is perplexing (see McCormick (1991)).

2.2.6 Analysing the Behaviour of Regional Unemployment

Seeking to explain the cyclical and persistent patterns of regional unemployment have until the last 15 or so years been at the forefront of regional economic analysis. The development of both more and accurate data has, however, enabled research in this area to re-evaluate previous work and test hypotheses seeking to try and explain regional unemployment behaviour.

Explaining regional unemployment as part of a broader regional labour market model has generated numerous studies. Work on migration and more recently on housing has not only sought to identify why certain market forces might fail to work in removing regional unemployment differences but also to offer a number of policy solutions. Hughes and McCormick (1981, 1985, 1987), Elias (1979), Molho (1982), Blackaby and Murphy (1995) and McCormick(1997) have all found that net migration makes a positive contribution to the equalisation of regional unemployment rates. The focus of attention in explaining persistent regional unemployment differentials has thus switched toward the ease by which migration can take place and in particular housing. This analysis has resulted in a number of authors arguing that institutional barriers within the housing sector, both private and public exist, making it more difficult for people to relocate from the high unemployment areas and thus prevent regional unemployment differences from disappearing (Hughes and McCormick (1987), Bover, Muellbauer and Murphy (1989) and McCormick (1997)). In particular a number of authors argue that changes in relative unemployment rates might well be due to the differing regional effects interest rate policies have on the regional labour markets. This might simply occur through high interest rate charges adversely affecting the spending power of the larger owner-occupancy regions of the UK, such as the south. Indeed this was the focus of Taylor and Bradley's (1994) paper on the rise of unemployment in the south in the recession of the early 1990s. They cite Bover Muellbauer and Murphy (1989) and Carruth and Henley (1992) as establishing the link between houses and economic activity.

The reason why unemployment rose by so much in the south of the UK relative to the north in the early 1990s, according to the literature is because of the relatively larger concentration of owner-occupiers in the south. Large rises in nominal interest rates had a much greater negative shock on demand in the south than the north and this caused regional unemployment rates to narrow (Evans and McCormick (1994)).

> "The narrowing of regional unemployment rates, 1990-93, resulted from the increased inability in the South-East to sustain high levels of mortgage payments without reduction in consumption, and large falls in regional housing wealth" (Evans and McCormick, (1994), p. 645).

This is a view shared in part by Audas and MacKay (1996). However, McCormick (1997) argued that the changing pattern of regional unemployment was less dramatic than a single event, that in actual fact regional unemployment dispersion had been falling throughout the 1980s and was accelerated by the events of the early 1990s. His paper concluded "The modest tendency for trend regional unemployment rates to converge is not yet fully understood..." ((1997) p. 588).

The fact that regional unemployment behaviour changed post 1990 is well-documented. The reason behind this change is less well-established. Consequently the future behaviour regional unemployment relativities is hard to speculate on. Examining the behaviour of unemployment on its own can be misleading. The unemployment rate is a percentage of the registered workforce and changes in the workforce will, for a given fixed number of unemployed persons, change the unemployment rate. Before theories seeking to explain regional unemployment behaviour are examined in more detail, notably through regional labour market interaction, the regional labour markets of employment, unemployment and workforce changes need to be examined more thoroughly.

2.2.7 The Behaviour of Regional Unemployment Revisited

The previous sections examined regional unemployment behaviour across the UK. The recession of the 1990s changed regional unemployment relativities but there has been little work done in examining labour force participation across the regions to see whether changing regional unemployment can be explained via changing workforce participation. Essentially this examines whether there has been a labour supply effect on changing regional unemployment rates. Only Morgan (1996) has attempted to examine regional unemployment behaviour in the context of the regional labour market populations. Martin (1996), argues that not only is there the issue of examining labour force participation but also the increased role of female and part-time employment to consider in evaluating unemployment behaviour. He also raises the issue that unemployment asymmetries can also be addressed in terms of how little unemployment rose in the north as opposed to how much it rose in the south.

2.2.8 The Regional Labour Market

To get a better idea of the broader picture of regional labour market dynamics the following tables piece together the relative components that comprise the regional unemployment rate. The regional unemployment rate is determined by two moving components: the labour force and the numbers unemployed. The literature argues that a negative demand shock in both the 1980s and 1990s led to a large fall in employment and thus unemployment rose. Unemployment, however, can also rise if people enter the labour market without having employment. The unemployment rate can change if workforce participation changes. To understand why unemployment rates changed through the two recessionary periods, whether labour demand or labour supply-side effects dominated and the nature of apparent regional asymmetrical adjustment processes this needs further exploration.

Tables 2.6, 2.7 and 2.8 present a comparative picture of unemployment and labour force participation rates. Table 2.6 offers different unemployment rate measures over the two recessionary periods of the early 1980s and 1990s. The exact dating of the economic recessions differ across a number of authors, this in part reflects the lack of any official dating by the Official for National Statistics (ONS). Also the fact that unemployment typically lags movements in real GDP. The consensus amongst authors is to define the recession of the early 1980s as that of 1980-1982 and of the early 1990s as that of 1990-1992. Bearing this in mind and monitoring unemployment behaviour the recessionary periods chosen for comparative purposes are taken as 1980-1983 and 1990-1993.

In order to examine regional unemployment movements in more detail, the percentage change, and the absolute and relative dispersions of unemployment were calculated over the two recessionary periods for each regions total unemployment rate. These results are presented in Table 2.6.

Table 2.6: Regional Unemployment Behaviour, Totals

Region	1980-1983: Change in Unemployment Rate.			1990-1993: Change in Unemployment Rate.		
	Percentage Rate	Absolute $(U_{UK} - U_i)$	Relative (U_{UK}/U_i)	Percentage Rate	Absolute $(U_{UK} - U_i)$	Relative (U_{UK}/U_i)
East Anglia	146.9	4.7	-1.2	144.1	4.9	0.0
East Midlands	151.4	5.6	-0.3	102.1	4.9	0.0
North	97.3	7.1	1.2	40.0	3.4	-1.5
North-West	131.6	7.5	1.6	45.3	3.4	-1.5
South-East	180.8	4.7	-1.2	188.9	6.8	1.9
South-West	121.1	4.6	-1.3	148.8	5.8	0.9
West Midlands	184.4	8.3	2.4	101.8	5.6	0.7
Yorkshire & Humberside	145.7	6.7	0.8	62.5	4.0	-0.9
Northern Ireland	78.6	6.6	0.7	7.0	0.9	-4.0
Scotland	90.6	5.8	-0.1	18.1	1.5	-3.4
Wales	120.3	7.1	1.2	58.5	3.8	-1.1
UK Average	134.1	5.9		89.1	4.9	

All values are the average over the two periods.

Table 2.6 indicates how the recession of the 1990s has changed regional unemployment. The picture is the same for both men and women. In the first column, the percentage change provides a figure of how much the unemployment rate changed over the four years for each region. The second column gives the overall total change in unemployment rate against the national average whilst the third gives the relative change. The regional pattern of the two recessionary periods is clear based on all three measures. What is of particular interest, however, is the relative worsening of the regional unemployment rate in the south, particularly in the South-East. As Martin (1996) pointed out, although the percentage rate of change in unemployment in the south is almost the same across both periods. What is of note is by how much the north did not experience such a large rise in unemployment as in the south, in this case relative to the 1980-1983 period.

The results presented in Table 2.6 confirm the earlier analysis of a north-south differential in regional unemployment behaviour in the early 1990s. However, unemployment rate changes can be as much as a function of changes in workforce participation. To examine this Table 2.7 presents the percentage change in the registered workforce over the two recessionary periods.

Table 2.7: Percentage Change in Regional Workforce Participation

Region	1980-1983	1990-1993
East Anglia	3.43	1.35
East Midlands	0.51	-1.53
North	-4.49	0.38
North-West	-4.15	-2.15
South-East	0.60	-3.73
South-West	1.30	-0.14
West Midlands	-0.99	-2.47
Yorkshire & Humberside	-1.89	-1.41
Northern Ireland	3.48	1.27
Scotland	-1.52	1.49
Wales	-3.76	-0.53
UK Average	-0.78	-1.71

Changes in labour force participation presented in Table 2.7 present a different picture of the north-south divide over the two periods. Evidence of a well-defined north-south split in the 1980-1983 period, with falling labour force participation in the north, is countered by the mixed results of 1990-1993. This latter period indicates the south to have experienced the largest fall in labour force participation, particularly in the South-East.

Whether the final unemployment rate is dominated by changes in workforce participation of changes in the unemployment – employment ratio is difficult to disentangle. Changes in the size of the workforce can affect the unemployment rate without changing the actual numbers unemployed and vice-versa. As a way of disentangling these two effects on the unemployment rate Table 2.8 constructs comparative unemployment rates for all 11 regions over the two recessionary periods. This is based on differences in the unemployment rate due to workforce or numbers unemployed changing.

Table 2.8: Percentage Change in the Unemployment / Workforce Ratio*

Region	1980-1983		1990-1993	
	Workforce Unemployment Differences	Change in Unemployment Rate	Workforce Unemployment Differences	Change in Unemployment Rate
East Anglia	4.88	4.78	4.95	4.91
East Midlands	5.67	5.65	4.76	4.84
North	6.75	7.09	3.47	3.43
North-West	7.18	7.43	3.27	3.43
South-East	4.73	4.72	6.62	6.76
South-West	4.62	4.57	5.86	5.87
West Midlands	8.29	8.33	5.43	5.57
Yorkshire and Humberside	6.64	6.73	3.90	3.99
Northern Ireland	6.83	6.55	1.10	0.94
Scotland	5.72	5.82	1.68	1.56
Wales	6.83	7.06	3.79	3.83
UK Average	5.90	5.94	4.80	4.90

* Columns one and three shows the unemployment rate for changes in unemployment holding the actual size of the workforce constant at the period beginning values. Columns two and four give the actual change in the unemployment rate reported. For each period, the "workforce effect" on the unemployment rate can be determined.

In Table 2.8, for each recessionary period the unemployment rate based purely on changes in the numbers unemployed are given in the first column, against the actual change in the unemployment rate in the second. For each period, differences between the first and second columns enables an examination of the relative effects of changes in the workforce had on unemployment.

Table 2.8 indicates that the relative change in regional unemployment rates is predominantly due solely to changes in the actual numbers unemployed. Changes in the size of the workforce appear to have had a very negligible or insignificant impact on the unemployment rate.

The picture of regional unemployment behaviour presented in Tables 2.6-2.8 sheds further light on the behaviour of relative regional unemployment. Regional unemployment differences over the two recessionary periods appear to be solely due to increases in the number of persons registered as unemployed but in which a clear north-south divide exists. In particular the north exhibited a relatively greater rise in unemployment compared with the south over the 1980-1983 period which was reversed in 1990-1993. Changes in the size of the workforce were in some cases significant, but given the relatively small percentage of persons unemployed made very little impact on the unemployment rate.

The 1990-1993 narrowing of regional unemployment differentials, is uncharacteristic of regional unemployment behaviour. As to why this might have happened rests firmly in trying to explain why the percentage increase in unemployment in the south was greater than in the north. The literature has discussed the possibility that this narrowing was due to the recession being asymmetric in its impact, (see e.g., Evans and McCormick (1994), Martin (1996)). If this is the case then assuming regional unemployment is determined by regional labour markets, such an impact on regional unemployment can be investigated with respect to regional wage and price behaviour.

2.2.9 The Regional and National Average Unemployment Relationship

Although Thirlwall's model in estimating the slope coefficient in the regression of the regional unemployment rate against the national was used in examining the cyclical sensitivity of a region's unemployment rate, it has also been interpreted as picking up the long-run equilibrium relationship between the region and the national. If this is the case then the notion of labour market adjustment processes and changes in the unemployment rate refer to changes in equilibrium unemployment. The inability for regional unemployment differences to disappear combined with evidence of weak regional migration effects has led to the suggestion that regional unemployment rates are in equilibrium. (Marston (1985), Blanchard and Katz (1992)). As such region-specific characteristics such as the industrial mix, cost of living differences etc., explain regional unemployment differences in a model of full employment in the national economy (see Byers (1989), p. 451).

Using Thirlwall's model of estimating the cyclical sensitivity of regional unemployment, Byers (1989, 1991), and Chapman (1991), sought to establish whether the slope coefficient of equation (2.5) might in fact be picking up the long-run equilibrium relationship between the region and national variables in levels. Indeed Martin (1996, p. 248) suggests that the events of the early 1990s of the changes in regional unemployment differentials simply represents the movement of the regional economies to a new equilibrium. Using cointegration analysis of regional unemployment rates against each other, Byers (1989) and Chapman (1991) sought to estimate the cointegrating relationship between regional unemployment rates. Their results were, however, inconclusive, it was not possible to significantly accept the null hypothesis of a cointegrating relationship existing between the regional unemployment rates modelled.

The models used in both Thirlwall's cyclical senstivity analysis and the above cointegrating analysis refer purely to statistical processes. That is they lack economic theory as to why these processes might hold. The relationship between the region and the nation can, however, be difficult to model, as the nation is by definition determined by its regions. Region-specific characteristics and nation-specific characteristics in labour market adjustment processes are difficult to separate.

A key hypothesis of this thesis is that the regional labour market is not statistically, significantly different from the national average. In terms of unemployment differences, this needs to be addressed. Changing regional unemployment rates in the 1990s appears to have shifted regional unemployment differentials from one that exhibited relatively large changes for given changes in the national unemployment rate to one that now exhibits a much higher degree of conformity. But by how much do regional unemployment rates differ from the national? And how significant has this relationship changed? In seeking to develop a better understanding of the relationship between the regional and national unemployment rate these questions need to be formally addressed.

To test the hypothesis that the regional unemployment rate is not significantly different from the national average, it is possible to use the regression results from equation (2.5) and perform Wald tests on the joint-restriction: $\alpha_{0i} = 0$, $\alpha_{1i} = 1$. Failure to reject the null hypothesis implies it is possible to conclude that the regional unemployment rate is the same as the national average. Whilst this hypothesis was tested for the 1975-1996 sample period for all regions, the inability to reject the presence of a structural break in some regions as recorded in Section 2.2.5 suggested that this hypothesis of the joint-restriction be tested over the sub-sample period 1975-1989. Comparing the results over the two sample period provides a richer analysis of the relative regional unemployment picture. The probability values on the *F*-statistic of rejection of the null hypothesis are given in Table 2.9.

Table 2.9: Wald Test Results on the Hypothesis that Regional Unemployment Totals are not significantly different from the National Average.

Region	Wald Test: $\alpha_{0i} = 0, \alpha_{1i} = 0$,	
	1975-1989	1975-1996
East Anglia	0.14	0.13
East Midlands	0.52	0.30
North	0.19	0.84
North-West	0.00***	0.94
South-East	0.00***	0.74
South-West	0.31	0.71
West Midlands	0.00***	0.00***
Yorkshire & Humberside	0.07*	0.82
Northern Ireland	0.04**	0.42
Scotland	0.51	0.16
Wales	0.00***	0.31

*** indicates rejection of the null hypothesis at the 1% level, ** at the 5% level and * at the 10% level.

Table 2.9 indicates that in all region's with the exception of the West Midlands it is not possible to reject the null hypothesis that a regions unemployment rate is not statistically, significantly different from the national average. Although the test statistic is not very strong on small sample sizes, the results imply that there is a high degree of conformity in regional unemployment behaviour against the national average over the full sample period. For 1975-1989 period, in six cases the null hypothesis that the regions are not statistically different from the national average is rejected at the 10% level. This suggests that the dramatic change in regional unemployment differentials resulted in a much greater degree of regional unemployment conformity.. This suggests that full sample estimates present a misleading view of the dynamics shifts in regional unemployment behaviour.

The West Midlands result is not terribly surprising given the parameter estimates in Section 2.2.5. But the results do indicate that despite apparently large differences in regional unemployment, the size of any potential aggregation bias being introduced in using movements in the national average unemployment rate as representative of the region appears to be small.

2.2.10 Explaining Unemployment Behaviour

A major criticism of the statistical work of Thirlwall (1966) is it's lack of any rigorous economic theory (c.f. Martin (1996)). Furthermore developments in econometric time-series have led (Byers (1989, 1991) and Chapman (1991) to argue that regional unemployment differentials that widen in times of rising national unemployment and fall in times of falling national unemployment simply reflect the operation of the equilibrating process in a cointegrating relationship. Nonetheless commentators are agreed that the fundamental landscape of regional unemployment differentials that led to the so-called north-south divide has seemingly changed in the early 1990s with no obvious evidence of a return to the previous state.

As it stands two competing theories are currently vying to explain how and why regional unemployment rates patterns have changed.

The first hypothesis is that the relative rise in unemployment in the south in the 1990-93 recession was due to a significantly greater deflationary impact hitting the south than the north. Rising nominal interest rates not only hit a more heavily debt-laden south than the north, but the collapse of house prices led to a much sharper fall in the house price-earnings ratio in the south and the loss in equity hit consumer demand far more (see Taylor and Bradley (1993), Evans and McCormick (1994, p. 645.), Audas and MacKay (1996)).

The second hypothesis is that the narrowing of regional unemployment differences was due in no small part, to the north reacting better than the south to a national negative shock (see Morgan (1996) and Martin (1996)) According to Morgan falling labour force participation, increased part-time employment and rather suggestively the employment law reforms in the 1980s made work practices much more 'flexible' with respect to employment and wage adjustment. To Morgan this is perhaps exemplified by the relatively fast fall in national unemployment once the peak was hit in the mid 1990s compared with the prolonged rise and maintained high level of unemployment in the 1980s. Whilst agreeing that there are economic problems and adjustment processes in the labour market, Martin ((1996), p. 246-248) argues that the north had very little excess labour to shed in light of the big clear out of labour in the early 1980s. Hence only the south experienced a major clearout in the 1990s. Whether the south was particularly badly hit or the north coped better is at the heart of the asymmetrical result of the 1990-1993 recessionary period.

The idea that sectors within an economy move together and are thus symmetric has with respect to unemployment been challenged by a number of authors spearheaded by Lilien's (1982) seminal paper on sectoral shifts. Differing labour market adjustment processes reflected by differences in unemployment questions the integration of the national labour market across the UK regions. In particular are the issues of differing institutional, (see Bayoumi (1997)) as well as cultural and social barriers across the UK. To understand and explain regional unemployment differences within the wider context of regional labour markets an analysis of regional labour market variables needs to be developed. The next section looks at nominal wages.

2.3 Wages

2.3.1 Introduction

Attempts at formally modelling the relationship between regional wages and unemployment go back to early Phillips curves estimates in which differing relationships between the regional unemployment rates and wage inflation were thought to be uncovered. Such early works include Thirlwall (1970), Kaun and Spiro (1970) and Hart and MacKay (1977).

Models based on labour market wage-unemployment interactions seek to explain and measure wage and unemployment adjustment processes. In this respect the analysis of regional unemployment has meant that regional wage behaviour has been examined to try and explain why regional unemployment differences persist. Blackaby and Manning (1987) and Blackaby and Murphy (1995) suggest that regions with higher unemployment have lower nominal and expected real wages, but found these wage effects to be negligible. Working in wages levels and the unemployment rate the wage curve of Blanchflower and Oswald (1990, 1994) and the work of Jackman and Savouri (1991) find support for a significant relationship existing between relative regional wage levels and unemployment, but these processes are not fully understood. Indeed the argument that regional wage differentials should be larger given regional unemployment rate differences was examined by Hyclak and Johnes (1989, 1992) and Johnes and Hyclak (1989), but their results were inconclusive.

Establishing wage responsiveness to unemployment is also a specification problem. Hyclak and Johnes ((1989) p. 189) point out that whilst region-specific Phillips curves might indicate a good 'fit' between local unemployment and local wage bargaining, this might merely reflect the high correlation between the region and the national average. For instance if national wage bargaining matters the regional variable will pick this up. There also, however, problems of errors in variables that will bias the estimated coefficients and possible simultaneity bias. The direction of this relationship is, however, difficult to verify. The relationship between the regional wage and the national wage needs to be explored before the relationship between wages and unemployment is developed.

Regional Phillips curves and wage curves are examined in Chapters Four and Five respectively. Support for these models implies that that there is a relationship between regional unemployment and regional wages. Empirically, however, the specification and identification of region-specific variables given the high degree of correlation between the region and the nation is difficult to achieve. As discussed in Chapter Four, the high degree of correlation questions whether regional economic modelling is a worthwhile exercise.

A number of related empirical studies come out in support of the regional model. Forrest and Naisbitt (1988) on the industrial concentration of regions in explaining relative regional unemployment cycles; the work on corporatism and local level bargaining along with "the ability to pay" hypothesis developed by Carruth and Oswald (1989) all indicate that local pay and local unemployment are strongly related. Indeed a number of studies have argued that regional wage inflation rates can differ throughout a national economy (e.g. Walsh and Brown (1990) on increased firm-level wage bargaining and Johnes and Hyclak (1989)).

Previous empirical studies on local or regional wage–unemployment dynamics support a local / regional labour market model. This along with persistent regional unemployment differences suggests that the UK labour market is not fully integrated with regard to national labour market adjustment. In studying regional and national wage-unemployment dynamics nominal wage behaviour must first be analysed.

2.3.2 Regional Wage Behaviour

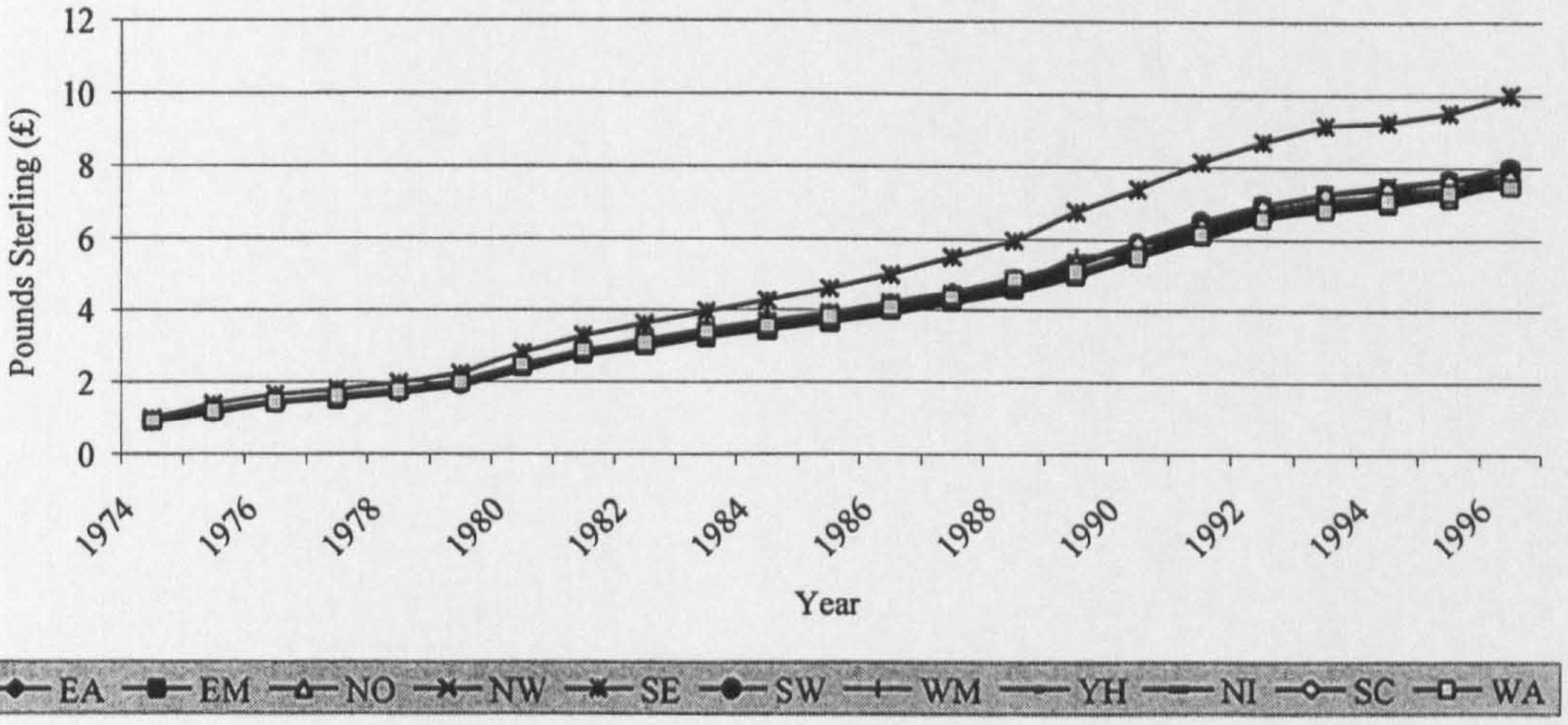
At the regional level there are a number of different measured wage rates. Official figures released by the ONS are published for April of each year by the Department for Education and Employment (DfEE hereafter), in the New Earnings Survey, (NES hereafter). The data contained in the NES give, amongst other measures, the average weekly earnings of those workers whose pay was not affected by absence, including overtime for each region of the UK. Dividing by the total recorded hours gives an approximation of the average gross hourly earnings figures (AGHE hereafter). These figures are annual and are based on sampled questionnaire responses by firms and employees over a four-week period. The results are thus based on a representative sample that aims to be greater than 5% of those that are believed to be working in that region.

For comparative purposes on regional earnings (wages hereafter), Figures 2.16-2.18 depict nominal average gross hourly wages levels and Figures 2.19-2.21 the growth rates, for all adults[9], all males and all females, excluding those whose pay was affected by absence.[10]

[9] This series was first made public in 1989, to construct an equivalent series prior to this period it was necessary to multiply the male and female earnings series by the relative employment shares in each region for each year.

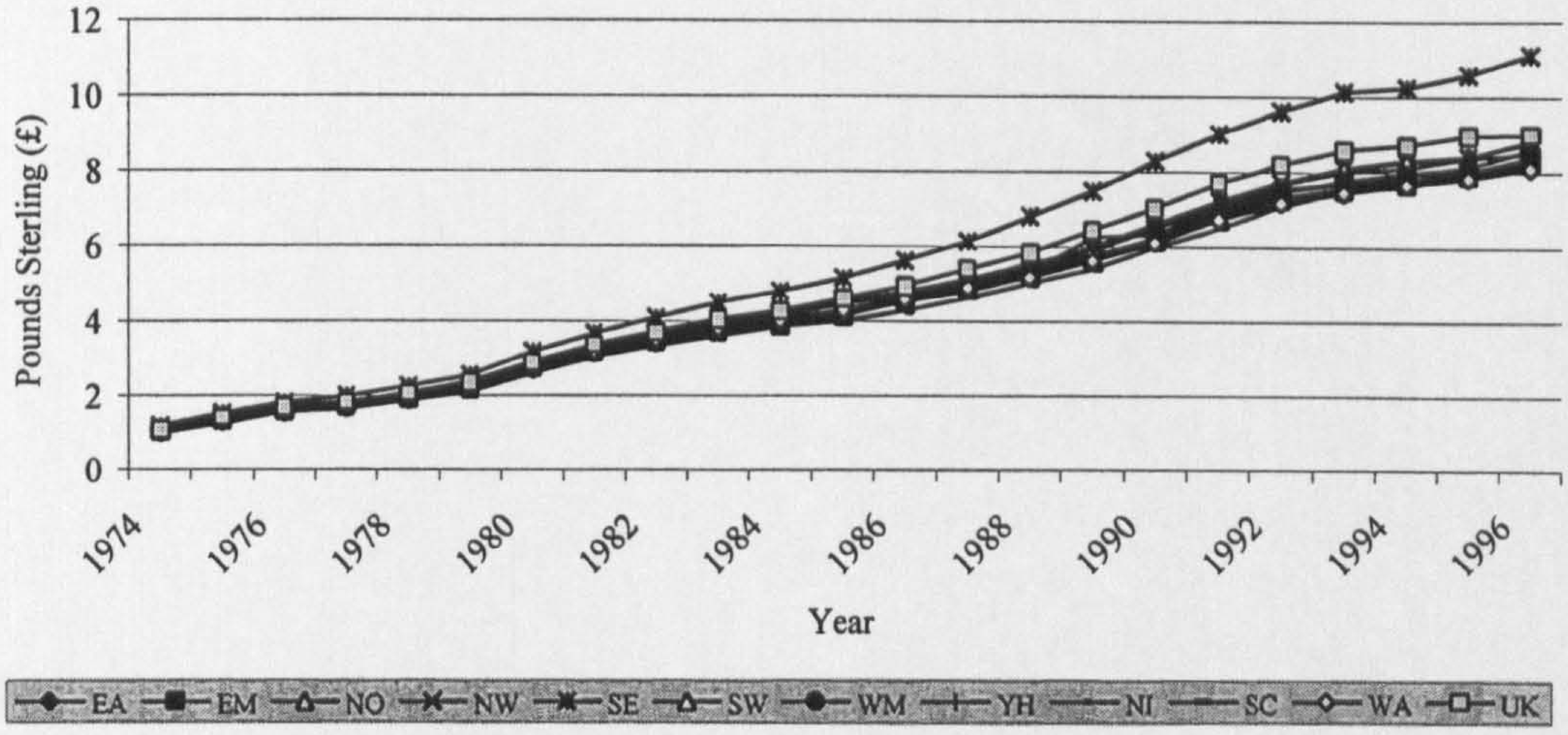
[10] In 1984 the adult male and adult female wages measures were changed from "all men aged over 21" and "all women aged over 18" to all those on "adult rates". This introduced a small change to the figures.

Figure 2.16: All Regions AGHE Including Overtime, Totals 1974-1996



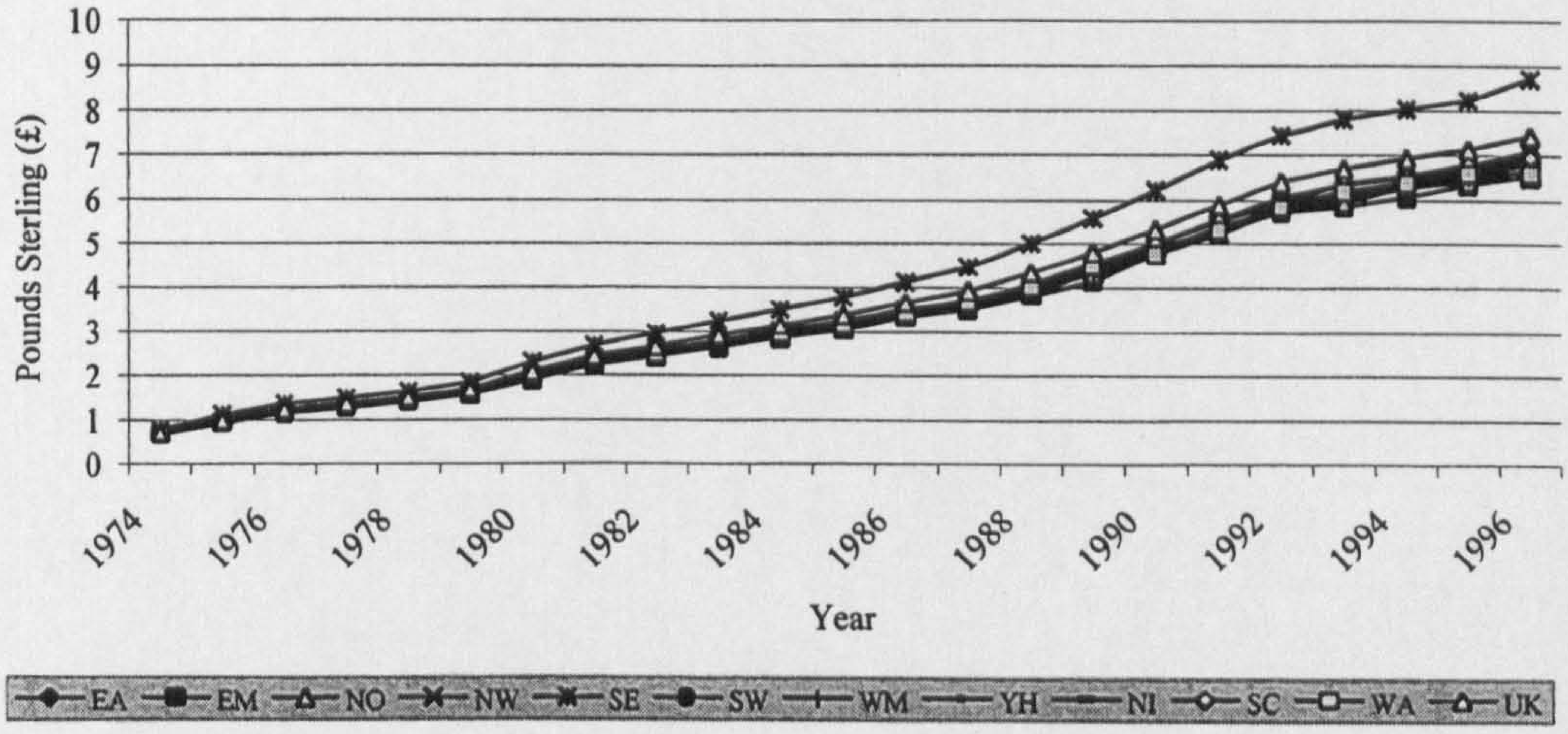
Source: New Earnings Survey Various Editions: April Values: Average Gross Hourly Earnings. Pre-1989 Employment Weighted Male and Female Totals.

Figure 2.17: All Regions AGHE Including Overtime, All Males, 1974-1996



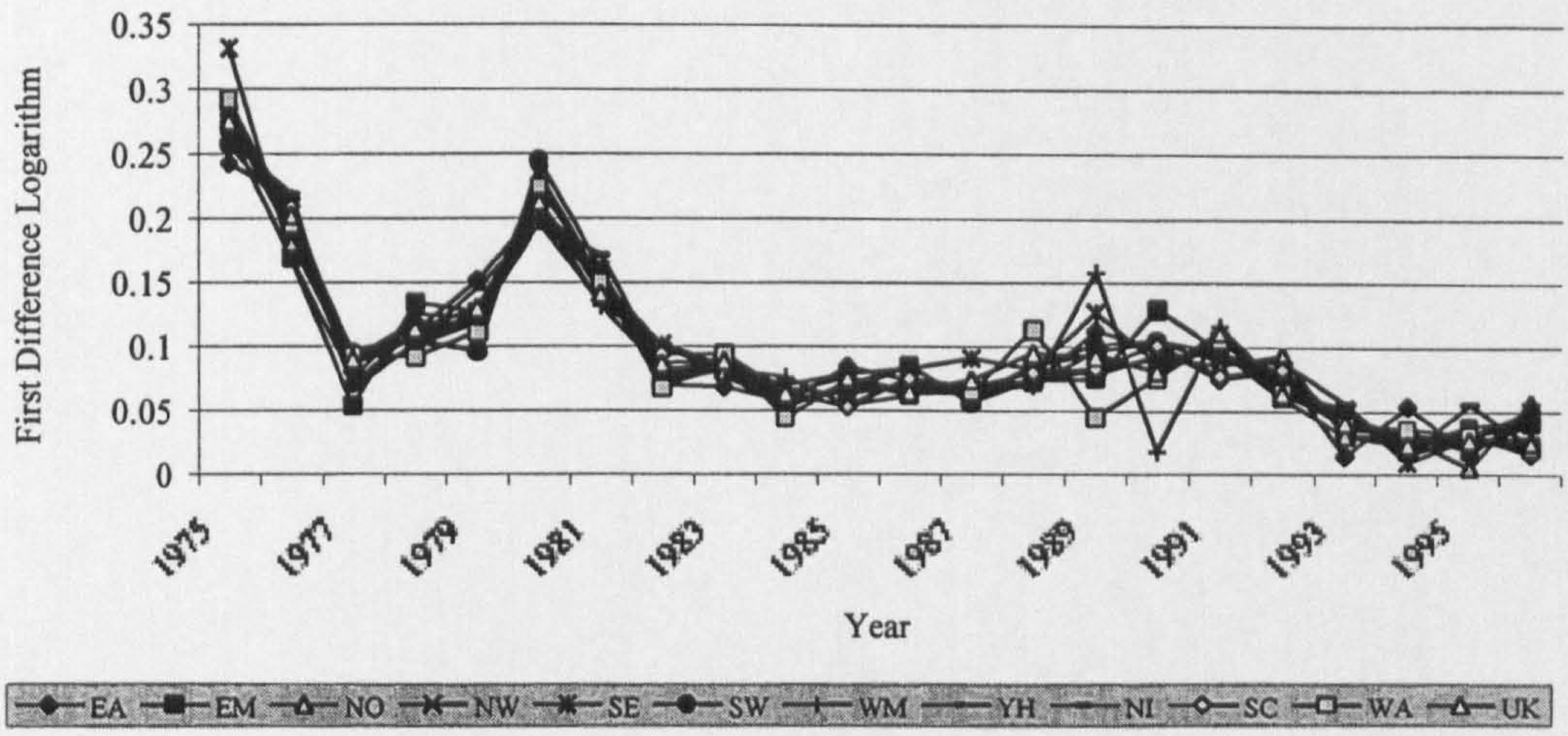
Source: New Earnings Survey Various Editions: April Values: Average Gross Hourly Earnings.

Figure 2.18: All Regions AGHE Including Overtime, All Females 1974-1996



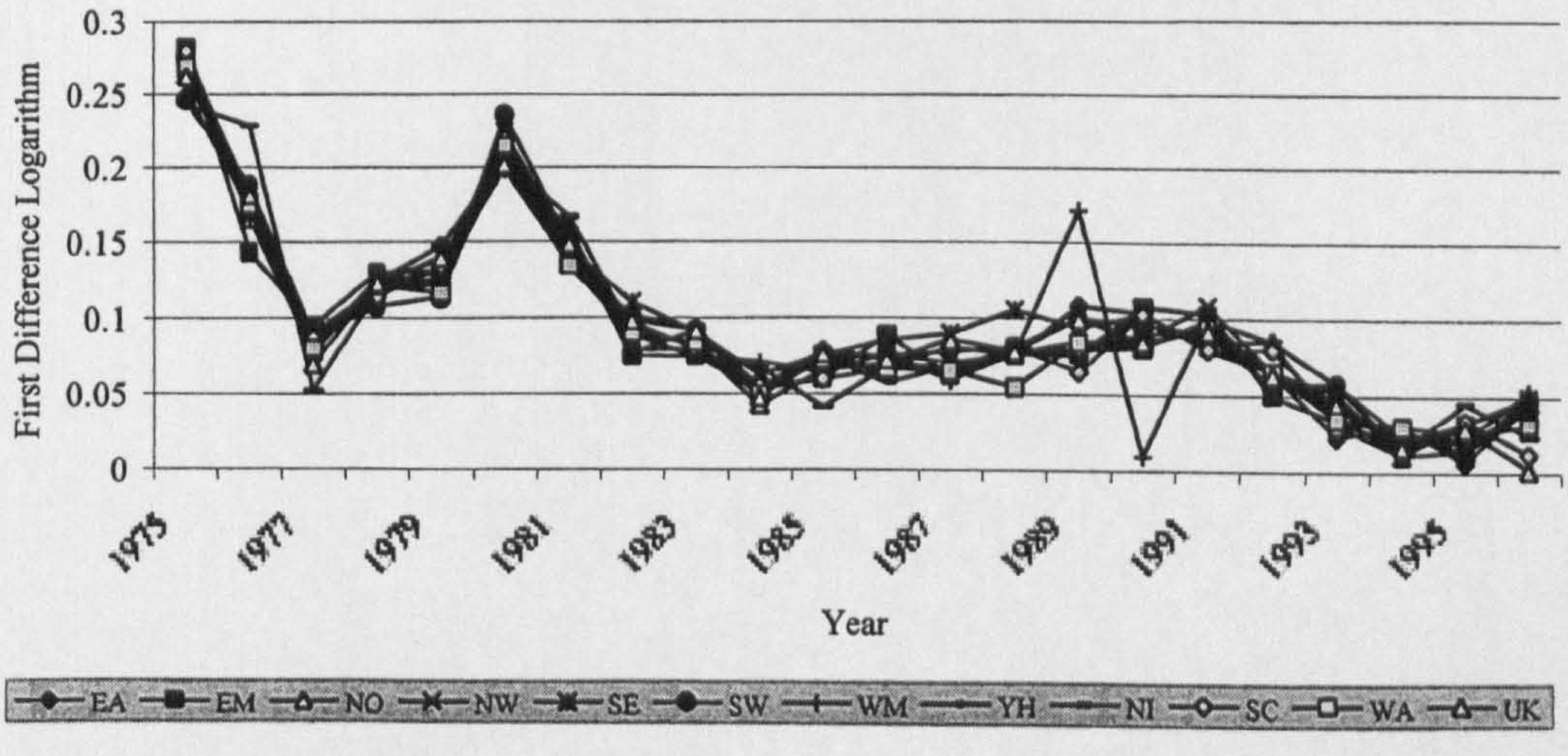
Source: New Earnings Survey Various Editions: April Values: Average Gross Hourly Earnings.

Figure 2.19: First-Difference Logarithms: All Regions AGHE Including Overtime; Totals, 1974-1996



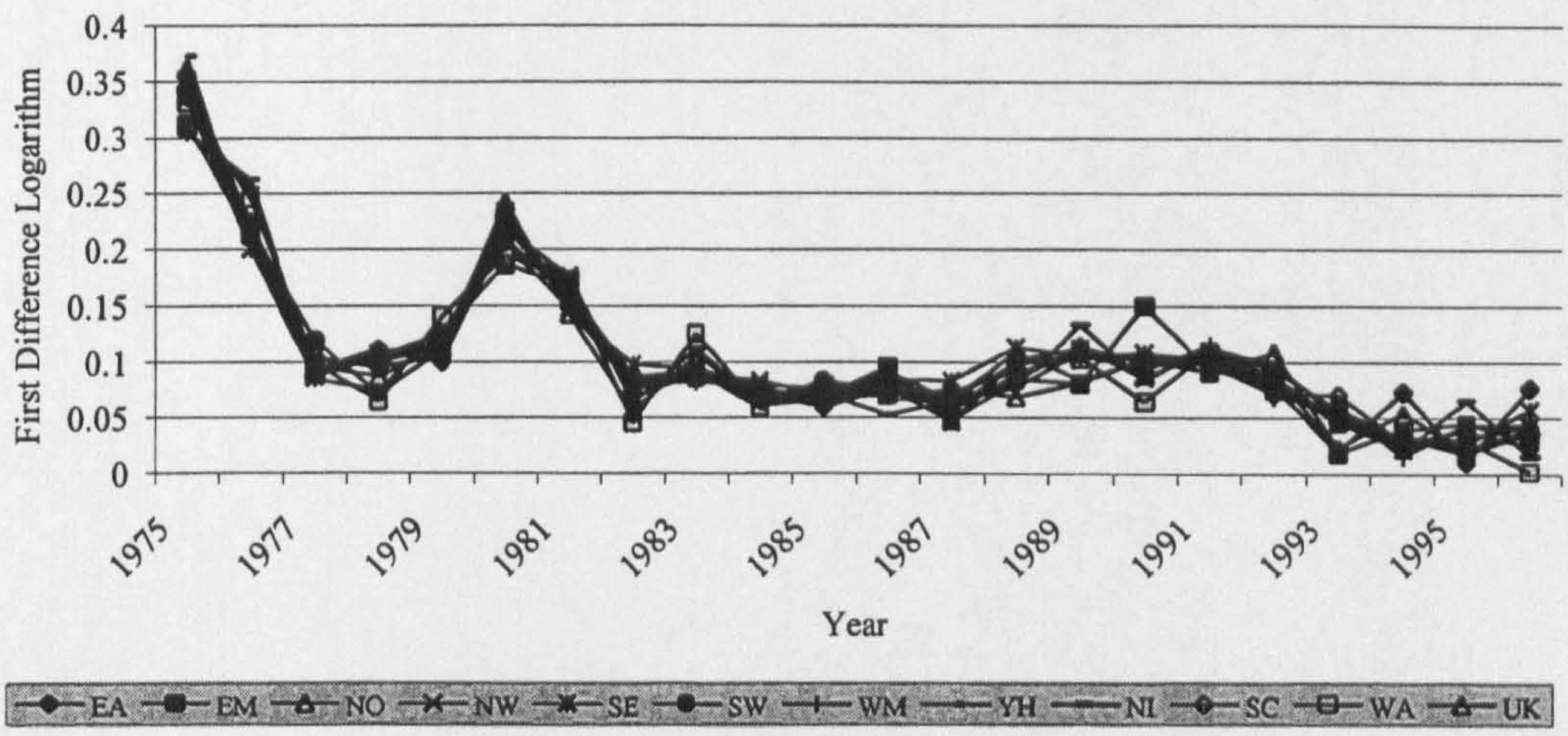
Source: New Earnings Survey Various Editions: April Values: Average Gross Hourly Earnings. Pre-1989 Employment Weighted Male and Female Totals.

Figure 2.20: First-Difference Logarithms All Regions AGHE Including Overtime; All Males, 1974-1996



Source: New Earnings Survey Various Editions: April Values: Average Gross Hourly Earnings.

Figure 2.21: First-Difference Logarithms All Regions AGHE Including Overtime; All Females, 1974-1996



Source: New Earnings Survey Various Editions: April Values: Average Gross Hourly Earnings.

Each of the Figures indicates a clear persistency of growing differences in nominal earnings for each category of worker. The growth rates follow the same pattern pretty much throughout - that of an increasing trend which slows in the mid-1980s, increases toward the latter part of that decade and then slows in the early 1990s. The change in the rate of growth of earnings appears to peak through the two recessionary periods, defined here as 1980-1983 and 1990-1993. The Figures also illustrate the rather controversial issues of differing pay awards between males and females. The largest regional growth in earnings, is that of the South-East. Indeed a number of studies have focused on the idea as to whether economic behaviour in the UK is driven by the South-East – the so called leading-sector hypothesis (see Cowling and Metcalf (1967), Thirlwall (1970) and Jackman and Savouri (1991))[11].

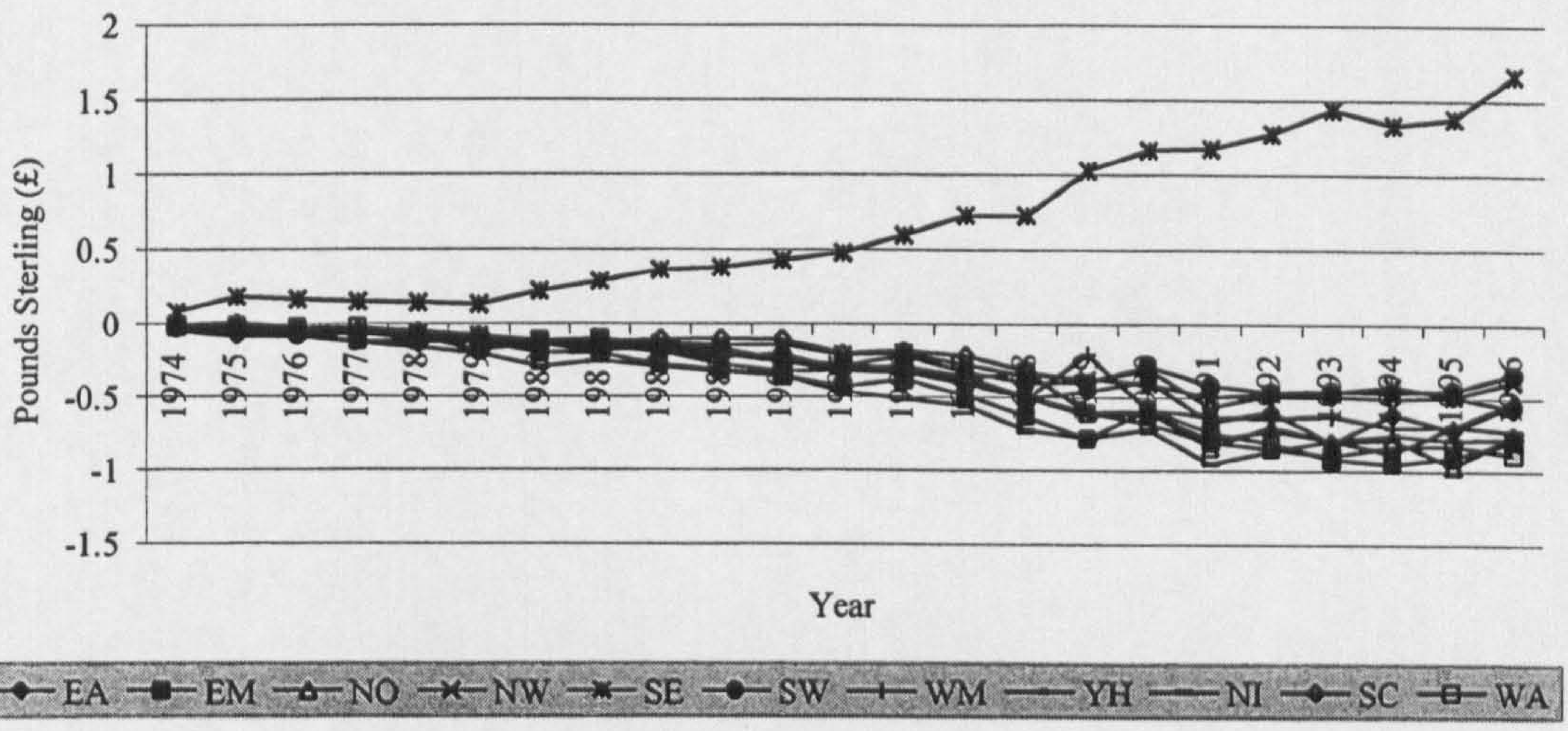
Figures 2.19-2.21 illustrate the growth rates of nominal wages in which there is evidence of a reduction or slowing down of wage inflation from the early 1980s onwards. With it there appears to have been a reduction in wage rate variability. Despite dissimilar regional unemployment rates over the same period, regional wage rate growth exhibits a much greater degree of conformity across the regions though there is some evidence of a widening regional variation in the mid to late 1980s. However, this appears more strongly evident in the case of male earnings.

2.3.3 Regional Absolutes and Relativities

Relative regional wage differentials across the three earnings groups are provided in Figures 2.22 2.23 and 2.24. In all cases the nominal growth rate of the South-East dominates forcing all other wage measures below the national average.

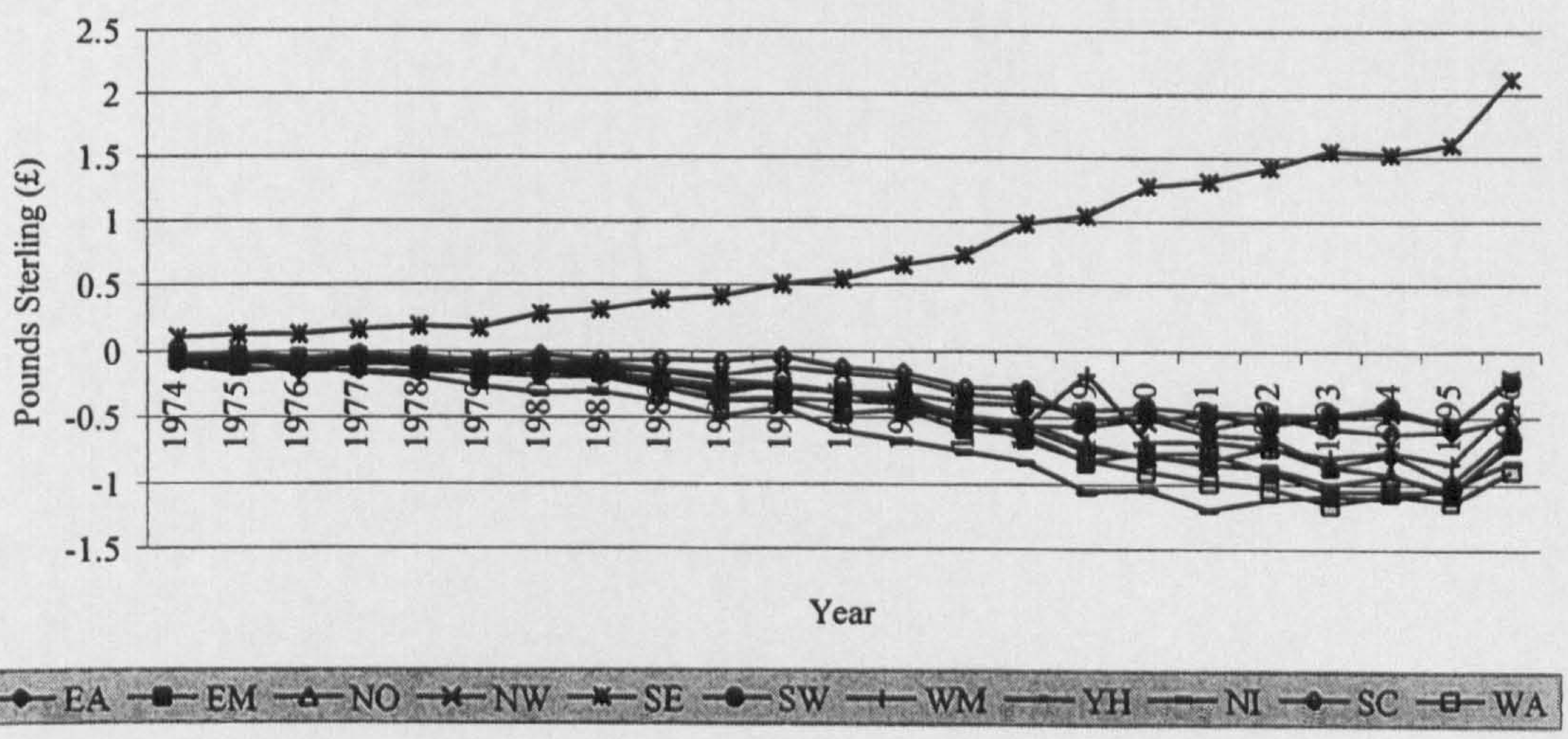
[11] Jackman and Savouri find no support for the leading sector hypothesis, in this case the South-East, p. 21 (1991))

Figure 2.22: Relative Regional AGHE Including Overtime, All Adults, 1974-1996



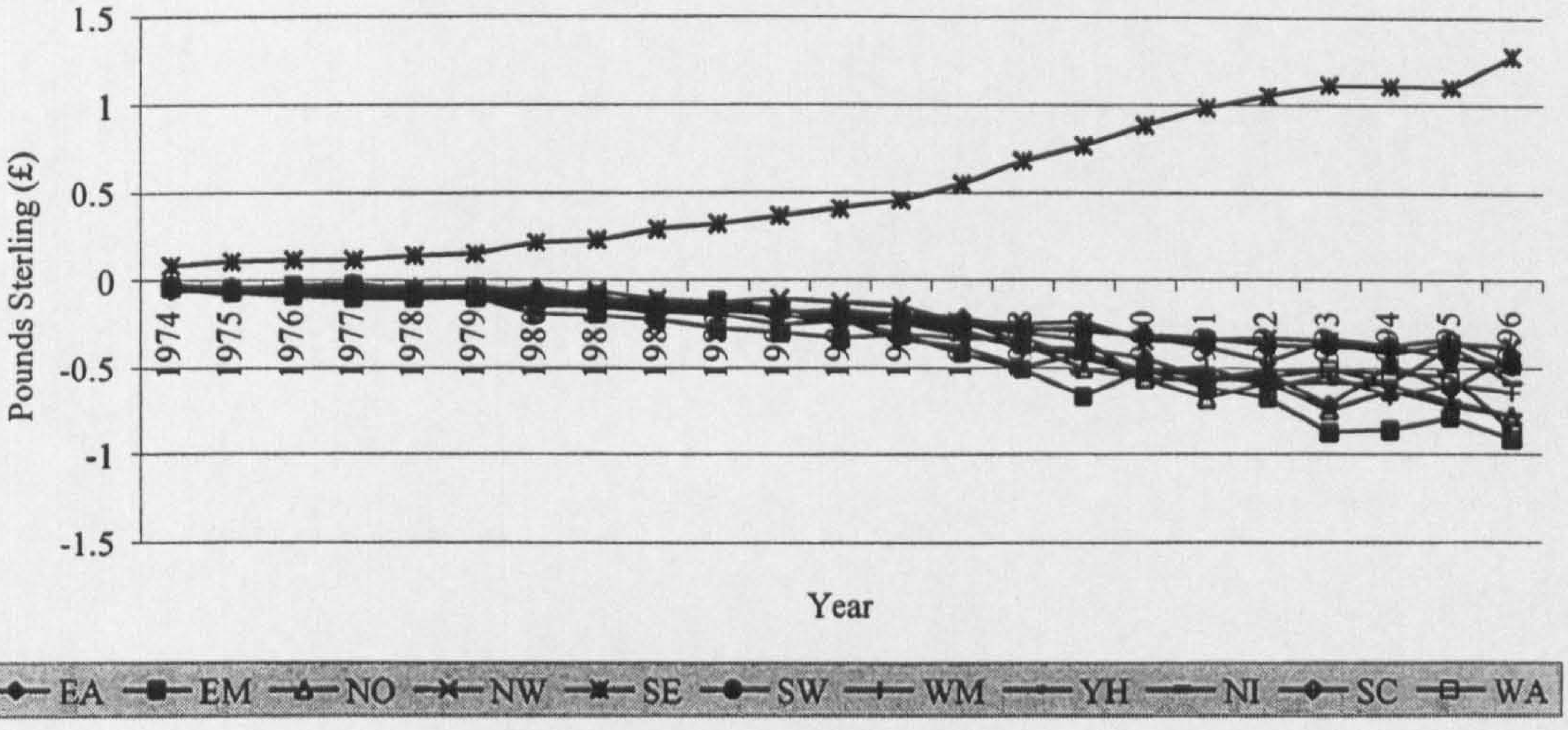
Source: New Earnings Survey Various Editions: April Values: Average Gross Hourly Earnings. Pre-1989 Employment Weighted Male and Female Totals.

Figure 2.23: Relative Regional AGHE Including Overtime, All Males, 1974-1996



Source: New Earnings Survey Various Editions: April Values: Average Gross Hourly Earnings.

Figure 2.24: Relative Regional AGHE Including Overtime, All Females, 1974-1996



Source: New Earnings Survey Various Editions: April Values: Average Gross Hourly Earnings.

Figure 2.25: A Comparison of the Absolute and Relative Dispersion of Regional Wages: Totals, 1974-1996

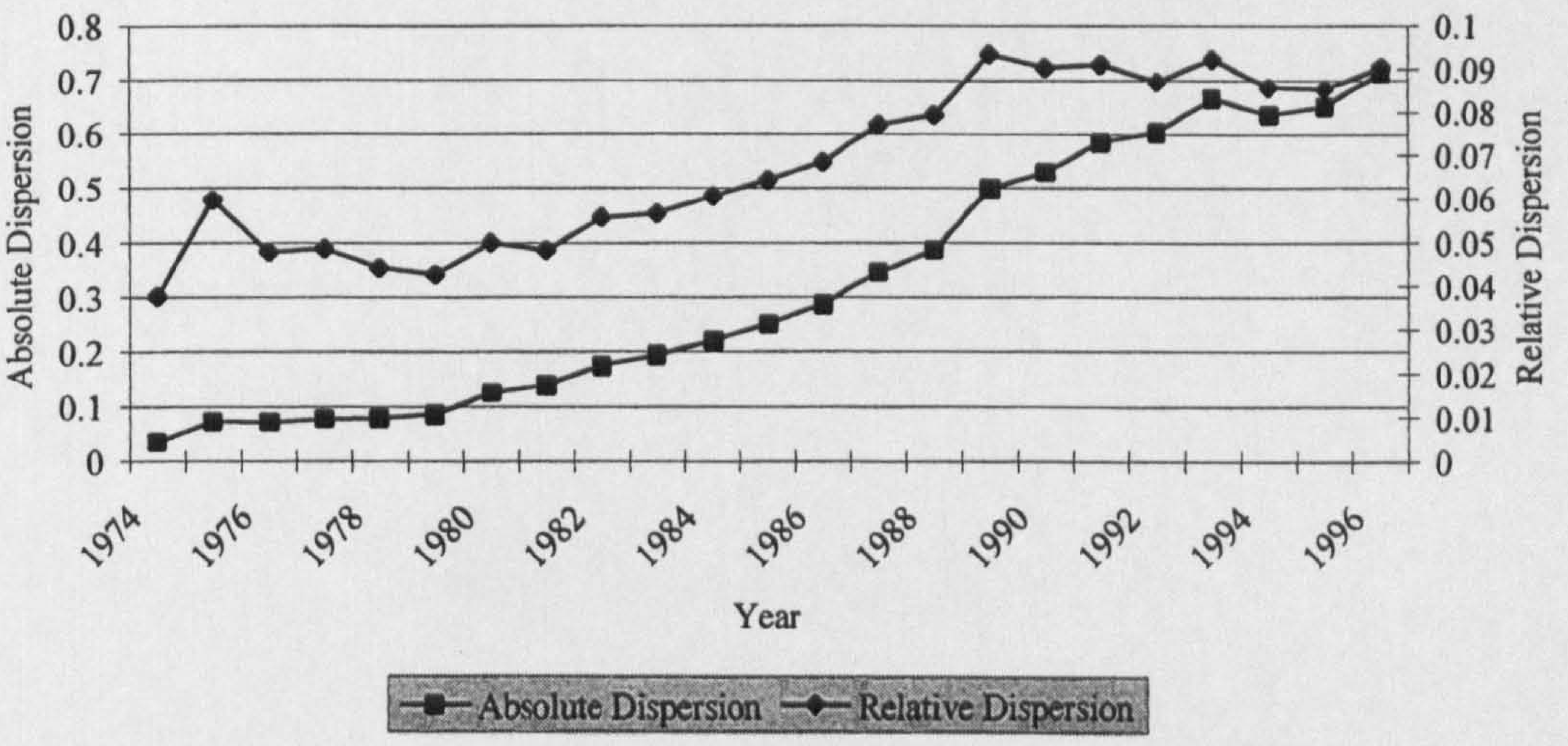


Figure 2.26: A Comparison of the Absolute and Relative Dispersion of Regional Wages: All Males, 1974-1996

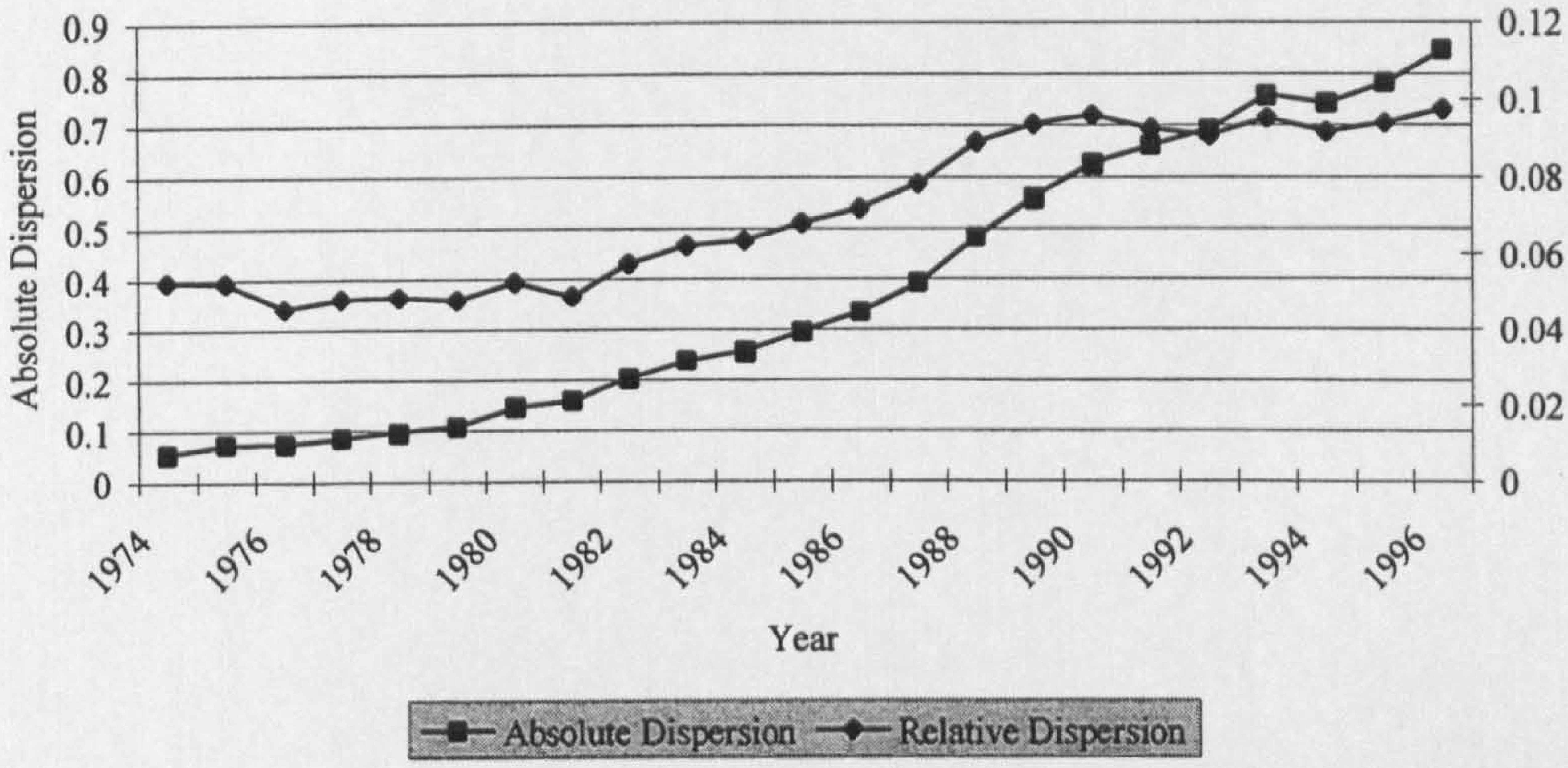
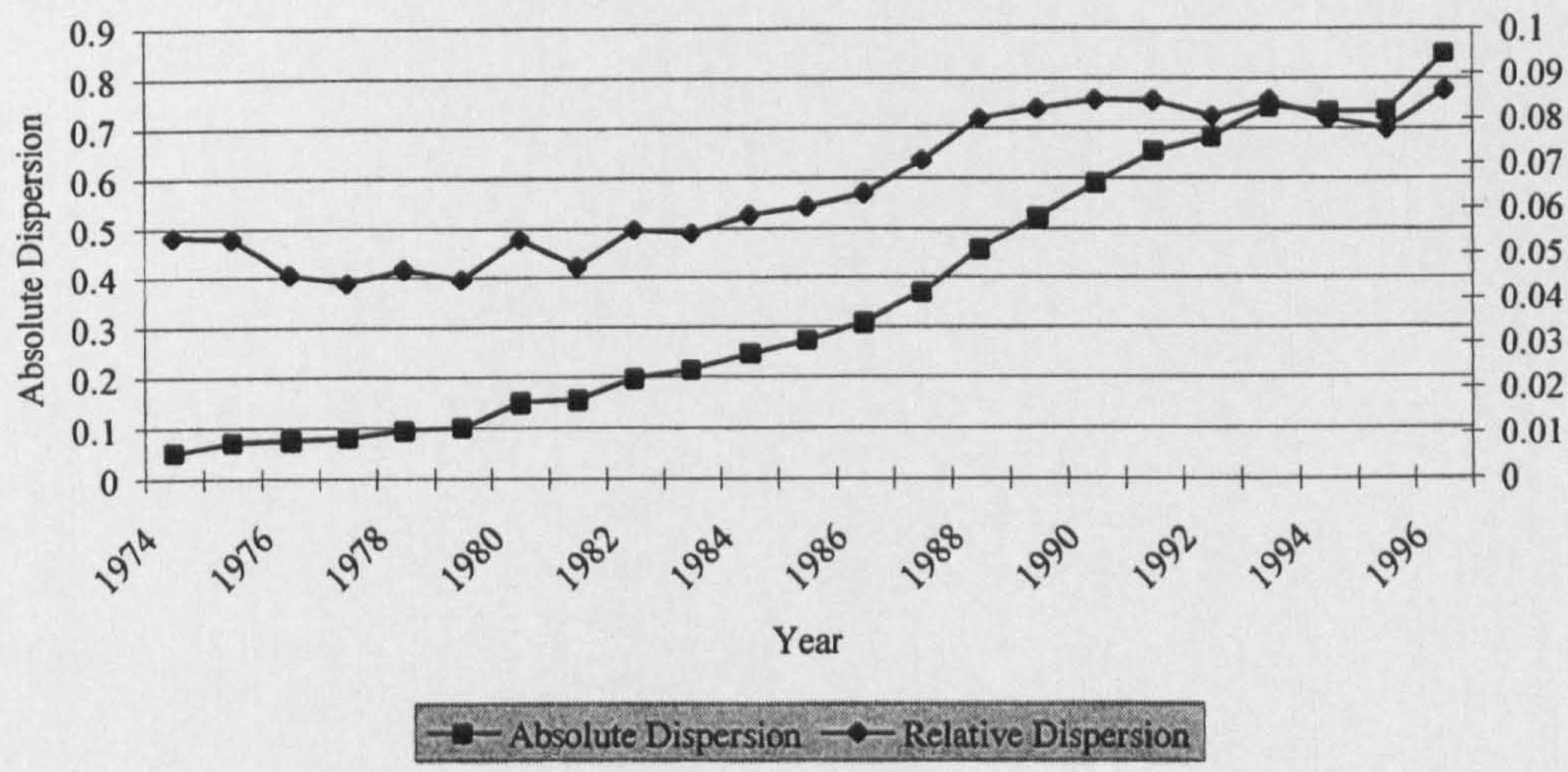


Figure 2.27: A Comparison of the Absolute and Relative Dispersion of Regional Wages: All Females, 1974-1996



Relative regional wages indicate a dominant South-East effect which is not paralleled by regional unemployment relativities.

Mapping out the regional dispersion of regional wages Figures 2.25-2.28 provide measures of the absolute and relative dispersion of wages. In all cases there is a clear increase in the regional variation of the dispersion of nominal wages. Whilst allowance is made for the fact that the figures are measuring nominal wages, there is, nonetheless strong evidence to support the case that at least in one region the growth rate of nominal wages is different from the others. Unlike unemployment, the difference across the two measures is not that great, though the absolute dispersion - the standard deviation - indicates greater regional dispersion indicative of relative differences in wages growth rates. Nonetheless both measures indicate a general increase in regional wage differences that increased throughout the 1980s. From the beginning of the 1990s, however, these differences appear to have stopped growing, or even in the case of the relative dispersion fall. This implies, in the case of the latter, that the asymmetric wage rate increase has reversed, with the low wage rate regions experiencing a relatively faster growth rate.

Comparing the relative regional dispersion of wages against those of unemployment in Section 2.2.3 there appears to be no obvious relationship between wage and unemployment behaviour for all three groupings: totals, males and females. Unemployment for instance exhibits a cyclical pattern in unemployment dispersion, whilst there is no evidence of this with wages. Although this will in part be due to the boundary conditions attached to the unemployment range, if unemployment and wages are related some common pattern would be expected.

The weak or poor link between regional unemployment relativities and wages presents part of the dilemma in establishing any causal link between wages and unemployment. Whilst the South-East dominates the wages figures, the South-East unemployment rate is much more closely allied with the other regions of the south: East Anglia, East Midlands and the South-West. The dominance of the South-East has, however, been remarked upon by a number of other authors, in particular with reference with what is called the leading sector hypothesis.

The leading-sector hypothesis posits that the national economy is driven by events in one sector. The remaining sectors lag this leading-sector, and in the case of regions it is assumed that regions lag behind the South-East. High correlations between the South-East and other regions have, however, led to his model being dropped by a number of authors (e.g. Jackman and Savouri (1991) Hyclak and Johnes (1992)). The lack of any clear South East regional wage-unemployment relationship distinct from other regions questions this leading-sector hypothesis.

2.3.4 The Cyclical Sensitivity of Regional Wages

As with total unemployment, an attempt is made to try and establish the relationship between changes in the total regional wage rate against the national average. Non-linearities in the data, and the inability to reject a unit root in levels, however, leads to an investigation into relative growth rates rather than levels. Examining the relative growth rates, and testing the hypothesis that the regional wage growth rate is not significantly different from the national average, equation (2.6) was estimated in accordance with the procedure outlined in Section 2.2.6.

$$\Delta W_{it} = \alpha_{0i} + \alpha_{1i}\Delta W_{UK,t} + \varepsilon_{it} \qquad (2.6)$$

where ΔW_{it} is the first-difference logarithm of total nominal wages in region i at time t, UK indicates the United Kingdom average and ε_{it} a random error term.

The previous analysis of unemployment leads to questions being raised regarding the parameter stability of the estimates in equation (2.6) As with unemployment the method of recursive residuals and the Chow test were undertaken to determine whether it was possible to reject the null hypothesis of a structural break occurring throughout the sample period. The recursive residuals results indicated some instability over the 1989-1992 period in the case of Wales. However, in all cases the Chow test results on the hypothesis of there being not having been a structural break could not be rejected at the 1%. Unlike unemployment, nominal wage behaviour appears to be relatively stable over the sample period.

Comparing relative growth rates of regional wages provides information on the pattern of nominal wages against the national average. Whilst this is not the same as examining the cyclical sensitivity of regional wages against the national average it nonetheless provides information on relative regional growth rates of wages.

Adopting the same procedures as with the cyclical sensitivity analysis of regional unemployment the following two hypotheses were tested. First, that there is no clear north–south regional dimension to the growth rate of wages, and second that the nominal wage growth rate of each region is not significantly different from the national average. For both hypotheses the regression (2.6) was performed using OLS over the sample periods 1975-1989 and 1975-1996:

Residuals from each regression were tested for normality, first-order serial correlation and heteroscedasticity, in a number of cases it was not possible to accept the null of no serial correlation and heteroscedasticity and had to be corrected.

Table 2.10: Regional Wage Growth Rate Analysis: $\Delta W_{it} = \alpha_{0i} + \alpha_{1i}\Delta W_{UK,t} + \varepsilon_{it}$

Regions	1975-1989			1975-996		
	α_{oi}	α_{1i}	R^2	α_{oi}	α_{1i}	R^2
East Anglia	0.01	0.95	0.92	0.00	0.99	0.90†
	(0.48)	(12.48)***		(0.02)	(18.71)***	
East Midlands	0.00	0.93	0.88	0.00	0.92	0.90
	(0.21)	(10.02)***		(0.53)	(13.80)***	
North	-0.01	1.04	0.98	-0.00	0.97	0.94†
	(-1.94)	(25.15)***		(-0.63)	(29.86)***	
North-West	-0.00	1.00	0.96†	0.00	0.97	0.97†
	(-0.70)	(26.98)***		(0.65)	(34.30)***	
South-East	-0.01	1.09	0.91	-0.00	1.06	0.92#
	(-0.39)	(8.21)***		(-0.16)	(9.57)***	
South-West	-0.00	1.00	0.92	0.00	0.97	0.94
	(-0.04)	(12.57)***		(0.34)	(17.12)***	
West Midlands	-0.00	0.98	0.92†	0.00	0.94	0.90†
	(-0.24)	(35.12)***		(0.75)	(27.95)***	
Yorkshire &	-0.00	0.98	0.95†	0.00	0.95	0.96†
Humberside	(-0.40)	(21.87)***		1.08	(59.11)***	
Northern Ireland	-0.00	1.00	0.93	0.00	0.95	0.92
	(-0.39)	(14.19)***		(0.56)	(15.64)***	
Scotland	-0.00	1.02	0.97	-0.00	1.01	0.95
	(-0.61)	(23.00)***		-0.65	(29.61)***	
Wales	-0.02	1.09	0.93†	-0.00	1.00	0.95†‡
	(-2.26)	(18.28)***		(-0.52)	(24.75)***	

t-statistics are in parentheses, *** indicates significance at the 1% level, ** at the 5% level, * at the 10% level, † signifies Cochrane-Orcutt AR(1) correction for serial correlation, # signifies White's correction for heteroscedasticity and ‡ indicates the inclusion of a dummy variable.

As with the unemployment results of cyclical sensitivity, the confidence in the estimated coefficients are subject to small sample bias and can therefore only be interpreted tentatively. For the 1975-1989 sample period regional wage growth rates are fairly mixed across the 11 regions. Relatively low rates of growth in the south, with the exception of the South-East are found against the relatively higher growth rates in the north. Over the full sample period, the dominance of the South-East is evident with almost all other wage growth rates being less than the national average. Based on these results there is no clear north-south split in regional wage growth rates.

The results are, however, plagued by a rather high incidence of serial correlation amongst the residuals. This can be indicative of a mispecification problem. Given that this model is a reduced-form equation this finding is not surprising and is reminiscent of some of the criticisms of this modelling approach when used for unemployment.

To test the second hypothesis that the regional wage growth rates are not statistically significantly different from the national average, Wald tests on the joint-restriction $\alpha_0 = 0$, $\alpha_1 = 1$ were undertaken and the probability values on the F-statistic of the null hypothesis are given in Table 2.11.

Table 2.11: Wald Test Results on the Hypothesis that Regional Wages are not significantly different from the National Average

Region	1975-1989 P-Value	1975-1996 P-Value
East Anglia	0.72	0.95
East Midlands	0.45	0.27
North	0.08*	0.01***
North-West	0.29	0.35
South-East	0.36	0.56
South-West	0.98	0.88
West Midlands	0.02**	0.06*
Yorkshire & Humberside	0.08*	0.01***
Northern Ireland	0.66	0.64
Scotland	0.83	0.64
Wales	0.79	0.49

*** indicates rejection of the null hypothesis at the 1% level, ** at the 5% level and * at the 10% level.

The results indicate that for some regions of the north: the North, Yorkshire and Humberside and the West Midlands it is not possible to accept the null hypothesis that regional wages are not statistically different from the national average over both periods. This hints at the possibility of an aggregation bias being introduced if the growth rate in UK average wages are interpreted as representative of these regions. It also implies that not allowing for regional variation in policy analysis will lead to misleading forecasts. However, compared with the results on unemployment, the rejection of the null hypothesis for the North and Yorkshire and Humberside in wages are the only characteristics not shared.

The results on unemployment and nominal wages suggest high correlations amongst regions in both unemployment rates and regional wage rates. However, the results do not support the notion of any clear north-south divide when it comes to relative wages and unemployment relativities.

Whilst regional wage differentials and regional wage growth rates are difficult to reconcile with regional unemployment behaviour, the dominating nature of the South-East provides some common ground. Over much of the sample period the relatively low unemployment rates of the South-East are matched in part with it's relatively high nominal wage rate growth. Both of these results figure significantly in determining relative regional unemployment and wage behaviour. Events post-1990, however, indicate for the South-East rising relative unemployment rates against slowing nominal wage rate growth over this period (see Figure 2.22). Other than this interesting relationship no other firm conclusions can, however, be drawn on regional unemployment and wage behaviour.

2.3.5 Regional Wages and the Regional Labour Market

The relationship between nominal wage behaviour and unemployment is complicated. The regional wage and unemployment literature combined with studies on migration seemed to indicate that wage relativities and nominal wage growth to do very little in offering an incentive for workers to relocate. The literature suggests that there are institutional problems that prevent wage differences fully reflecting regional labour market conditions. Whether wages alone reflect the desire to either work or migrate is, however, an assumption of the neo-classical model that has, in the context of regional studies been re-examined. The majority of studies in this area of wage-unemployment behaviour have analysed nominal wage and relative wage differentials in trying to understand the labour market. The apparent failure to reconcile wage and unemployment may, however, simply indicate a mispecification problem. Friedman (1968) in his analysis of the Phillips curve argued that it is real wages that matter to workers and not nominal. Consequently differences in regional cost of living imply differing regional real wages and attempts have been made to develop a real wage analysis at the regional level. Nominal wage behaviour differences may therefore lead to misleading conclusions on the operation of the regional labour market.

Incorporating region-specific factors in the regional labour market has led to attempts of trying to identify and quantify aspects of a working and living environment which help define real cost of living differences. Whilst on the one hand there are studies which emphasise the physical and psychological costs incurred in relocation, or even comparisons of the quality and availability of amenities (for the UK see Martin (1996), for the USA see Eberts and Schweitzer (1994)). Others such as Muellbauer and Murphy (1994), Hughes and McCormick (1987), McCormick (1997) have examined housing costs and availability, Minford *et al* (1988) the uniformity of the social security system and Jackman and Savouri (1991), Blackaby and Manning (1987, 1990a, 1990b, 1992), Blackaby and Murphy (1995), Blanchflower and Oswald (1994) and Hughes and McCormick (1994) have all examined the issue of regional cost of living in terms of estimating a regional price variable.

The attractiveness of incorporating a regional cost of living measure is the possibility that it more accurately allows an evaluation of real wages across regions and help gain a better understanding of the operation of the regional labour market.

2.3.6 Regional Real Wages

The determination of regional real wages can, however, be problematic if the data is unavailable or incomplete, studies into amenities and quality of life indices for instance incorporate more information than simply prices (see e.g. Topel (1986) and Eberts and Schweitzer (1994)).

For the UK analysing labour market adjustment processes have turned increasing attention towards attempts at measuring relative cost of living differences across the regions. The lack of any official data on regional prices has meant a number of alternatives have been employed, the most notable one is that of the Reward Group's regional cost of living surveys. These surveys do, however, come with a number of problems when seeking to reconcile their construction of regional prices with the construction of the published Retail Price Index (RPI hereafter).

2.4 Conclusion

This chapter analysed regional unemployment and wage rate behaviour for each of the 11 regions of the UK over the 1974-1996 period for all adults, all males and all females. The purpose of this chapter was foremost to examine the changing pattern of regional unemployment and wages and to examine the relationships in these variables both across regions and against the national average.

The results presented here suggest some degree of regional labour market interaction between wages and unemployment exists as has been found in the literature. Notably the changing of relative cyclical patterns and relative growth rates of unemployment and nominal wages over the course of the economic cycles. These offer some support for estimating short-run regional Phillips curves and wage curves, (Blanchflower and Oswald (1990)).

At the centre of regional or sectoral economics analysis is the assumption that regional markets differ from the aggregate. This implies that there are economic processes relatively more important in some regions than others. For both unemployment and wages it was not possible to reject the hypothesis that the regional economy is not significantly different from the national in the majority of regions. Though there was notably less support for this in the case of unemployment over the 1975-1989 period. Over the sample period unemployment for all three categories demonstrates a clear reduction in the regional dispersion from the early 1990s. This shift in the pattern in regional unemployment relativities led to a number of regions rejecting the hypothesis that the regional unemployment relationship with the national average was stable over the period before and after 1990. Such a result indicated that the post-1990 period is characterised by a change in regional unemployment behaviour significantly different from that before 1990. Examining the changing pattern of regional unemployment, the absolute and relative dispersions of unemployment were calculated and both measures indicated a significant reduction in regional unemployment differences from 1990 onwards.

The differing regional unemployment pattern of the UK is characterised as based on a north-south split in which the regions of the south are defined as having an unemployment rate persistently below the national average: East Anglia, East Midlands, the South-East and the South West, the north regions were therefore based on the remaining seven, who all exhibited clear above average unemployment rates over the full sample period. The changing patterns of regional unemployment dispersion was formally modelled taking Thirlwall's analysis of estimating the slope coefficient of a regression of changes in the region's unemployment rates against the national average. Whilst the estimated regressions supported the hypothesis that regions with below average unemployment exhibited a lower cyclical sensitivity of unemployment than the national average, it was found, in support of the earlier Figures and Tables that, over the 1990-1996 period, the cyclical sensitivity of regional unemployment became more similar, reflecting the narrowing of regional unemployment differences. This narrowing is, however, perplexing as it is the first time in over 70 years in which regional unemployment rates differences narrowed in the context of a recession. Given that regional unemployment rates are affected by changes in the workforce, the notion that relative regional unemployment differences might be significantly influenced, across the regions, by changes in workforce participation was examined for the two recessionary periods 1980-1983 and 1990-1993, (so-defined according to the rise in regional unemployment). Workforce changes alone were not found to be significant in explaining changes in regional unemployment rates.

The analysis of regional nominal wage behaviour for all adults, males and females followed on from the analysis of regional unemployment and is based on a number of empirical studies supporting the case for a regional wage-unemployment relationship. Unlike unemployment, regional wage differences were, however, found to be both highly correlated across the regions and with the national average over the sample time period. However, the hypothesis that the regional nominal wage rate growth was not significantly different to the national average was rejected in a number of regions based on results from the Wald test. There was also no similar clear north-south divide in nominal wage levels, whilst evidence was found of a steady increase in both the absolute and relative dispersion of regional wages over the sample period.

Whilst there was some evidence of regional wage growth rates being influenced by the events of reduced unemployment differences. The literature tends to support the notion that structural or institutional factors prevent nominal wage adjustment reflecting unemployment disparities and the lack of any evidence of a clear relationship between regional wages and unemployment unsurprising. What might then link regional unemployment with regional wages are regional prices and regional real wages, the former of which is left to Chapter Three.

CHAPTER THREE

ESTIMATING REGIONAL PRICES

3.1 Introduction

Of all the different price measurements the most commonly used is the Retail Prices Index (RPI hereafter). It is an officially published index and according to Cunningham (1996) is predominantly used for indexing, for cross-country comparisons of inflation and for monetary policy. It is the issue of indexing in the context of nominal and real wages that is of interest here. In particular that of examining the behaviour and importance of real wages. However, although the RPI is not a cost of living index per se it is interpreted as such and changes in it used to measure retail price inflation.[1]

This chapter focuses on the construction and behaviour of the UK RPI over the period 1974-1996. Within the context of regions, however, a major failing of the RPI is that the index is a national average and to date no regional equivalent exists. This means that significant regional RPI differences would not be picked up with the use of the aggregate index, regardless of how the index is constructed. To remedy this problem this chapter attempts to construct region-specific cost of living indices comparable with the RPI in construction using in the main, the unofficial publications of the Reward Group's regional cost of living reports.

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[1] According to the National Audit Office, cited in Cunningham (1996, p. 7), "The Retail Prices Index (RPI) measures the change from month to month in the general level of prices charged to consumers across the range of goods and services that they buy. As such, it is a measure of consumer price inflation. It does not measure the cost of maintaining a given standard of living – it is not a cost of living index". National Audit Office, "The Retail Prices Index", p. 7, (1990). Although the issue being raised here is the question as to whether the RPI is a cost of living index of not, the definition of the

Attempts to construct a region-specific cost of living or retail price index for the UK by a number of authors have suffered from a number of methodological problems which this chapter seeks to address and rectify. As such whilst this chapter concentrates on constructing a regional cost of living index, these methodological problems need to be addressed and the constructed index validated as an accurate measure of regional living costs.

This chapter first examines and analyses the RPI, both with respect to its construction and its behaviour. Given that the RPI is only produced at the UK average level of aggregation, the Reward Group's cost of living surveys are examined with a view to constructing regional cost of living indices comparable to the RPI over the sample period. Due to limitations on data availability it is not possible to produce regional RPI, furthermore data available suggest that there are a number of alternative procedures in which approximations to regional RPI can be produced. As a result a number of alternative techniques in producing regional indices are used in constructing aggregate price indices that are compared with the RPI. The chosen method for constructing regional indices is based on which aggregate measure is most closely related to the behaviour of the RPI. From this regional cost of living indices are constructed for each of the 11 regions of the UK over the sample period 1974-1996 and their behaviour examined.

RPI is actually wrong. It is *changes* in the Retail Prices Index which measures the change from month to month in the general level of prices, not the index itself.

3.2 Regional Prices

The few papers that have, so far, used some measure of a regional price index (Shah and Walker (1983), Jackman and Savouri (1991), Blackaby and Manning (1987, 1990a, 1990b, 1992), Blackaby and Murphy (1995), Blanchflower and Oswald (1994) and Hughes and McCormick (1994)) have all used the unofficial Reward Group's cost of living reports in some way. These reports are published twice a year and offer the opportunity for a measure of regional real wages to be generated. Moreover, within a dynamic setting, differing levels and different rates of change can be used to analyse phenomena such as interregional migration and regional unemployment.

This chapter analyses the construction of both the RPI and regional price indices based on the Reward Group's cost of living reports. In doing so a number of problems are highlighted and an attempt is made to construct a regional price index for each of the 11 regions of the UK over the period 1974-1996. A simple statistical analysis of the regional price data is followed by hypothesis tests of the regional series on the national average. In particular the hypothesis that the regional price level is not significantly different from the national average is tested. In the construction and analysis of regional price series, this chapter enables an examination of regional labour markets with respect to region-specific real wages. Differences between regional real wages deflated using a regional price series as opposed to the RPI may lead to a greater understanding of the regional labour market dynamics.

3.2.1 The Retail Price Index

For constructed regional price indices to gain validation it is necessary that a comparative study with the construction of the RPI be undertaken.

The RPI is an aggregate price index of nominal prices collected once a month on a selection of commodities throughout the UK.

The selected commodities are based on an annual survey of family expenditure patterns (taken from the Family Expenditure Survey, (FES hereafter)) of approximately seven thousand households. It is divided into eleven sections which are further divided into ninety-five sub-groups of commodities. The statistics are then aggregated for all households on each good to obtain individual weights. To derive the weights used to construct the RPI from the FES, the expenditures of all 'index' households (i.e. those within the specified income group, the construction of the RPI excludes pensioners and those whose average weekly income is in the top 5%[2]) on each good are aggregated to obtain a weight which represents total expenditure by all household's as a proportion of total spending. However, the price information is intended to be representative in its distribution across regions, size of town, and type of outlet (i.e. 'co-operative', 'multiple', or 'independent'). As a result, retail information from both the FES and the Census of Distribution on the relative value of sales from different outlets and across different regions is used. This retail information provides the weights required to combine 36 prices (in 12 regions[3] and 3 types of outlets) into a single item index. Each of these 36 prices is a simple average of the price levels quoted, relative to that in January.

The use of the annual expenditure patterns makes possible a continual revision of the weights in deriving the index. The weights are necessary to try and make the index as representative of actual spending patterns as possible. In order to produce a regular series in light of changing spending patterns the price index which is a simple base-weighted (Laspeyres) index, is a 'chained' index. That is the weights and prices used each year are updated by linking them to the previous years values. For example, the January 1995 value of the RPI is obtained by multiplying the January 1994 value by the change in the value of the monthly index between January 1994 and January 1995. The weights are then updated and the procedure repeated for the following year.

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[2] Such exclusion is based on the reasoning that these group's expenditure patterns would disproportionately bias the constructed RPI. The two groups are at opposite ends of the income scale, at the lower end are those pensioners who draw at least 75% of their income from the basic state pension or supplementary benefit, whilst at the upper end the 3-4% of households whose heads have the highest weekly incomes. These two groups are believed to have expenditure patterns significantly different from the rest of the population, whereas the remaining income groups are regarded as having relatively homogeneous spending patterns.

[3] A distinction is made between the South-East excluding Greater London and Greater London.

More formally, writing each link (comparing year t with year t-1) as:

$$P_{t-1,t}(\mathbf{q}_{t-1}) = \frac{\sum_{i=1}^{n} p_{it}\, q_{it-1}}{\sum_{i=1}^{n} p_{it-1}\, q_{it-1}} \tag{3.1}$$

(where p_{it} and p_{it-1} represent the prices of goods i in periods t and t-1; q_{it-1} represents the quantity of goods i and n represents the number of goods examined), then the chained Laspeyres index[4] comparing say year 5 with year 0 $(P_0 = 100)$ is:

$$P_{0,5} = 100.P_{0,1}(\mathbf{q}_0).P_{1,2}(\mathbf{q}_1)...P_{5-1,5}(\mathbf{q}_{5-1}) \tag{3.2}$$

The need to weight expenditure patterns from which the RPI is constructed is an attempt to calculate the relative importance of price changes on the average household. For instance price changes on goods that are purchased more frequently will, ceteris paribus, have a relatively greater impact on the households income than goods purchased less frequently e.g. price changes in bread versus toothbrushes.

Although the use of annually revised weights is an improvement from the forerunner to the RPI, the fact that since 1975, the expenditure patterns used to derive the weights are based on data collected from June to June of the previous year exposes it to criticism. It means that on average the weights used to construct the following year's monthly RPI are twelve months out of date.[5] To ease this problem, the monthly expenditure on each good is revalued in current (January) prices.

The RPI is a monthly index and is one of several that are constructed and compiled for the UK by the Office for National Statistics (hereafter ONS, formerly the Central Statistical Office (CSO)). The accuracy and representation of the RPI has been discussed in a number of studies (see for instance Fry and Pashardes (1986) and, Cunningham (1996)). Criticisms of the RPI tend to fall into two main categories, the

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[4] The chaining of index numbers involves the base index number being compared with each date directly. The chain method uses a comparison of one date with the preceding one and so, by multiplication back to the base date.

first is the way it is constructed and the second is it's coverage or representation. This latter criticism focuses on possible aggregation bias in the RPI based on UK demographics and spending patterns. It does not, however, consider possible geographical bias either in expenditure patterns or prices.

The RPI is based on the expenditure patterns of households which determines which goods are priced and the weights attached to these goods. Given the costs imposed in monitoring every single product bought, and identifying varieties available the construction of the RPI relies on selective product and leading brands being monitored at each retail outlet at the beginning of the year. Annual reviewing of products allows both new goods and new versions of existing goods to be incorporated into the index. A problem with the RPI is that of incorporating changes in commodities. In the case of quality change adjustments, these are avoided where possible. The exceptions being when a particular brand is discontinued and therefore a link has to be made between the old and the new goods. If both remain on sale for a period their price differential is taken to reflect quality improvement if, however, there is no overlap in availability, it is left to the discretion of the collector to assess the relative quality of items. This dependence on collectors subjective views can lead to anomalies, and some evidence exists that this is particularly true of the treatment of fashion changes in the clothing sector, (see Fry and Pashardes (1986) and Cunningham (1996)).

The only major change that has occurred in the construction of the RPI in recent years has been the removal of the "imputed rent" measure of housing expenditure. This measure of housing expenditure was replaced by an index reflecting movements in mortgage interest payments. Imputed rent proved too difficult to measure, being an estimation of the costs of owner-occupied housing based on the possible rental income foregone that could be gained if a house owner lived as occupier rather than renting it out. The weight used for owner-occupied housing is now calculated from average mortgage interest payments and the price indicator from the product of the interest rate and an estimate of outstanding mortgage debt. This latter amount is calculated as the sum of outstanding mortgage debt taken out over the past 25 years.

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[5] A problem with the use of the Laspeyres price index is that changes in prices are assumed not to lead to changes in expenditure patterns, assuming expenditure patterns are constant in the face of rising

Based on standard repayment patterns data and the frequency of house purchase this new weight now yields a value that is a weighted average of past house prices but which declines as years go by. As such each weight corresponds to the proportion of current outstanding debt taken out in that year. As a result of this change movements in house prices in any given year only enter the current index via mortgages taken out in that year, but continue to affect the index years after.

3.2.2 Regional Reward Surveys

The Reward Group was established in 1971 specialising in compiling cost of living reports across towns, cities and regions throughout the UK for use by the public and private sectors. The purpose of such reports has typically been to enable firms and workers to negotiate over pay and conditions taking into account geographical differences in the cost of living.

The Reward Group's cost of living reports are based on the expenditure levels necessary to keep identified lifestyles constant over time, and from area to area. The company's reports are published at least twice a year and relate to the particular month of publication. Each of the lifestyles, which total eight, corresponds to an income group and its associated consumption bundle. These lifestyles are based on a family of two adults and two children. These are based as far as possible on wages data taken from the New Earnings Survey (NES) and from which population weights based on income data enables regional totals to be constructed. The regional totals enable regional and UK national average cost of living indices to be produced.

In order to construct its reports, the Reward Group collects both local and aggregate price data on over 260 specific items in over 100 localities one month before each report is published.

As with the RPI, the Reward Group's indices are an approximation to the 'chained' Laspeyres index in which the expenditure bundles are linked through to price changes, but in line with the FES, the weights are updated each year. Unlike the RPI, however, other than producing regional comparisons, the survey data also includes

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prices, the index can lead to an over-estimation of inflation. (c.f. Fry and Pashardes (1986), p. 25-28).

unpublished spending patterns of the very high income groups. Whilst the Reward Group's reports do not appear as frequently as the RPI, nor cover as many commodities, the manner in which price data are collected is very similar. The only significant difference is that based on calculating the cost of housing.

Each of the regional cost of living estimates is based on the combined total of two expenditure estimates: consumer and housing. Unlike the RPI, the estimated mortgage payments used in calculating the housing expenditure total is based on individuals taking an 80% mortgage loan on current house prices in the survey period. This means that the housing expenditure series in each regional cost of living report is based on the individual purchasing a new house. It is therefore not representative of the costs incurred on individuals paying off outstanding mortgage debt on previously bought houses.

A more formal presentation of the Reward Group's regional indices can be written as:

$$\sum_{i=1}^{8} X_{i,j} \tag{3.3}$$

where $X_{i,j}$ is expenditure in region j, for lifestyle i, where $i = 1,\ldots,8$.

The regional sum total based on the relative population weights for each lifestyle is then:

$$\sum_{i=1}^{8} k_i X_{i,j} \tag{3.4}$$

where k_i is the relative weight assigned to each lifestyle i.

The UK average is then a regionally weighted sum of each regions totals based on population sizes:

$$\sum_{j=1}^{11} w_j \sum_{i=1}^{8} k_i X_{i,j} \tag{3.5}$$

where w_j is the regional population share.

Given that the Reward Group's results differentiate between consumer expenditure and housing expenditure for each lifestyle, in each region, each year, then the UK totals can be divided into:

$$\sum_{j=1}^{11} w_j X_j = \sum_{j=1}^{11} w_j C_j + \sum_{j=1}^{11} w_j H_j \tag{3.6}$$

where C_j represents consumer expenditure in region j, and H_j represents housing expenditure in region j.

In order to construct regional price indices comparable to the RPI, the housing expenditure item of the Reward Group's surveys cannot be used without fear of biasing the results according to the behaviour of actual house prices in each period. As a result the problem of measuring housing expenditure needs to be resolved.

3.2.3 Constructing a Regional Price Index[6]

The Reward Group's cost of living reports are the closest available measure of regional retail price indices. Nonetheless there are a number of problems associated with these reports, the most difficult being the issue of calculating a measure of housing expenditure not reliant on current house price data. Whilst the resolution of this problem is the main theme of this section it also serves to point out three other problems that have not as yet been addressed:

- The cost of living reports for each region includes the consumption habits of the top 1% income groups whilst excluding the consumption habits of those

[6] Strictly speaking there is a difference between a cost of living index and a price series, see footnote 1. However, the comparison here is against the RPI and, from which, some data are used. From hereon in these series will be referred to as price series.

individuals on very low incomes. This difference makes it more difficult to compare the regional indices with the RPI.

- The months in which the reports are based on have varied over the sample period 1974-1996[7]. Hyclak and Johnes (1992) conclude that this problem alone is sufficient to avoid using the regional cost of living reports as a proxy for a regional RPI. A possible solution to this difficulty, and the one adopted here was that of taking naïve linear interpolations of the two monthly values to April of each year. Repeating the same exercise using the RPI yielded almost identical results.
- The problem with housing and the lack of any alternative guidelines in the construction of a regional price index meant that four alternative regional price indices were constructed at the aggregate level and compared with the behaviour of the RPI over the sample period 1974-1996. Only through a variety of tests was it decided which procedure was adopted for the construction of the regional series.

Attempts to overcome two of the three problems are detailed below. The inclusion of the top 1% high income households and the exclusion of low income households relates to the first problem and could not be rectified. This should be borne in mind when it comes to the evaluation of the final series results.

As mentioned earlier data limitations at the regional level prevents regional equivalents of the RPI to be produced. As a result, four different techniques to produce as accurate as possible regional price indices were adopted. The chosen technique was based on how accurate the aggregate measure was against the RPI. Each of the four measures were therefore subject to a number of tests against the RPI. The critical difference between the four is the issue of housing. The need to incorporate a housing expenditure component is of vital importance. This is not only because of the size of the expenditure weight of housing in the RPI (over the sample period it varies between 12% and 20%) but because it is this component that exhibits the greatest degree of regional variability. As a result of this all four indices differ in

[7] Initially, price data was collected at six monthly intervals with January taken as the initial month. Fears that January prices might be unrepresentative of the year due to post-Christmas sales meant that from 1991 price data collection was switched from January and July, to February and August.

their attempt to incorporate a housing expenditure measure that was deemed suitably representative of housing costs.

At the regional level, the only official housing data available was nominal housing expenditure totals taken from Regional Trends. This series is a nominal total expenditure measure with no information on prices or quantities at the regional level. At the national level, however, the monthly housing expenditure index (called the Housing Price Index or HPI), which measures the price inflation rate of aggregate housing expenditure, along with the aggregate weight. Incorporating these data offers a variety of alternative techniques to rectify the housing expenditure bias in the cost of living reports in producing regional price indices.

3.2.4 UK Price Indices

Four methods of constructing UK average price indices were adopted and tested[8]. The reason for doing so was to establish a method of constructing the regional price series by comparing the possible different techniques but applied to the aggregate data so that the technique which most closely approximates the behaviour of the RPI be taken as the preferred method. Each method differs in the use of the available information listed in the previous section. What follows is a brief summary of each method to produce an aggregate equivalent to the RPI. In all cases the focus is on the construction process of the regional series, in particular the housing price index measure.

3.2.4.1 Method 1 – Regional Price Level (PL)

Here the published HPI is added to the cost of living reports consumer expenditure values for the UK. By nature of the HPI, both series were indexed based to April 1974=100. The series were combined using weights derived from the UK housing expenditure values as a percentage of total expenditure. (This would be the procedure adopted for each regional series in order to have a region-specific measure of housing). Relative regional totals can be constructed but the interpretation of

[8] A fifth series was produced based on regional consumer expenditure totals alone. This series has been adopted by other authors e.g. Jackman and Savouri (1991) but its results were, statistically, the least correlated with the published RPI. Its analysis has been dropped for reasons of space.

changing relativities is made difficult because each regional series will be set to 1974=100.

3.2.4.2 Method 2 – Relative Regional Price Level (RPL)

For the aggregate index Method 2 adopts the same procedure as Method 1 but takes actual consumer expenditure values for 1974 as the consumer expenditure share as opposed to indexing consumer expenditure to 1974=100. In the aggregate these two procedures amount to the same thing but will differ at the regional level. At the regional level, whilst Method 1 sets both consumer and housing values to 1974=100 before the weighted total is calculated, this method calculates the consumer expenditure total in each region relative to the UK total of 1974=100. The regional totals, which as in Method 1 are a weighted average of consumer and housing values based on housing expenditure as a proportion of total expenditure, produce relative regional prices indices. This method does, however, raise the problem as to whether relative regional price indices can be approximated by relative consumer expenditures but it provides a guide.

3.2.4.3 Method 3 – Weighted Regional Price Level (WPL)

The third series is based on a weighted average of the housing expenditure and the cost of living report's consumer expenditure totals. The weights are based on the percentage share of total expenditure taken by housing expenditure. This method, as with 1 and 2 relies on the housing expenditure share of total expenditure in determining the relative weights by which housing is incorporated. Relative regional totals can be compared.

3.2.4.4 Method 4 – Unweighted Regional Price Level (UPL)

Method 4 is similar to 3. Here the aggregate price index is simply an unweighted combination of the housing expenditure values from Regional Trends with the Reward Group's consumer expenditure totals. The proportion of housing expenditure of consumer expenditure is interpreted as the relative weight. Movements in the housing series will therefore be interpreted as real. Relative regional totals can be compared.

3.2.5 Analysis of Regional Price Models

The desire to produce, as accurately as possible, a series of regional price indices for the UK amounts to the need to test each of the four series produced above to determine the most suitable technique. To this end each series was subject to a number of tests against the RPI over the sample period. The tests amount to nothing more than a simple comparative analysis in which the chosen aggregate series is that which most closely resembles the behaviour of the RPI

As listed above the four aggregate price indices – the Price Level, the Relative Price Level, the Weighted Price Level and the Unweighted Price Level (PL, RPL, WPL and UPL hereafter) were constructed as UK averages, for April of each year over the period 1974-1996. The point of this exercise is to assess which of the four different constructed price series most closely matches the RPI over the sample period.

3.2.6 Aggregate Price Tests

The aggregate price tests amount to no more than a series of simple statistical and econometric analyses of each constructed series against the RPI, for April of each year over the sample period 1974-1996. Cross-correlation matrices in levels, logarithm levels and first-differences logarithms were first constructed and compared; secondly OLS regressions of each constructed index against the RPI were estimated and the joint-restriction of the values on the constant and slope coefficients tested using the Wald test. Finally Root Mean Square Errors were estimated for each series as a predictor of the RPI.

3.2.6.1 Cross-Correlation Matrices

Tables 3.1–3.3 give the results of the cross-correlations between the four constructed series and the RPI in levels, logarithm levels and first-difference logarithm levels. The matrices compare the relative movements of each series against one another.

In both levels and logarithm levels all five series appear to be highly correlated. It is not until first-difference logarithms that it becomes easier to identify which series appears to be most closely correlated with the RPI over the period. Here the *WPL* measure shares a correlation of only 0.92 with the RPI whilst the *PL* and *RPL* measures share a correlation of 0.97. The similarity in the results of these two measures is expected as other than the starting value both series are identical.

Table 3.1: Cross-Correlation Matrix National Price Indices - Levels

Price Index	PL	RPL	WPL	UWPL	RPI
PL	1.00000	1.00000	0.99709	0.99943	0.99920
RPL		1.00000	0.99709	0.99943	0.99920
WPL			1.00000	0.99851	0.99846
UPL				1.00000	0.99921
RPI					1.00000

Values are to 5 decimal places.

Table 3.2: Cross-Correlation Matrix National Price Indices - Logarithm Levels

Price Index	LPL	LRPL	LWPL	LUWPL	LRPI
LPL	1.00000	1.00000	0.99844	0.99973	0.99948
LRPL		1.00000	0.99844	0.99973	0.99948
LWPL			1.00000	0.99918	0.99902
LUPL				1.00000	0.99956
LRPI					1.00000

Values are to 5 decimal places.

Table 3.3: Cross-Correlation Matrix National Price Indices – First-Difference Logarithms

Price Index	ΔLPL	ΔLRPL	ΔLWPL	ΔLUWPL	ΔLRPI
ΔLPL	1.00000	1.00000	0.93847	0.96433	0.96697
ΔLRPL		1.00000	0.93847	0.96433	0.96697
ΔLWPL			1.00000	0.95983	0.91693
ΔLUPL				1.00000	0.94161
ΔLRPI					1.00000

Values are to 5 decimal places.

3.2.6.2 Regression Analysis

Another technique with which to examine the relationship between the four indices and the RPI is a simple regression analysis in which each constructed series is regressed against the RPI. To do this it is first necessary to examine the time series properties of each of the variables to determine whether they are stationary. The growth rate of the price indices indicated a logarithmic transformation was appropriate with which to examine the data. As a result, the ADF test for the presence of a unit root, could not be rejected at the 10% level for each of the four indices as well as for the RPI. As a result the logged data were first-differenced stationary. Equation (3.7) was then estimated using OLS for each of the four price indices against the RPI over the sample period 1975-1996:

$$\Delta P_{it} = \alpha_{oi} + \alpha_{1i}\Delta P_{RPIt} + \varepsilon_{it} \tag{3.7}$$

where P_{it} represents the logarithm of the price level according to method i in time period t, where i represents each of the four different constructed price series, P_{RPIt} represents the first-difference logarithm of the RPI in period t and ε_{it} is a random error term.

Regression estimates of equation (3.7) are given in Table 3.4.

Table 3.4: Aggregate Price Regressions

Price Variable	α_{0i}	α_{1i}	DW	R^2
PL	0.01	0.98	2.38	0.94#
	(0.91)	(11.24)***		
RPL	0.01	0.98	2.38	0.94#
	(0.91)	(11.24)***		
WPL	0.01	0.93	1.70	0.84
	(0.73)	(10.28)***		
UPL	0.01	0.92	2.67	0.89#
	(1.60)	(9.59)***		

t-statistics are in parentheses, *** indicates significance at the 1% level, ** at the 5% level, * at the 10%, # indicates Whites correction for heteroscedasticity and DW indicates the Durbin-Watson test for serial correlation.

The residuals from each regression were tested for the presence of first-order serial correlation, heteroscedasticity and normality. In all cases it was not possible to reject the null hypothesis of no serial correlation (as verified by the Durbin-Watson statistics) and normality. However, in three regressions the null hypothesis of no heteroscedasticity was rejected at the 10% level. Heteroscedasticity was removed using White's correction for the presence of heteroscedasticity. The models were also tested for stability by examination of the recursive residuals. This in part was prompted by the analysis of regional unemployment and wages from Chapter Two. The method of recursive residuals allows possible identification of any structural changes occurring in the model over the sample period (c.f. Greene (1997), p. 355-356) In none of the cases did the residuals from each regression exceed the 2% standard error bands. The hypothesis of no structural change could not be rejected.

The results in Table 3.4 identify series *PL* and *RPL* as having the closest correlation with the RPI in first-difference logarithms. These results confirm the findings of the correlation matrix.

3.2.6.3 The Wald Test

More formally the hypothesis that each constructed aggregate price index is not significantly different from the RPI can be tested using the Wald test on the joint-restriction $\alpha_{0i} = 0$ and $\alpha_{1i} = 1$ in equation (3.7). The probability values of accepting the null hypothesis on the *F*-statistic are reported in Table 3.5.

In all cases it was not possible to reject the null hypothesis that each price series were significantly different from each other at the 1% level, as such it is not readily possible to choose between each of the series.

Table 3.5: Wald Test Results on the Joint-Restriction of Aggregate Prices

$(\alpha_{0i} = 0,\ \alpha_{1i} = 1)$

Region	P-Value
PL	0.30#
RPL	0.30#
WPL	0.71
UPL	0.17#

# indicates Whites correction for heteroscedasticity.

3.2.6.4 The Root Mean Square Error

Finally the Root Mean Square Error (RMSE hereafter) was used to try and distinguish between each of the four constructed series. The RMSE is a measure of the size of error between two series over a sample range. In forecasting it can be used as a forecasting error. Applying this to the four constructed aggregate series, the RMSE of the first-difference logarithms of each series against the RPI is calculated. The results are in Table 3.6.

As with both the cross-correlation matrices and the regressions, series *PL* and *RPL* share the same results. Here they have the same error, though the margin of difference is small compared with the others.

Table 3.6: Root Mean Square Errors: Aggregate Prices

Variable	RMSE*
PL:	0.01428
RPL	0.01428
WPL	0.02223
UPL	0.01814

* Values are to 5 decimal places

3.2.6.5 Summary of Findings

Four methods of aggregate price indices were constructed and tested against the RPI. The alternative methods each reflected data limitations in the construction of a regional price index comparable to the construction of the RPI, in particular limitations in the incorporation of a regional housing element. The housing expenditure component used in the Reward Group's calculations was not adopted as the housing expenditure in these surveys is based on current house price data alone.

Comparing different ways to construct a regional price series by comparing a variety of results with the RPI was determined to be the most effective way of deciding which method to adopt. Comparisons were made with respect to cross correlation matrices, parameter estimates on OLS regressions, results of the Wald test on the joint-restrictions that the coefficient estimates of each aggregate series was not significantly different from the RPI and examination of the Root Mean Square Error of each series against the RPI. Of the four models, two produced the most consistently close approximations to the RPI – the *PL* and *RPL*.

The results of indices *PL* and *RPL* against the RPI were identical. However, regional indices based on these two methods will differ in levels due to differing initial values according to which technique is adopted. Initial values for regional *RPL* are based on relative regional consumer expenditure totals, whilst those in *PL* are each indexed 1974=100. In first-differences the results are not significantly different, however, adopting the method for *RPL* at the regional level enables relative price indices to be examined. How accurate these regional price relativities are, is therefore questionable and care is needed when these values, and calculations based in levels are examined.

3.2.7 Estimating Regional Price Indices

For each region, a relative price index was constructed as a weighted combination of consumer expenditure indices from the Regional Reward surveys, and the published HPI for each year. Each of the regional consumer expenditure indices was set relative to the national consumer expenditure total of 1974=100 provided in the Reward Group's surveys and the final regional price index calculated as a weighted total of the two indices. The weights were derived from Regional Trends housing expenditure totals as a proportion of total expenditure in each region.

A list of summary statistics for each of the series for each region are given in Table 3.7 whilst Figures 3.1-3.3 illustrate regional price indices in levels, logarithm levels and first-difference logarithms.[9]

[9] The appendix at the end of the thesis presents all of the estimated annual regional prices in levels from 1974-1996.

Table 3.7: Summary Statistics: Regional Retail Prices First-Difference Logarithms, 1975-1996

Region	Mean	St.Dev.	Max.	Min.	Skew.	Kurt.	J-B.
East Anglia	0.08	0.06	0.23	-0.006	0.83	2.93	2.51
East Midlands	0.08	0.06	0.23	0.003	0.92	3.04	3.11
North	0.08	0.06	0.23	-0.002	0.96	3.10	3.35
North-West	0.08	0.06	0.22	0.009	0.80	2.69	2.45
South-East	0.08	0.06	0.22	0.005	0.84	2.73	2.68
South-West	0.08	0.06	0.23	-0.005	0.88	2.93	2.84
West Midlands	0.08	0.06	0.23	-0.003	0.84	3.00	2.57
Yorkshire & Humberside	0.08	0.06	0.23	0.006	0.97	3.14	3.45
Northern Ireland	0.08	0.06	0.24	0.002	1.06	3.53	4.38
Scotland	0.08	0.06	0.24	0.001	0.99	3.43	3.76
Wales	0.08	0.06	0.24	-0.002	1.02	3.36	3.92
Agg PI	0.08	0.06	0.23	0.002	0.90	2.98	2.96
RPI	0.08	0.06	0.20	0.013	0.95	2.64	3.45

Where: St. Dev. represents the standard deviation; Max represents the maximum value of the series; Min. is the minimum of the series; Skew represents skewness, Kurt. represents kurtosis, and J-B is the Jarque-Bera statistic for normality. Rejection of the null hypothesis of normal residuals under the J-B statistic at the 5% critical value is 5.99.

Agg PI represents the constructed national average price index based on the regional price indices

Figure 3.1: Regional Price Levels: All Regions, 1974-1996

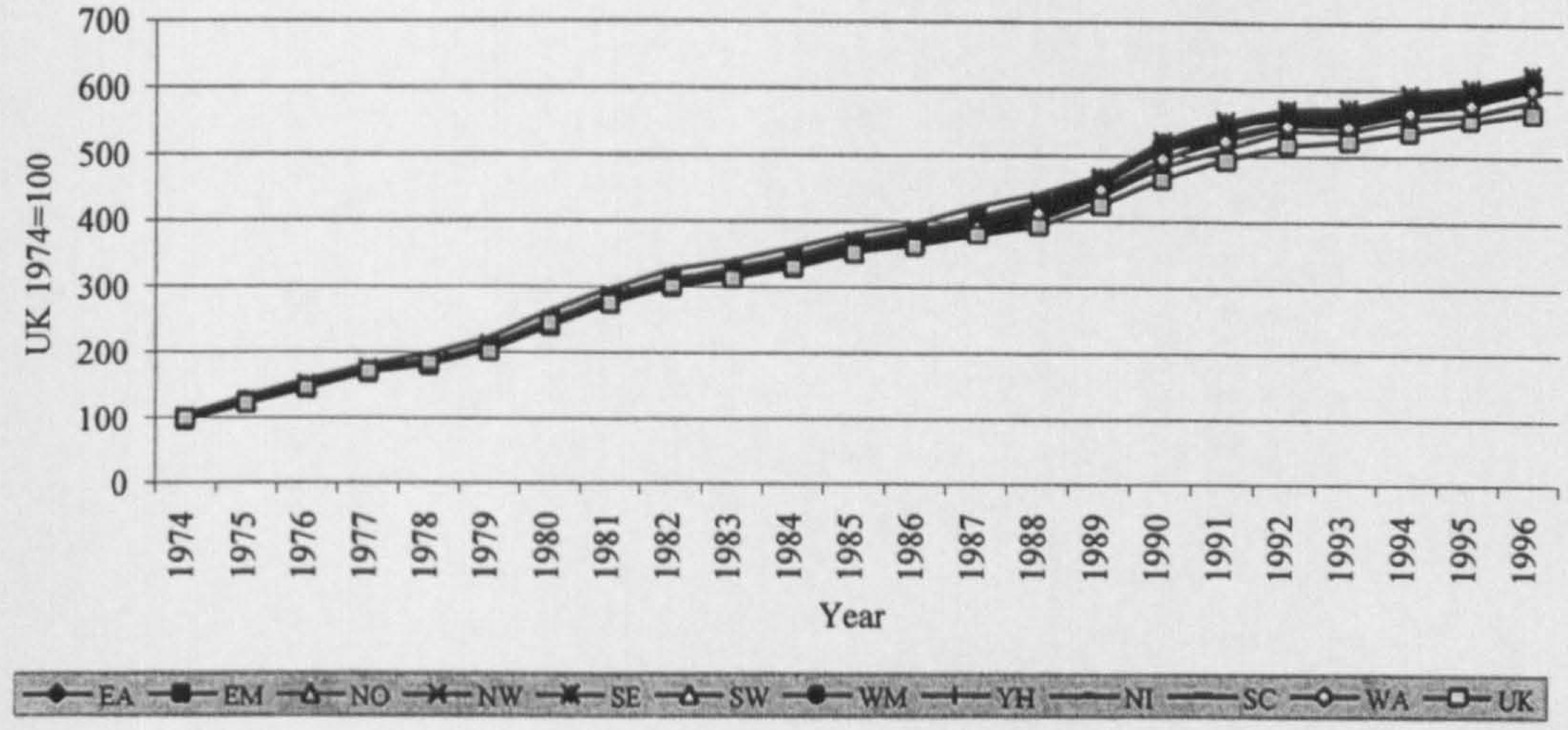

Figure 3.2: Regional Prices Natural Logarithms: All Regions, 1974-1996

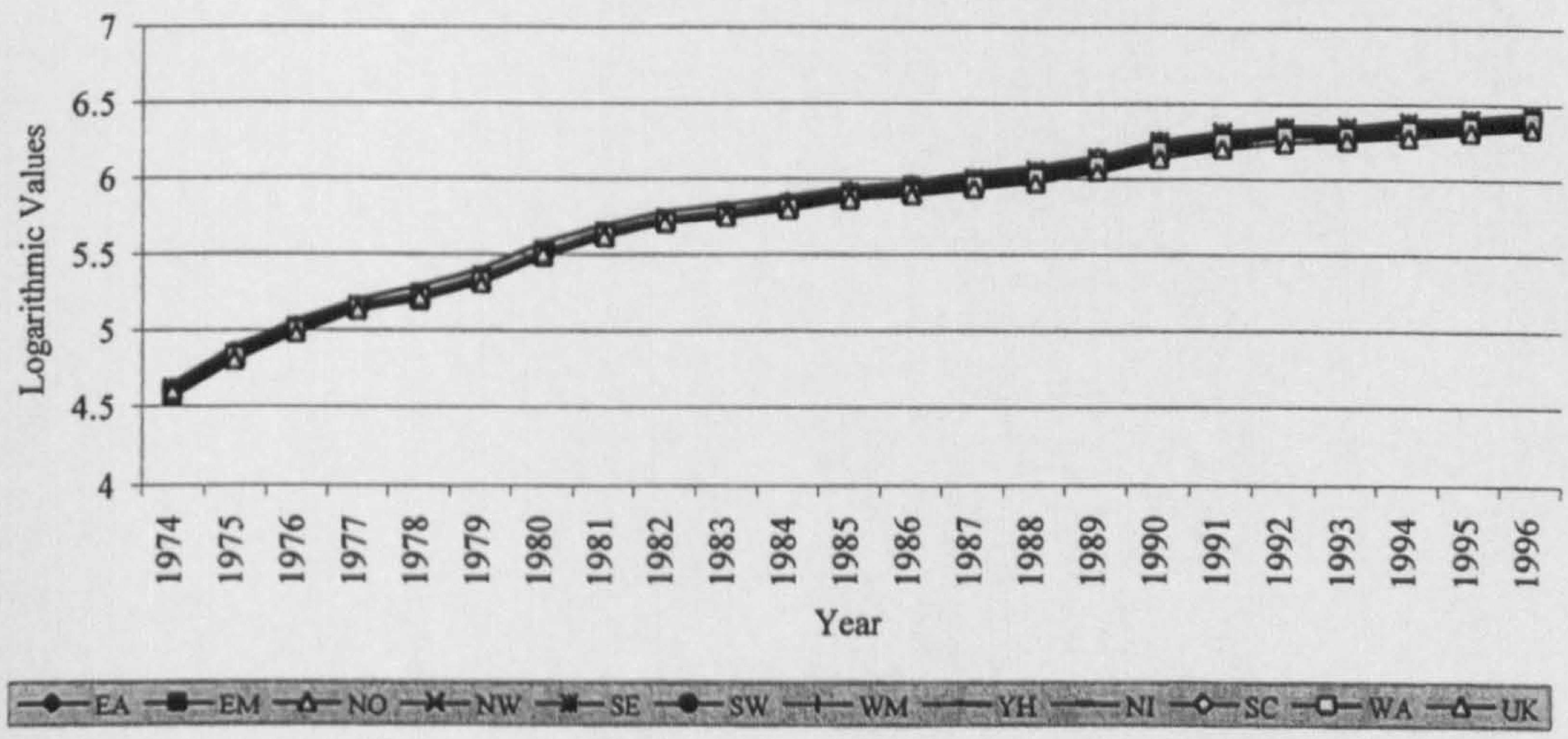

Figure 3.3: Regional Prices: First-Difference Logarithms: All Regions, 1975-1996

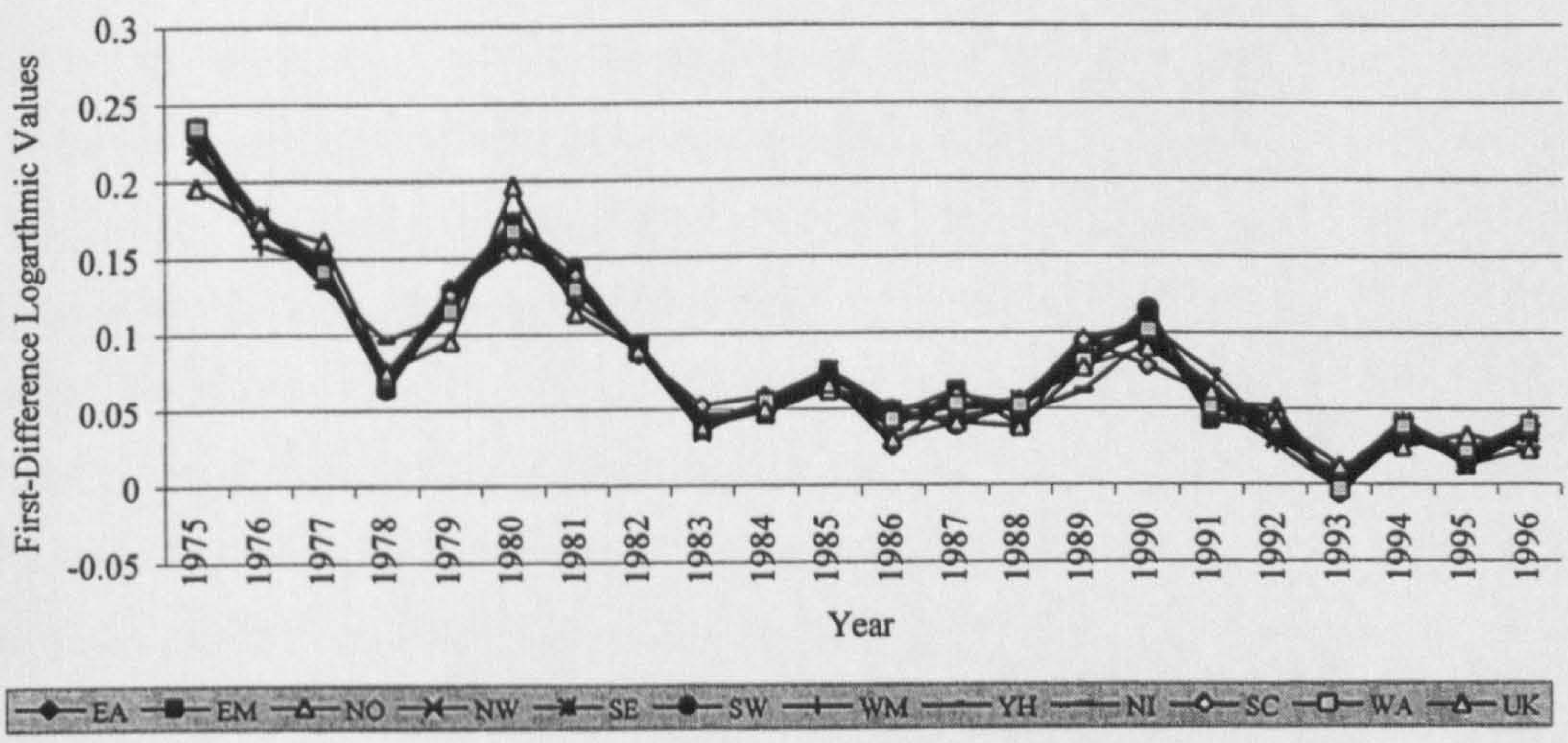

Table 3.7 presents summary statistics in first-difference logarithms for each of the regional price indices, a constructed national index based on the regional values and the RPI, for April of each year, over the sample period 1975-1996. The results are presented in first-difference logarithms to approximate the inflation rate and enable comparisons to be made across the regions and against the RPI. Over the sample period, each series appears closely related to one another. The only difference of note is that of the maximum and minimum values of the constructed aggregate series against the RPI. In all cases regional estimates of maximum and minimum values are greater / lesser than the RPI respectively. The results indicate that whilst the regional estimates are closely related to one another they are not so close to the RPI. The problems of errors in variables and the use of different data are obviously major considerations for these differences, but whether this implies that the regional prices are poor approximations to true regional RPI or that they are superior to the published RPI is a moot point. The results indicate a much greater variation in the regional series than the RPI though the RPI series appears to be slightly more positively skewed.

Figures 3.1-3.3, support the hypothesis that regional price indices are not significantly different from each other over the sample period. Indeed the growth rate of the regional price indices in Figure 3.3 are similar, to those of wages presented in Figure 2.19. Over the sample period the indices growth rates decline with notable falls in the recessionary periods of the early 1980s and 1990s. What is of interest, however, and with reference made to Figure 2.19 is the apparent increased inter-regional variability in both wage and price growth rates. Whether such variability is significant and whether it is symptomatic of price instability can be investigated. What Table 3.7 and Figures 3.1-3.3 indicate, however, is whether in fact regional price indices actually add anything new to regional modelling given how apparently close they are to the RPI.[10]

To further explore the degree of association between the regional series as depicted in Figures 3.1-3.3, the cross-correlation matrices for each series in levels and first-

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[10]. Kaliski (1964) opted to use the national price index over regional price indices in his study into Canadian regional Phillips after finding a high degree of correlation between the regional series and the national and reasoned that the results on the Phillips curves estimates would not matter, (p. 8-9).

difference logarithm levels were calculated, the results are presented in Tables 3.8 and 3.9.

Table 3.8: Cross Correlations Regional Price Levels, All Regions, 1974-1996

Region	EA	EM	NO	NW	SE	SW	WM	YH	NI	SC	WA	RPI
EA	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.999	0.999	1.000	1.000	0.999
EM		1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.999	1.000	1.000	0.999
NO			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
NW				1.000	1.000	1.000	1.000	1.000	0.999	1.000	1.000	0.999
SE					1.000	1.000	1.000	1.000	0.999	1.000	1.000	0.999
SW						1.000	1.000	0.999	1.000	1.000	1.000	0.999
WM							1.000	1.000	0.999	1.000	1.000	0.999
YH								1.000	0.999	1.000	1.000	0.999
NI									1.000	1.000	1.000	1.000
SC										1.000	1.000	0.999
WA											1.000	0.999
RPI												1.000

Table 3.9: Cross Correlation Matrix; Regional Prices First-Difference Logarithms: All Regions, 1975-1996

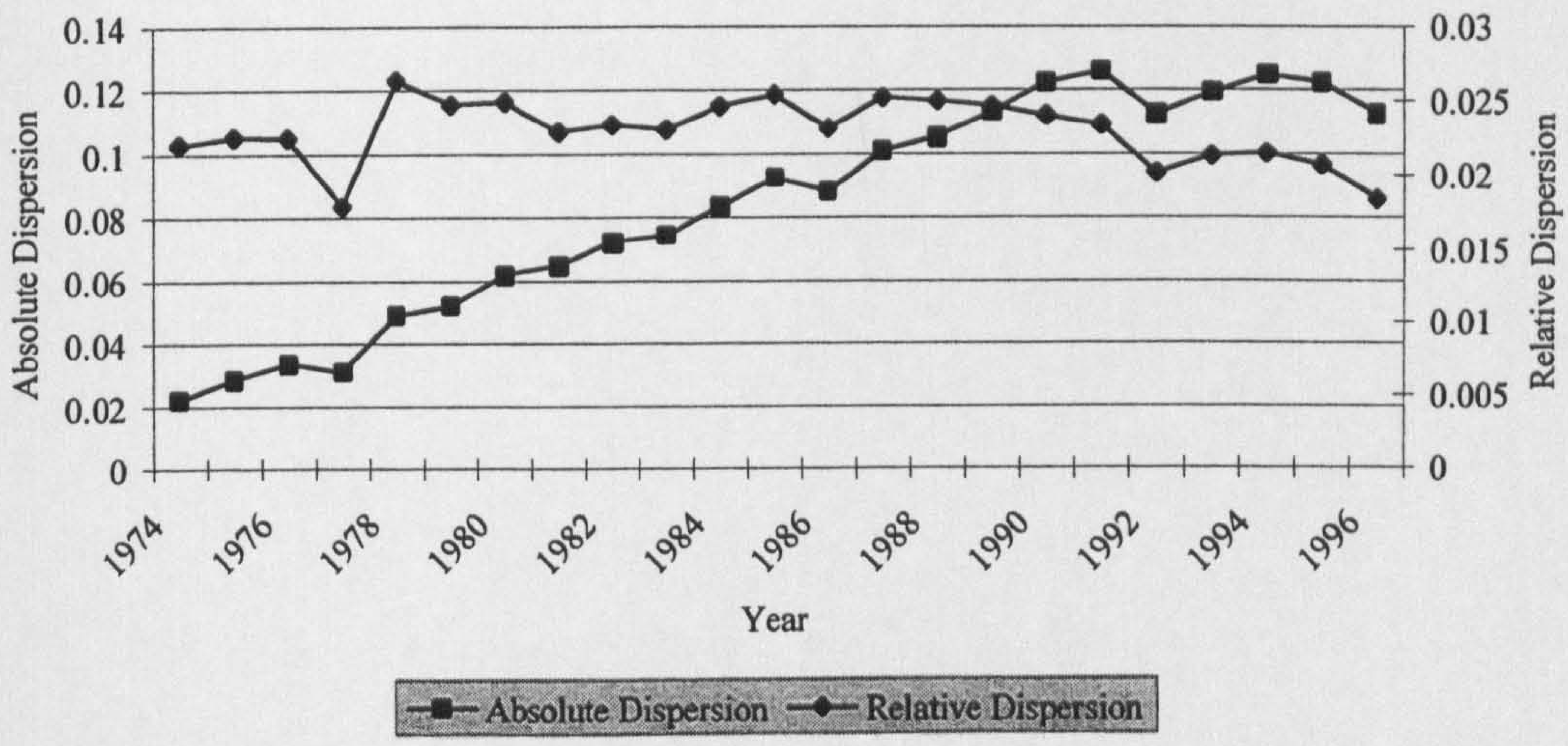
Region	EA	EM	NO	NW	SE	SW	WM	YH	NI	SC	WA	RPI
EA	1.000	0.994	0.994	0.988	0.993	0.993	0.993	0.985	0.979	0.984	0.995	0.961
EM		1.000	0.991	0.986	0.993	0.990	0.994	0.986	0.981	0.981	0.994	0.965
NO			1.000	0.989	0.992	0.993	0.990	0.992	0.982	0.986	0.996	0.968
NW				1.000	0.993	0.989	0.990	0.991	0.975	0.982	0.989	0.964
SE					1.000	0.995	0.994	0.995	0.978	0.979	0.993	0.969
SW						1.000	0.991	0.991	0.974	0.976	0.993	0.959
WM							1.000	0.991	0.973	0.981	0.992	0.959
YH								1.000	0.978	0.978	0.992	0.961
NI									1.000	0.975	0.987	0.961
SC										1.000	0.986	0.948
WA											1.000	0.965
RPI												1.000

Over the sample period the cross-correlation matrices indicate how closely related the indices are with each other and with the RPI. Based on these results alone there is strong support for not rejecting the hypothesis that the regional price indices are not significantly different from the RPI. However, regional price variability appears to increase over the mid 1980s to the early 1990s. Whether or not regional prices have been relatively stable and therefore continually similar to the RPI over the sample period can be explored. As with unemployment and wages, in the first instance regional price behaviour can be examined with respect to the absolute and relative dispersion of regional prices.

3.2.8 Absolute and Relative Dispersion of Regional Prices

As outlined in Chapter Two a useful technique to explore regional variations in data is that of examining the dispersion of the individual series. Whilst the literature supports the use of the absolute variation of dispersion of a regional variable, $(R_i - R_{UK})$ where R represents any regional variable and i the region) in economic decision-making the relative dispersion, (R_i / R_{UK}), in spite of the influence changes in the aggregate has on it is still a useful device in examining the regional series. The absolute and relative dispersion of regional price indices are provided in Figure 3.4.

Figure 3.4: The Absolute and Relative Dispersion of Regional Prices



From Figure 3.4 the absolute dispersion of regional prices can be seen to steadily increase from around 2% to 12%, whilst the relative dispersion of regional prices remains around 2%. The behaviour of the two series is, however, of particular interest. As outlined in Chapter Two, the relative dispersion is determined by relative growth rates. If growth rates in prices are relatively similar, then the relative dispersion will remain constant over time whilst the absolute dispersion will change. The results in Figure 3.4 suggest that the relative growth rates of prices across the regions have remained fairly constant over the sample period up until the late 1980s. That is regional prices growth rates have been relatively similar. From the late 1980s, the fall in the relative dispersion indicates that the relative growth rate of regional prices was beginning to narrow. That is regional price growth rates appeared to have changed across the regions, these changes imply a slowing in the growth rate of the relatively higher growth regions and vice versa for the lower growth regions over this period. Regional inflation rates appear to becoming increasingly similar.

In the context of regional unemployment changes modelled in Chapter Two, there appears some support that changes in regional unemployment are related to changes in both regional wage and regional price dispersion. If it is assumed that a relationship exists between unemployment wages and prices, this suggests that regional labour markets underwent some change from the late 1980s onwards. It also implies that a regional price deflated real wage series might pick-up regional labour market adjustments that the RPI would miss.

3.2.9 The Cyclical Sensitivity of Regional Prices

As with regional unemployment and regional wages, the hypothesis that regions are not significantly different from the UK national average is tested. The form of the equation is, however, the same as that adopted with wages in Chapter Two in which the growth rates of the each regional price index are compared with the growth rate of the RPI. The estimated equation is similar to (3.7):

$$\Delta P_{it} = \alpha_{0i} + \alpha_{1i} \Delta P_{RPI\,t} + \varepsilon_{it} \qquad (3.8)$$

Where P_{it} represents the logarithm of the regional price index in i at time t region and ε_{it} is a random error.

All series were logged, and first-differenced stationary after it was not possible to reject the null hypothesis of a unit root at the 10% level in price levels.

Given the apparent change in regional prices detailed in the last section, equation (3.8) was estimated over the two periods of 1975-1989 and 1975-1996 and the results compared. The method of recursive residuals was used to test the hypothesis that no significant structural break occurred in the regional price series over the sample periods. To test this hypothesis the method of recursive residuals was applied but could only to equations which had not been corrected for serial correlation using the Cochrane-Orcutt procedure. In all cases in which the method of recursive residuals was applied it was not possible to reject the null hypothesis that each models estimated parameters were stable over the period. The results from each regression are presented in Table 3.8.

Table 3.10: Regional Price Growth Rate Analysis: Totals: $\Delta P_{it} = \alpha_{0i} + \alpha_{1i}\Delta P_{RPI\,t}$

Regions	1975-1989			1975-1996		
	α_{oi}	α_{1i}	R^2	α_{oi}	α_{1i}	R^2
East Anglia	0.01	0.95	0.92#	0.003	1.01	0.92#
	(1.66)	(9.43)***		(0.59)	(11.32)***	
East Midlands	0.01	0.94	0.93#	0.01	0.99	0.93#
	(1.61)	(8.97)***		(0.80)	(11.13)***	
North	0.01	0.98	0.93#	0.002	1.00	0.95†#
	(0.84)	(9.53)***		(0.67)	(22.19)***	
North-West	0.01	0.92	0.92#	0.01	0.96	0.93†#
	(1.79)*	(9.37)***		(1.34)	(18.01)***	
South-East	0.01	0.93	0.93#	0.01	0.99	0.94#
	(2.02)*	(10.78)***		(0.97)	(13.17)***	
South-West	0.01	0.96	0.91#	0.00	0.99	0.92†
	(1.24)	(9.09)***		(0.65)	(19.27)***	
West Midlands	0.02	0.90	0.92#	0.01	0.96	0.92#
	(2.11)***	(9.12)***		(1.02)	(10.88)***	
Yorkshire &	0.01	0.95	0.91#	0.01	0.94	0.93†
Humberside	(1.14)	(8.26)***		(1.75)*	(20.00)***	
Northern Ireland	0.01	0.96	0.91#	0.00	1.00	0.92#
	(0.89)	(8.02)***		(0.38)	(9.82)***	
Scotland	0.01	0.91	0.87#	0.01	0.92	0.91†#
	(1.36)	(6.69)***		(1.69)	(14.04)***	
Wales	0.01	0.95	0.92#	0.00	0.99	0.93#
	(1.12)	(8.27)***		(0.69)	(9.98)***	

t-statistics are in parentheses, *** indicates significance at the 1% level, ** at the 5% level; * at the 10% level. † signifies Cochrane-Orcutt AR(1) correction for serial correlation and signifies Whites correction for heteroscedasticity.

Residuals from each regression were tested for the presence of first-order serial correlation, heteroscedasticity and normality. Whilst the test results indicated that it was not possible to reject the null hypothesis of normality in the residuals, it was possible to reject the hypothesis of no serial correlation and no heteroscedasticity in a number of cases suggesting mispecification problem with the regression. Why this might be the case was discussed in Chapter Two.

Table 3.10 indicates that the growth rates of regional prices against the RPI exhibit greater similarity over the full sample period than over the small period of 1975-1989 suggesting increased regional price conformity. As expected the differences in the rates of growth are very small with Scotland exhibiting relatively slower growth rate over the two periods. Again the results indicate that the relationship between regional prices and the RPI are very close. Compared with regional wage growth rates the findings are very similar, however, the relatively large differences in regional unemployment against the national average are not matched by regional prices.

As with unemployment and wages, the hypothesis that each regional series is not significantly different from the UK national average can be formally tested using the Wald test of the joint-restriction $\alpha_{0i} = 0$, $\alpha_{1i} = 1$, on the estimated regression of equation (3.8). The probability values on the F-statistic of rejection of the null hypothesis are given in Table 3.11.

Table 3.11: Wald Test Results On the Hypothesis that Regional Prices are Not Significantly Different from the RPI

Region	1975-1989 P-Value	1975-1996 P-Value
East Anglia	0.03	0.47
East Midlands	0.02**	0.31
North	0.16	0.50
North-West	0.05	0.29
South-East	0.03**	0.29
South-West	0.12	0.59
West Midlands	0.02	0.43
Yorkshire & Humberside	0.19	0.22
Northern Ireland	0.24	0.72
Scotland	0.13	0.23
Wales	0.07*	0.41

*** indicates rejection of the null hypothesis at the 1% level, ** at the 5% level and * at the 10% level.

For the full sample period, the results in Table 3.11 indicate that it is not possible to reject the null hypothesis, that each regional series is not significantly different from the UK national average, at the 1% level . This is, however, not the case over the small sample period of 1975-1989. Here the null hypothesis is rejected at the 10% level for the regions of East Anglia, East Midlands, the North-West, the South-East, West Midlands and Wales. The Wald test statistic, however, lacks power on small samples and these results therefore need to be interpreted with care but examination of the regression estimates for the 1975-1989 period does support the Wald test results.

The results presented in Tables 3.10 and 3.11 indicate that the relationship between the regional price indices and the RPI, for the full period, can be interpreted as being not significantly different from one another. However, there is some suggestion that this relationship has varied over the sample period. Whilst the dispersion results indicate a changing regional price relationship, particularly over the early 1990s, the failure to reject the hypothesis of stability in the parameters indicates that such changes are either gradual or unsubstantial. It would be expected that a fully integrated market economy would have highly correlated regional price values. Price differences are therefore likely to reflect the price of non-traded items. However, the degree and significance of inter-regional price variability that might help throw light on regional economic behaviour can be investigated. This is explored in the next section.

3.2.10 Regional Prices and Price Variability

Parks (1978) is widely accredited for developing a measure for price variability in examining whether movements in the aggregate price level were correlated with sub-aggregate price movements. Using regional price data the hypothesis that movement in the aggregate price series (the RPI) are correlated with inter-regional variability can be tested. In the literature this exercise is in part to try to understand movements in the aggregate series by linking them with movements in the sub-components. The correlation can then be explored as a means by which aggregate price behaviour might be better understood.

The analysis of the relative variability of regional prices provides an indication as to whether regional price behaviour has been stable or not through time. Whilst the Wald test results presented in Section 3.2.9 indicate that it is not possible to reject the hypothesis that regional price indices are not significantly different from the RPI, it is, however, not possible to determine whether relative regional prices have been consistently stable over the sample period. The results from estimating recursive residuals indicated that it was not possible to reject the hypothesis of parameter stability in the behaviour of regional prices, however, the analysis of the dispersion of prices suggest that regional price variations have occurred over the sample period. Examining regional price variability provides an opportunity to explore this in more detail.

Adopting Parks (1978)[11] measure of price variability with which to compare with the aggregate inflation rate, the model is as follows:

Let a_{it} represent the price index in region i in time period t. The rate of change in the ith region's price level between periods t and $t-1$ is denoted Δp_{it} and is the difference in the natural logarithm of the region's price in the two periods, that is $\Delta p_{it} = \ln p_{it} - \ln p_{it-1}$. The aggregate price level (the RPI) for the set of the regions $i = 1, ... ,n$ is denoted P_t and the rate of change in this index is defined as the weighted average of the rates of change for the individual regions. This produces a standard Divisia -index formulation:

$$\Delta P_t = \sum_{i=1}^{n} w_{it}^{*} \Delta p_{it} + \varepsilon_{it} \tag{3.9}$$

where w_{it}^{*} is the weighted value for each region's share and ε_{it} is a random error. The weights are non-negative and sum to 1.

A simple measure of the degree of relative price change between period $t-1$ and t is given by the weighted sum of squared deviations of the individual rates of price change around the average. Parks defines this variance as:

$$VP = \sum_{i=1}^{n} w_i^{*}(\Delta p_i - \Delta P)^2 \qquad (3.10)$$

The factor $\Delta p_i - \Delta P$ is the rate of change in the ith relative variable, that is, the logarithmic difference in the relative variable p_i/P. The average rate of change for the relative variable is zero, and VP is seen to be a measure of non proportionality of the variables movements. If all the sub-aggregate variables change by the same rate, then the variance measure will be zero; thus this measure will be larger the more non proportional the changes in the variable become. For each of the 11 regions of the UK, over the period 1975-1996, ΔP was taken to be the first-difference logarithm of the RPI and VP calculated from the regional price series and the results are given in Figure 3.5, and Table 3.12.

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[11] See also Hercowitz (1981) and Fischer (1981).

Figure 3.5: Regional Price First-Difference Logarithms and Variability

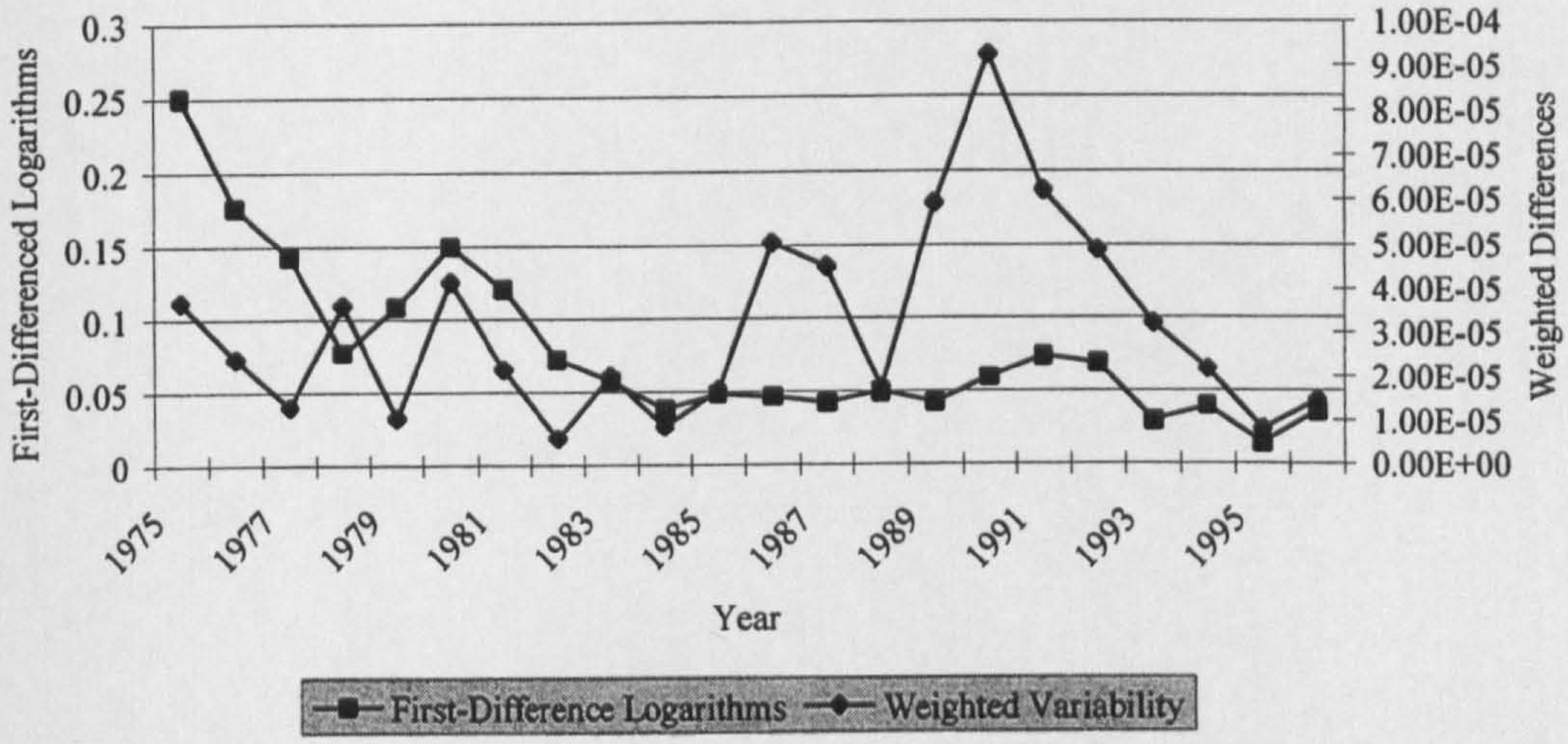

Table 3.12: Aggregate Prices and Price Variability

	First-Differences	Variability
1975	0.20	0.00299
1976	0.17	0.00005
1977	0.16	0.00033
1978	0.08	0.00004
1979	0.10	0.00016
1980	0.20	0.00227
1981	0.11	0.00008
1982	0.09	0.00031
1983	0.04	0.00035
1984	0.05	0.00016
1985	0.07	0.00038
1986	0.03	0.00037
1987	0.04	0.00006
1988	0.04	0.00017
1989	0.08	0.00125
1990	0.09	0.00099
1991	0.06	0.00023
1992	0.04	0.00086
1993	0.01	0.00036
1994	0.03	0.00027
1995	0.03	0.00038
1996	0.02	0.00021

Table 3.13: Regression Diagnostics $\Delta VP = \alpha_0 + \alpha_t \Delta P + \varepsilon$

	Constant	ΔP_t	DW Statistic	R^2
ΔVP_t	-0.001	0.01	2.34	0.01
	(-0.54)	(0.51)		

t-statistics are in parentheses. DW represents the Durbin-Watson statistic.

These results indicate that there has been increased inter-regional price variability over the period 1987 - 1993. This period coincides with the changing regional unemployment differentials and wage behaviour discussed in Chapter Two. Furthermore findings of increased variability coincide with the changing regression estimates on regional unemployment cyclical sensitivity, wage growth rates and the relative dispersion of regional prices, (see Tables 2.5 and 2.10 and Figure 3.4). How significant such variations does require some consideration. By scale, the regional variations only reach as high as 0.1% variability, however, the results indicate increased variability over the period in which the relative shares in the movements of the regional price series exceeds their weighted contribution to the RPI.

To test the hypothesis that the variability of regional price is a function of the change in the RPI, it was first necessary to difference-stationary the variability measure of regional prices due to the inability of rejecting the presence of a unit root in the estimated variables. Estimation of equation (3.11) over the period 1975-1996: are presented in Table 3.13.

$$\Delta VP_t = \alpha_0 + \alpha_1 \Delta P_t + \varepsilon_t \qquad (3.11)$$

where VP_t represents the inter-regional price variability measure in time period t, P_t the logarithm of the RPI, and ε_t is a random error.

Standard residual tests could not reject the assumption of normality nor detect the presence of serial correlation or heteroscedasticity at the 1% level.

The regression results do not support the hypothesis that inter-regional price variability is correlated with the first-difference logarithm of the RPI, such a result is, however, of little surprise given Figure 3.5. The results from Table 3.13 suggest regional price variability is associated with other variables. Whether these other variables include expectational errors is just one in a huge literature (see e.g. Lach and Tsiddon (1992)). However, based on the supposition that regional prices are determined at least in part endogenously, the modelling of labour markets based on expectational errors is a popular and attractive one.

Assuming that labour market decisions of the early 1990s are based on price expectations, and assuming the economic shock led to region-specific price expectational errors, then regional labour market behaviour, in particular that of unemployment can perhaps be explained. This is the focus of the next two chapters in which regional real wages and price expectations are introduced.

3.3 Conclusion

This chapter has focused on the construction and analysis of a regional price variable. A number of alternative techniques in constructing a regional price index were compared with the RPI in the aggregate, and one chosen on the basis of the closest approximate fit to the RPI over the sample data of 1974-1996. The annual indices produced for each of the 11 regions of the UK were a combination of the Reward Group's regional cost of living surveys and the published Housing Price Index, weighted from the Regional Trends estimates of housing expenditure as a proportion of total expenditure. All values were produced to April of each year.

The Reward Group's regional surveys mimic a method of price data collection used in the RPI, providing a fairly close approximation for comparison. However, the use of current house price data in compiling the expenditure totals for each region in the surveys meant that an alternative housing expenditure item was needed. The different methods of producing a regional index similar to the RPI differed with respect to the treatment and addition of this housing component.

Of the method adopted and the regional indices produced, the values and behaviour of each index was compared against the RPI. The cross correlation matrices in levels, logarithm levels and first-difference logarithm levels indicated the extent by which regional prices moved against each other. This result was verified in the regressions of equation (3.8). Here it was not possible to reject the null hypothesis that the first-difference logarithms of the regional price indices and the RPI are not significantly different.

The regression results provided information on the relative growth rates of regional prices against the RPI. The analysis covered both the full sample period and the sub-sample period 1975-1989. Wald test statistics indicated that whilst it was not possible to reject the null hypothesis that the regional price indices are not significantly different from the RPI over the full sample period at the 10% level, this hypothesis was rejected in a number of cases over the earlier period. Together the two regression results suggested that regional price differences have narrowed from 1990 onwards. Whilst the narrowing of regional price differences was supported by calculations of the absolute and relative price dispersion of regional prices the hypothesis of structural stability could not be rejected using the method of recursive residuals. This suggests that these regional price changes were either not significant or more gradual than the regression results suggested.

The hypothesis that regional price variation had changed over the full sample period was tested by applying the literature on relative price variability and inflation. Over the late 1980s to early 1990s evidence presented suggested that there had been a marked increase in inter-regional price variability not correlated with movements in the RPI.

The price variability literature introduces the idea that measured price variability is related to the operation of the regional labour market. Models of wage determination such as the Expectations-Augmented Phillips Curve imply that price expectational errors affect wage determination. If regional price variability is related to uncertainty then it is possible to examine whether regional prices, unemployment and wages can help explain the operation of regional labour markets. Whether existing wage determination models at the regional level are aided by the use of a regional price index is left to the next two chapters.

Growing interest in the disaggregation of economic variables and in particular that of regional labour markets implies that a regional price deflator is of great importance in the examination of real variables at the regional level relative to the national average. A growing concern in economic modelling is that aggregation might be failing to capture subtleties of many economic relationships that occur at a lower level of aggregation (Abraham and Katz (1986), Machin and Manning (1994)). Furthermore the problem could be confounded if economic modelling combines disaggregated and aggregated data. The regional indices are an attempt to go some way in trying to enable the modelling of real and nominal variables at the regional level. Whilst the results so far indicate that at the regional level the behaviour of nominal wages and prices are, highly synchronised the fact that this appears not to be the case with regional unemployment suggests that in order to understand the regional labour market more fully necessitates the calculation of region-specific real wages. The use of a regional price deflator enables a regional real wage variable to be constructed, to be compared to one produced using the RPI and then examined with respect to unemployment. This is the focus of the next chapter.

CHAPTER FOUR

ANALYSING REGIONAL REAL WAGES

4.1 Introduction

This chapter constructs regional real wage series and examines the behaviour of regional real wages, both with respect to the particular price deflator used and unemployment.

Labour market models have been developed in trying to explain wage-unemployment behaviour. The analysis of regional variables in this thesis has focused on the 1990-1993 recessionary period as well as the 1990-1996 period in general and with regard to the apparent change in the so-called north–south divide of unemployment differentials. The explicit modelling of a regional real wage now adds another dimension to examining regional labour markets. Regional real wage behaviour is now governed by the behaviour of the nominal wage series and the behaviour of the price deflator used. By construction nominal wage behaviour is identical to real wage behaviour if all nominal series are deflated by the same price index. The introduction of region-specific prices allows an examination of relative real wages as a function of changing relative regional nominal wages and prices.

The exact interpretation of coefficient estimates in the labour market models have, however, to be considered alongside the problem of errors in variables as mentioned in Chapter Three. This problem relates to measurement errors that exist in the data on variables and how representative the data are of the true values of the variables themselves. Consequently all data are subject to measurement error, how much of a problem this might be in labour market estimation is, however, a moot point. The region on national average regressions in the previous two chapters sought to examine the relative behaviour of the region against the national and how representative the national average measure is of the region. As the collection and measurement of data is similar across all regions and that the national average is a weighted average of the regional, measurement errors affects all variables equally. As a result, whilst the absolute value of the coefficient might be under or over-estimated the relative values are assumed to be the same.

The problem of errors in variables, however, becomes compounded when the estimated coefficients are either pooled across groups of regions or a coefficient value is interpreted in an absolute context. The regional labour market models developed in this chapter and the next whilst in the main refer to relative regional differences the estimated coefficients need to be interpreted with care both with respect to the appropriate functional form and the accuracy of the data used. (see Greene (1997)).

This chapter constructs two measures of regional real wages over the period 1974-1996. The difference between the two lies in the relevant price deflator used: the regional price indices of Chapter Three and the published RPI. The hypothesis that there is no difference between the two different measures of real wages is tested. As with unemployment and nominal wages in Chapter Two, and the regional price series in Chapter Three, the examination of regional real wage behaviour is undertaken. For each real wage series both the absolute and relative dispersion of regional real wages are examined in order to examine relative real wage behaviour. The hypothesis that each regional real wage series is not significantly different to the UK national average is tested, whilst inter-regional real wage behaviour is examined adopting Parks (1978) method of price changes against relative price variability. This procedure is also applied to nominal wages and unemployment in seeking to identify similar inter-regional behaviour over the sample period. In the context of regional labour market adjustment, regional real wage behaviour is examined in light of the changing pattern of regional unemployment described in Chapter Two. The final sections of this chapter explore the relationship between regional real wages and unemployment.

4.2 Real Wages

The real wage is the physical cost or benefit of employment. To the firm it is the output value paid to the worker; to the worker it is the physical reward from employment, both are typically denoted in some form of monetary payment. As a result a distinction is made between a producer or product real wage, and consumer or consumptive real wage respectively. Measuring the real wage is, however, far more problematic, as is therefore examining its behaviour (see Brandolini (1993) for a full review). The general distinction in the literature is therefore between a producer real wage using a producer price index with which to deflate the wages series, whilst the consumer real wage uses a consumer or retail price index.

In the empirical literature the behaviour of the real wage rate relates to what is now called "the real wage debate". This debate centres around the actual versus predictive behaviour of the real wage against real GDP over the course of the business cycle. A countercyclical real wage-GDP cycle predicted by the "neo-classical" model (see Dunlop (1938), p. 413) has been challenged by numerous empirical findings claiming that either there is no clear cyclical real wage-GDP relationship or that the relationship is in fact procyclical. In seeking to resolve this debate, a number of factors have been incorporated into the analysis. Such factors relate to different measures of productivity, the time period, the nature of the economic shock examined, the heterogeneity of the workforce, capital utilisation etc, (see Brandolini (1993)). The possibility that the measurement of real wage cyclicality is subject to an aggregation bias has been examined by Bodkin (1969), Chirinko (1980), Mehra (1982), Burda (1985), and Michie (1987). Such aggregation bias refers to the composite real wage masking different real wage behaviour determined at a higher level of disaggregation. None of these studies have, however, considered aggregation bias within a geographical context. Examining the behaviour of regional real wages to the UK national average therefore relates to examining aggregation bias.

4.2.1 Regional Real Wages

The hypothesis that the use of the national average as representative of the region introduces an aggregation bias in labour market modelling relates to the examination of regional real wage behaviour against the aggregate. It relates to possible differences between the regional series and the aggregate. In the analysis of the real wage, the source of aggregation comes through the nominal wage series and / or the price deflator. An analysis of the behaviour and determination of regional real wages is part of an attempt to test the hypothesis that the regional labour market is not significantly different from the aggregate and that any differences are generated at the regional level. The use of a region-specific price series in producing regional real wages offers the possibility of identifying and examining regional real wage behaviour in light of potential aggregation bias introduced when regional wages are deflated by the RPI. In their study of the RPI, Fry and Pashardes, (1986) discuss various demographic issues of representation, problems with the weights used, incorporation of housing etc. but nothing on regions. However the notion of significant regional cost of living differences existing was investigated by the 1968 Retail Prices Index Advisory Committee. Their report recommended the publication of some regional price indices.[1]

In this thesis the use of regional real wages refers to a measure of the consumer real wage. The desire to construct regional real wages using regional price indices is primarily to test the hypothesis that the regional real wage is not statistically significantly different from the national average real wage. However, how real wages are determined is also part of wider the picture of analysing regional economic integration and behaviour.

The lack of an official regional price index meant that early modelling of UK consumer real wages used a national or aggregate price index with which to calculate regional consumer real wages,[2] (see for instance Thirwall (1970), Johnes (1989) and Hyclak and Johnes (1992)). The initial problem with using an aggregate price index in constructing regional real wages is that relative regional variation in real wages

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[1] The report "Proposals for retail prices indices for regions" (Dept. of Employment, Cmnd. 4749 (1971)) was published in August 1971. It outlined a number of problems associated with constructing regional price indices but recommended the publication of an annual series for Northern Ireland, Scotland, Wales and the then Greater London Council. The Government in Parliament made allusions to considering the report Hansard (1971)) especially with respect to the CBI and the TUC. The recommendations were never adopted and it has not been possible to trace the official reasons for this.
[2] This would be as opposed to the producer or product real wage which is the nominal wage rate deflated by the producers own price of output and hence assumed relevant in only demand for labour decisions.

will be identical to those of nominal wages. The main objection, however, refers to whether the aggregate price series adequately captures regional price movements.

Attempts in using the unofficial Reward Groups regional cost of living surveys in constructing regional price indices have been a recent development in analysing regional real wages. Jackman and Savouri (1991), Blackaby and Manning (1987, 1990b, 1992), Blanchflower and Oswald (1994), Hughes and McCormick (1994) and Blackaby and Murphy (1995) have all had some success in applying the Reward Group's cost of living indices to produce regional real wages concluding that regional real wages are significant in the regional labour market, albeit weakly.[3] The major weakness of these studies, however, is that, as regional equivalents to the RPI, they suffer from the problems outlined in Chapter Three. In particular the use of current house price data in these Reward Group's indices biases each regional series However, in using the series to examine migratory patterns this problem is not so serious (see Blackaby and Manning (1992))[4].

4.2.2 Constructing Regional Real Wages

Two regional real wage series, one based on the regional price series from Chapter Three and the other from the RPI, were constructed for each of the 11 regions as well as the UK average, for the *all adults* AGHE category from 1974-1996. Producing two regional real wage series' enabled a comparison of regional real wages based on the particular index adopted. In particular, the hypothesis that each regional price series was not significantly different from the national average from Chapter Three prompts the question whether regional real wages differ according to the price deflator adopted.

Analysing regional real wage behaviour according to the particular deflator is a development spurred on by Kaliski (1964). It is also driven by the fact that in a number of papers the RPI is the preferred price deflator, results from these studies

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[3] Hughes and McCormick (1994) argue that regional housing costs are still very significant in explaining regional real wage differences, whilst Blackaby and Murphy (1994) argue that the importance of regional real wages depends on the particular wages groups being examined.

[4] In none of the papers is their any allusion to how the data was constructed given the ambiguities and problems associated with the months in which the reports were published. Indeed as reported in

can thus be compared. Comparing the behaviour of real wages results based on two different price deflators can help to evaluate these previous works, (see e.g. Johnes (1989), Hyclak and Johnes (1992)).

4.2.3 Testing Regional Real Wages

As with regional unemployment, nominal wages and prices each real wage series was examined with respect to the absolute and relative dispersions of regional real wages in examining regional real wage differences. More formal testing of the relative movements of the individual series against the national average were based on OLS estimates and the hypothesis that each regional real wage series is not significantly different from the national average was tested using the Wald test of the joint-restrictions on the coefficients.

4.2.4 The Absolute and Relative Dispersion of Regional Real Wages

The absolute and relative dispersions of regional real wages were calculated for both real wage series. The purpose being to examine the relative movement in the regional real wages over the sample period and to detect whether any significant differences or similarities are evident. Comparable to earlier regional analyses such an examination offers an insight into real wage behaviour before more formal testing. However, in the case of RPI-deflated regional real wages, by definition, the two measures of dispersion will produce the same results as that for the nominal wages in Chapter Two.

Both the absolute and relative dispersions of both regional real wages series are given in Figures 4.1 and 4.2. Both Figures show similar patterns in regional real wage differences. In both Figures the absolute and relative dispersions of regional real wages grew throughout the 1980s and from 1990 it appears that such regional differentials appear to have slowed down or stopped. The only significant difference between the two different measures of real wages is that the regional price-deflated real wage differences are not as great across regions as the RPI-based series, nor do they grow apart as much. The absolute and relative dispersions of regional nominal

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Chapter Three Hyclak and Johnes (1992) decided against using the Reward surveys because of the wages and prices in Chapters Two and Three are therefore similar to the behaviour of regional real wages. Whilst there appears to be a slowing down in regional real wage differences, these patterns appear to be driven by the behaviour of the different price series. Figures 4.1 and 4.2 therefore suggest some differences in regional price movements over the sample period.

Figures 4.1 and 4.2, imply that regional real wage differences are smaller when regional prices are taken into consideration and that the growth rate in these differences are smaller than when regional real wage are constructed wit the RPI. These results imply that regional price differences are significant enough to influence regional real wage rates and should be taken into consideration when evaluating regional real wage movements.

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problems with the months.

Figure 4.1: Absolute and Relative Dispersion of Regional Price-Deflated Regional Real Wages: Totals: 1974-1996

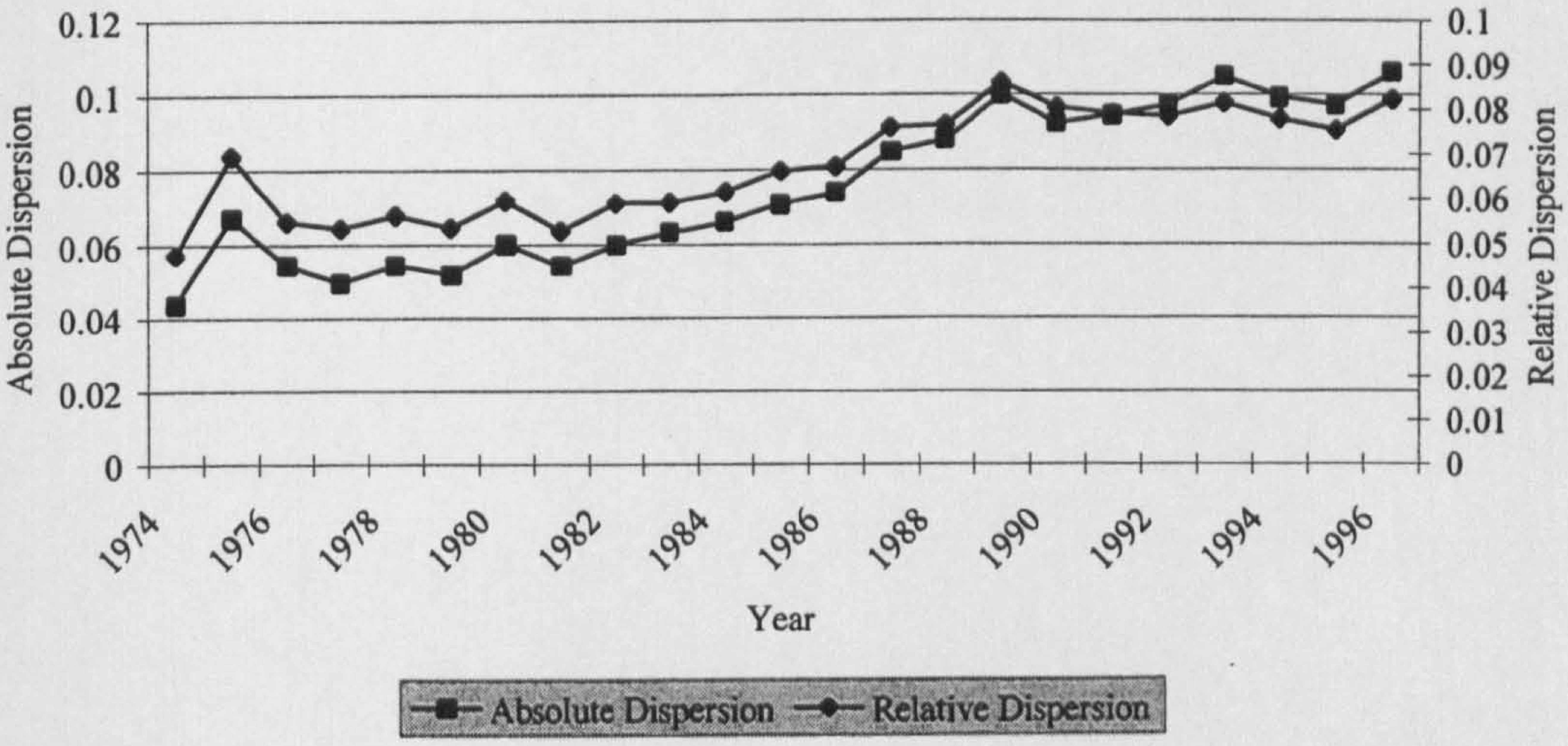
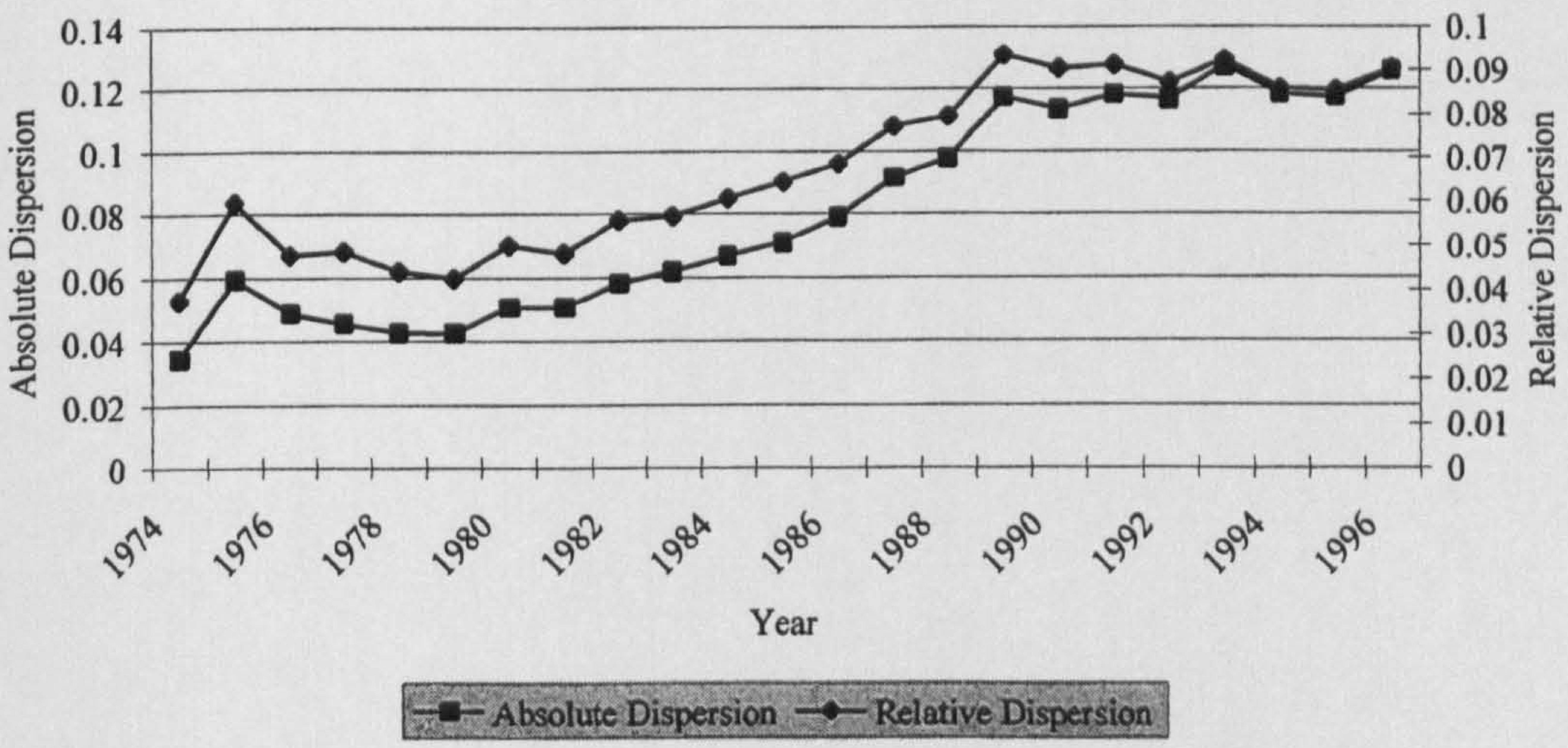


Figure 4.2: Relative and Absolute Dispersion of RPI-Deflated Regional Real Wages: Totals 1974-1996



4.2.5 The Growth Rate of Regional Real Wages

The absolute and relative dispersion of the two regional real wage series indicate some growth in real wage differences throughout the 1980s. To examine the relationship between each regional real wage series and the national average, the estimated coefficients from OLS estimates were examined for the two sample periods 1975-1989 and 1975-1996 as given in equation (4.1):

$$\Delta RW_{it} = \alpha_{0i} + \alpha_{1i}\Delta RW_{UKt} + \varepsilon_{it} \tag{4.1}$$

where RW_{it} represents the logarithm of the real wage index for region i in time t, UK represents the UK national average and ε_{it} a random error.

ADF test results in levels indicated that it was not possible to reject the presence of a unit root at the 10% level. As a result all data were differenced to make them stationary.

Whilst examination of recursive residuals for each estimated regression failed to indicate support for the presence of any structural instability, the behaviour of regional unemployment, and nominal wages in Chapter Two prompted use of the Chow test to test for a break in the data in 1990. The results are provided in Tables 4.1 and 4.2 for each measure of regional real wages respectively. The results indicate that in the majority of cases it was not possible to reject the null hypothesis of no structural break in 1990. In those series in which this hypothesis could be rejected a dummy variable was added to those regressions, which took on the value 0 before 1990 and 1 thereafter. The regression results are provided in Tables 4.3 and 4.4.

Table 4.1: Chow Test Results of the Hypothesis of No Structural Break in 1990; Regional Price-Deflated Regional Real Wages

Region	Regional Real Wages
East Anglia	0.41
East Midlands	0.05**
North	0.27
North-West	0.40
South-East	0.72
South-West	0.44
West Midlands	0.29
Yorkshire & Humberside	0.80
Northern Ireland	0.40
Scotland	0.54
Wales	0.43

*** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.

Table 4.2: Chow Test Results of the Hypothesis of No Structural Break in 1990: RPI-Deflated Regional Real Wages

Region	Regional Real Wages
East Anglia	0.10#
East Midlands	0.00***
North	0.04**
North-West	0.21
South-East	0.59#
South-West	0.47
West Midlands	0.58
Yorkshire & Humberside	0.19
Northern Ireland	0.10*
Scotland	0.34
Wales	0.52

*** indicates significance at the 1% level, ** at the 5% level and **at the 10% level and # signifies White's correction for heteroscedasticity.

Table 4.3: Regional Real Wages Cyclical Sensitivity Analysis Regional Price-Deflated: 1975-1989 and 1975-1996, $\Delta RW_{it} = \alpha_{0i} + \alpha_{1i}\Delta RW_{UK,t} + \varepsilon_{it}$

Region	1975-1989			1975-1996		
	α_{0i}	α_{1i}	R^2	α_{0i}	α_{1i}	R^2
East Anglia	-0.00	0.73	0.81	0.00	0.69	0.76†
	(-0.28)	(5.15)***		(0.82)	(5.87)***	
East Midlands	0.02	0.97	0.75	-0.01	0.93	0.73 ξ
	(-2.41)***	(6.21)***		(-2.54)***	(7.05)***	
North	-0.01	0.75	0.79	-0.00	0.73	0.73
	(-1.21)	(7.09)***		(-0.40)	(7.35)***	
North-West	-0.00	0.88	0.81	-0.00	0.87	0.79
	(-0.97)	(7.50)***		(-0.44)	(8.56)***	
South-East	-0.00	0.99	0.73†	0.00	0.91	0.70†
	(-0.50)	(6.13)***		(0.25)	(6.73)***	
South-West	0.00	0.60	0.75†	0.01	0.59	0.64†
	(0.14)	(4.02)***		(1.39)	(4.40)***	
West Midlands	0.00	0.62	0.68†	-0.00	0.77	0.61†
	(0.39)	(4.43)***		(-0.07)	(4.10)***	
Yorkshire & Humberside	-0.00	0.64	0.80	0.00	0.65	0.71
	(-0.06)	(7.29)***		(0.16)	(6.94)***	
Northern Ireland	-0.00	0.66	0.56	0.00	0.62	0.42
	(-0.19)	(4.04)***		(0.71)	(3.77)***	
Scotland	0.00	0.60	0.66†	0.00	0.63	0.62†
	(0.54)	(3.86)***		(0.96)	(5.03)***	
Wales	-0.00	0.70	0.68†	-0.00	0.85	0.61
	(-0.26)	(4.25)***		(-0.73)	(5.62)***	

t-statistics are in parentheses, *** indicates significance at the 1% level, ** at the 5% level, * at the 10% level † signifies Cochrane-Orcutt AR(1) correction for serial correlation, # signifies White's correction for heteroscedasticity and ξ indicates dummy-variable correction for 1990.

Table 4.4: Regional Real Wages Cyclical Sensitivity Analysis: RPI-Deflated: 1975-1989 and 1975-1996, $\Delta RW_{it} = \alpha_{0i} + \alpha_{1i}\Delta RW_{UK,t} + \varepsilon_{it}$

Region	1975-1989			1975-1996		
	α_{oi}	α_{1i}	R^2	α_{oi}	α_{1i}	R^2
East Anglia	-0.00	0.96	0.77#	0.00	0.88	0.73†#
	(-0.34)	(5.21)***		(0.40)	(5.62)***	
East Midlands	-0.01	1.22	0.88	-0.01	1.07	0.76ξ
	(-2.95)**	(9.81)***		(-1.89)*	(7.77)***	
North	-0.01	1.03	0.93#	-0.01	0.99	0.87†ξ
	(-3.36)***	(11.10)***		(-2.92)***	(12.66)***	
North-West	-0.01	1.12	0.94	-0.00	1.07	0.92
	(-1.78)*	(14.50)***		(-0.92)	(15.27)***	
South-East	0.00	1.20	0.78	0.00	1.14	0.76#
	(0.10)	(6.76)***		(0.46)	(6.90)***	
South-West	0.00	0.88	0.75	0.00	0.81	0.73
	(0.05)	(6.22)***		(0.85)	(7.26)***	
West Midlands	-0.00	0.94	0.88†	-0.00	0.89	0.82†‡
	(-1.64)	(13.81)***		(-0.23)	(7.33)***	
Yorkshire & Humberside	-0.00	0.92	0.90	-0.00	0.86	0.86†
	(-0.90)	(10.75)***		(-0.18)	(11.04)***	
Northern Ireland	-0.01	1.07	0.85	-0.00	0.95	0.73
	(-1.47)	(8.63)***		(-0.08)	(7.41)***	
Scotland	-0.00	1.03	0.94	-0.00	0.94	0.85†
	(-0.98)	(13.94)***		(-0.16)	(10.91)***	
Wales	-0.01	1.04	0.83†	-0.01	1.07	0.82
	(-1.59)	(7.87)***		(-1.32)	(9.54)***	

t-statistics are in parentheses, *** indicates significance at the 1% level, ** at the 5% level, ** at the 10% level; † signifies Cochrane-Orcutt AR(1) correction for serial correlation; # signifies White's correction for heteroscedasticity, ξ indicates dummy-variable correction for 1990 and ‡ indicates non-normal residuals at the 5% level.

The Chow test results combined with the findings on nominal wages and prices in Chapters Two and Three with those of recursive residuals imply structural stability in regional real wage behaviour over the full sample period. However, examination of the estimated coefficients on the UK real wage variable against each regional real wage variable over the two sample periods imply some change in the behaviour of regional real wages against the national average.

Tables 4.3 and 4.4 present the regression results for each regional real wage series. The residuals from each equation were tested for normality using the Jarque-Bera test, the Breusch-Godfrey LM test for first-order serial correlation and Whites test for heteroscedasticity. In the case of the regional price-deflated real wage series, it was not possible to accept the null hypothesis of no serial correlation in a number of regions and the Cochrane-Orcutt procedure was adopted. In the case of the RPI-deflated series, however, in a number of cases particularly for the full sample period the null of normal residuals, heteroscedasticity and serial correlation was rejected. The fact that the RPI-results failed more diagnostic tests than the regional price deflated series implies greater mis-specification problems with these models. However both sets of regressions suffer from a number of problems, such as sample size, possible simultaneity and errors in variables. As such differences in these diagnostic tests should not be interpreted as indicative of improved specification of the regional-price deflated real wage series over the RPI.

The estimated coefficients on the UK real wage variable measures the relative growth rate of the regional real wage against the aggregate. Both Tables fail to pick up any regional pattern in the relative growth rates of regional real wages. Whilst there is evidence of a large variance in the growth rates between regions and between Tables, the RPI-deflated series show a much greater variance than the regional price-deflated series. For the two sample periods the variance in the growth rates are measured as 8.3 and 7.3 for the RPI-deflated series compared with 4.2 and 4.3 for the regional price-deflated series. Furthermore the relative growth rate of the RPI-deflated regional real wages are higher in all cases against the national average than the regional price series.

The real wage regressions lead to differing regional real wage results dependent on both the time period and the appropriate deflator. The difference in regional real wage behaviour based on the two deflators, however, begs the question of what implications these results have for explaining regional labour market behaviour. These results that regional real wage differences are estimated as being greater than they really are when the RPI is used to deflate nominal wage, this would lead to a biased relationship between regional real wages and unemployment to be estimated. However, given the inability to assumed well-behaved residuals in a number of RPI-based equations and given the small sample size, these results do need to be interpreted with caution.

Equation (4.1) can also be used to test the hypothesis that the regional real wage rate is not significantly different from the national average by performing Wald tests on the joint-restriction $\alpha_0 = 0,\ \alpha_1 = 1$. This joint-restriction was performed for both real wage measures over the two sample periods and the probability values on the F-statistic of rejection of the null hypothesis are presented in Tables 4.5 and 4.6.

Table 4.5: Wald Test Results on the Hypothesis that Regional Real Wages are not significantly different from the National Average – Regional Price-Deflated

Region	1975-1989 P-Value	1975-1996 P-Value
East Anglia	0.04**	0.02**
East Midlands	0.02**	0.12
North	0.00***	0.01***
North-West	0.12	0.19
South-East	0.68	0.79
South-West	0.03**	0.02**
West Midlands	0.01***	0.21
Yorkshire & Humberside	0.00*	0.00***
Northern Ireland	0.05**	0.08*
Scotland	0.02**	0.01**
Wales	0.03**	0.19

*** indicates rejection of the null hypothesis at the 1% level, ** at the 5% level and * at the 10% level.

Table 4.6: Wald Test Results on the Hypothesis that Regional Real Wages are not significantly different from the National Average – RPI-Deflated

Region	1974-1989 P-value	1974-1996 P-value
East Anglia	0.80	0.69
East Midlands	0.04**	0.60
North	0.01***	0.02**
North-West	0.20	0.55
South-East	0.35	0.53
South-West	0.59	0.26
West Midlands	0.01***	0.17
Yorkshire & Humberside	0.15	0.05**
Northern Ireland	0.34	0.87
Scotland	0.61	0.51
Wales	0.17	0.43

*** indicates rejection of the null hypothesis at the 1% level, ** at the 5% level and * at the 10% level.

As has been mentioned earlier the Wald test results have to be interpreted with care given that the test results are based on small sample sizes and particularly as the residuals in some of the estimated equations indicated some degree of mispecification. Despite this the Wald test results indicate a much greater variation in regional real wage behaviour from the national average with the use of the regional price deflator than the RPI. Over the two periods, the null hypothesis that the regional real wage rate is not significantly different from the national average is rejected in 6 regions over the full sample using the regional price deflator as opposed to 2 with the RPI.

4.2.6 Regional Variables and Variability

The notion of relative regional price variability was introduced in Chapter Two and the results presented there indicated that movements in the aggregate series were not significantly associated with regional price variability. The increase in inter-regional price variability identified in the late 1980s and early 1990s, suggests the possibility that inter-regional labour market adjustment processes associated with changing regional unemployment differentials are related. To examine the relationship between the variability of regions and the national average and to see whether similar patterns in variability are present, this modelling can be extended to other regional variables. Examining patterns of variability, however, relates to not only exploring the existence and magnitude of regional variability but also the time period in which it occurs. Whilst such an exploration does not lead to any hard and fast conclusions with respect to causal factors, common inter-regional variability in space and time is consistent with region-specific labour market adjustment processes being at work. The existence of a region-specific price series may provide a better understanding of the regional labour market in light of the dramatic shift in regional unemployment differences in the early 1990s.

Chapter Three introduced the method by which regional prices and regional price variability could be modelled based on Parks (1978) study. This method is repeated here for the remaining regional variables, nominal wages, unemployment and both measures of regional real wages.

Figure 4.3: Nominal Wage First-Difference Logarithms and Variability

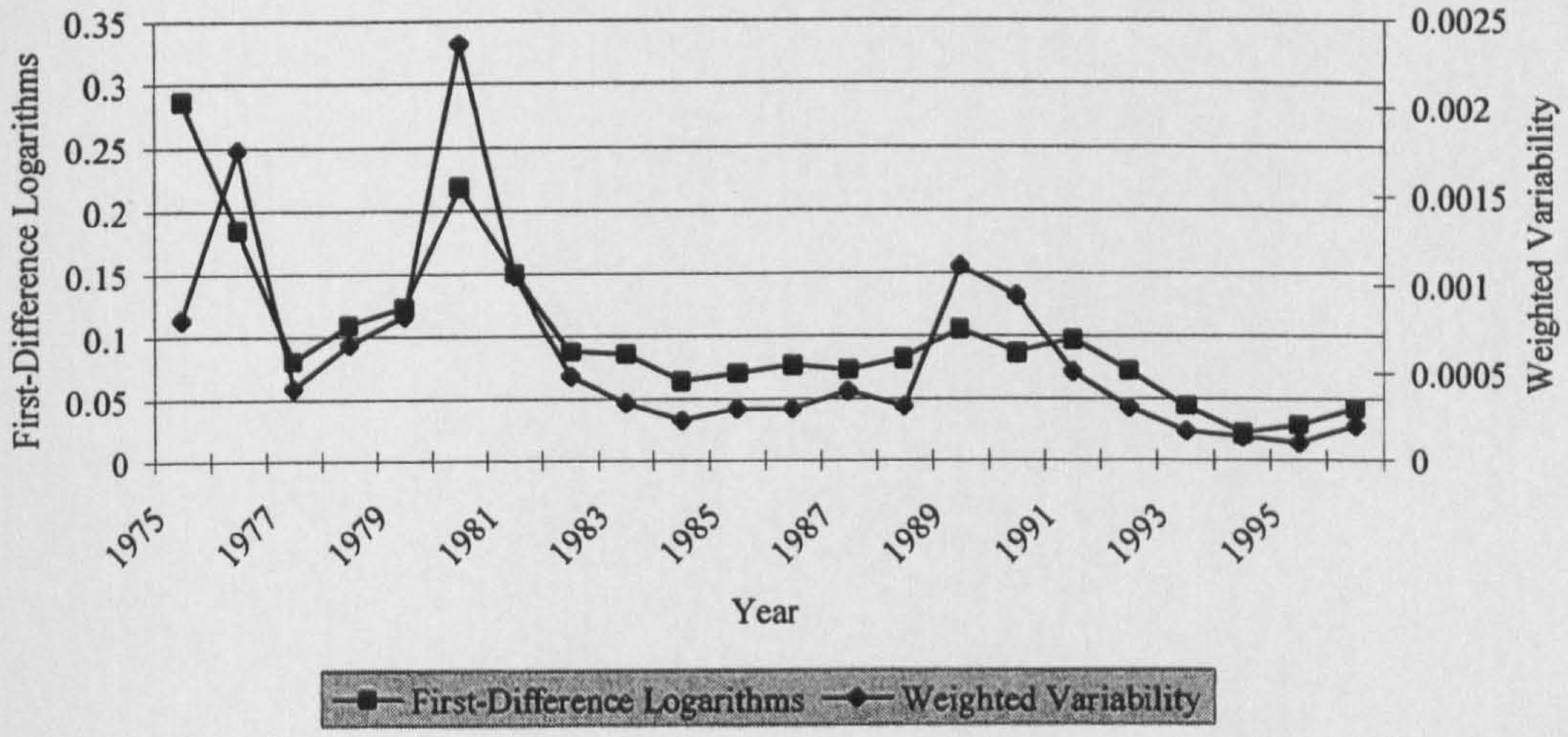


Table 4.7: Nominal Wage First-Difference Logarithms and Variability

Year	First-Difference Logarithms	Weighted Variability
1975	0.29	0.00081
1976	0.19	0.00177
1977	0.08	0.00042
1978	0.11	0.00067
1979	0.12	0.00083
1980	0.22	0.00237
1981	0.15	0.00105
1982	0.09	0.00049
1983	0.09	0.00033
1984	0.06	0.00023
1985	0.07	0.00030
1986	0.08	0.00030
1987	0.07	0.00040
1988	0.08	0.00031
1989	0.11	0.00111
1990	0.09	0.00094
1991	0.10	0.00051
1992	0.07	0.00030
1993	0.04	0.00017
1994	0.02	0.00013
1995	0.03	0.00010
1996	0.04	0.00020

Table 4.8: Regression Diagnostics, $VW_t = \alpha_0 + \alpha_1 \Delta W_t + \varepsilon_t$

	Constant	ΔW_t	DW Statistic	R^2
VW_t	-0.004	0.67	1.85	0.56#‡
	(-0.18)	(2.25)***		

t-statistics are in parentheses, *** indicates significance at the 1% level, # indicates White's correction for the presence of heteroscedasticity, ‡ indicates rejection of normality of residuals and DW represents the Durbin-Watson test statistic.

Figure 4.4: Unemployment First-Difference Logarithms and Variability

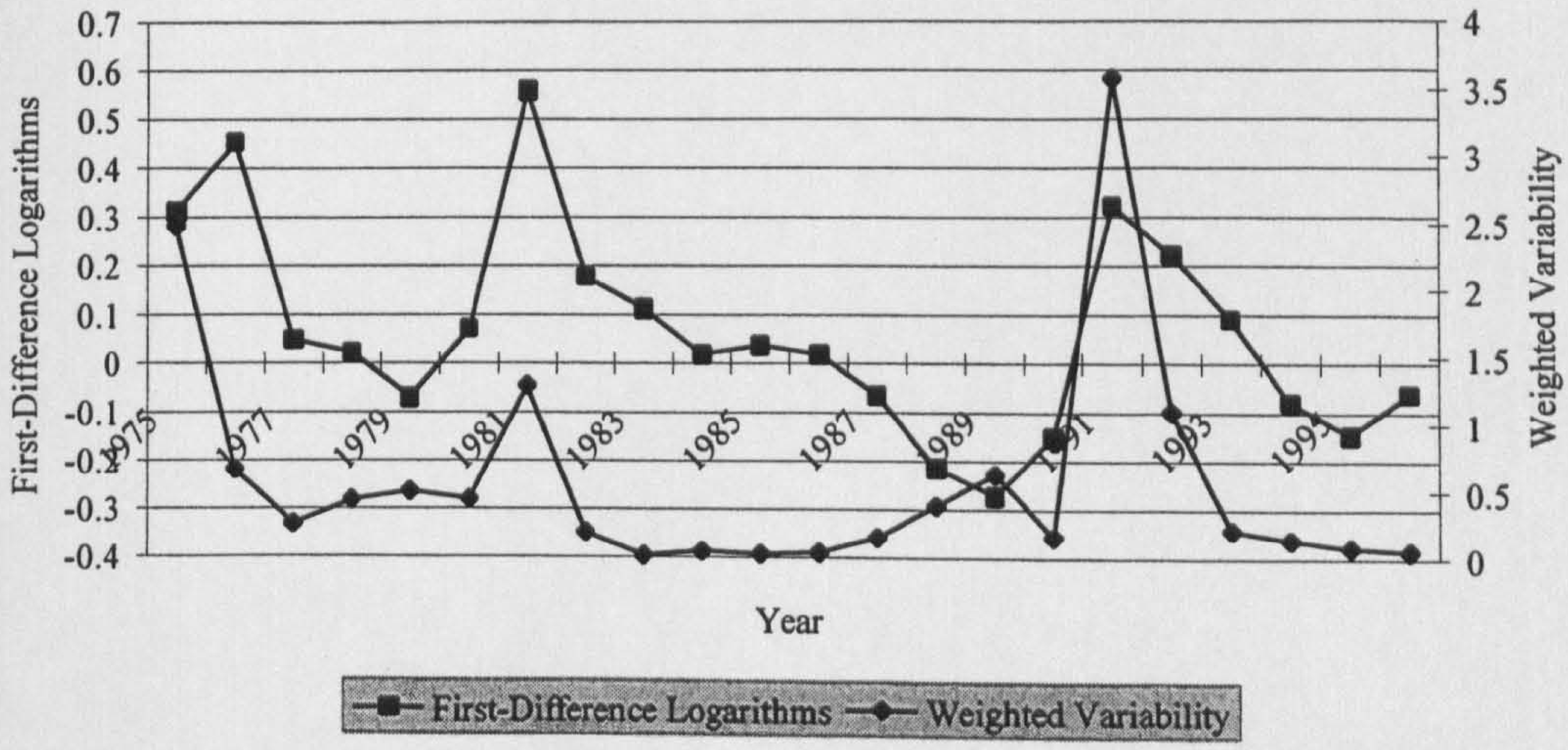


Table 4.9: Unemployment First-Difference Logarithms and Variability

	First-Difference Logarithms	Variability
1975	0.314	0.025
1976	0.455	0.007
1977	0.048	0.002
1978	0.023	0.004
1979	-0.071	0.005
1980	0.071	0.004
1981	0.560	0.013
1982	0.178	0.002
1983	0.113	0.000
1984	0.019	0.000
1985	0.037	0.000
1986	0.018	0.000
1987	-0.065	0.002
1988	-0.214	0.004
1989	-0.272	0.006
1990	-0.152	0.002
1991	0.323	0.036
1992	0.223	0.011
1993	0.091	0.002
1994	-0.080	0.001
1995	-0.146	0.001
1996	-0.062	0.001

Table 4.10: Regression Diagnostics, $VU_t = \alpha_0 + \alpha_1 \Delta U_t + \varepsilon_t$

	Constant	ΔU_t	DW Statistic	R^2
VU_t	0.44	2.30	1.55	0.30‡
	(2.60)***	(2.96)***		

t-statistics are in parentheses, *** indicates significance at the 1% level and ‡ indicates rejection of normality of residuals and DW represents the Durbin-Watson test statistic.

Figure 4.5: Regional Price-Deflated Real Wage First-Difference Logarithms and Variability

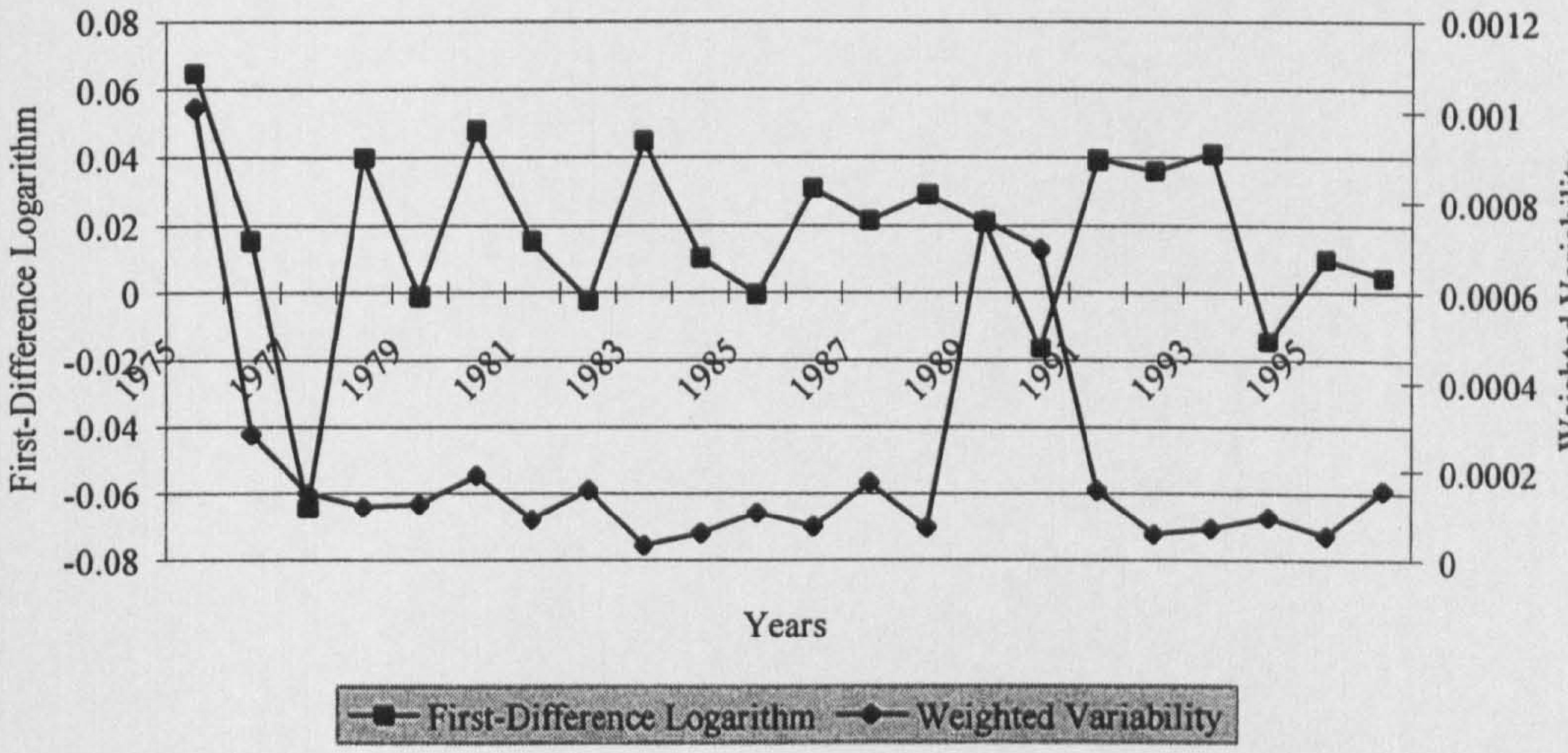


Table 4.11: Real Wage First-Difference Logarithms and Variability

	First-Difference Logarithms	Variability
1975	0.062922082	0.00098
1976	0.015620665	0.00028
1977	-0.064725201	0.00015
1978	0.040033656	0.00012
1979	-0.001151403	0.00013
1980	0.048407442	0.00019
1981	0.015226562	9E-05
1982	-0.002341746	0.00016
1983	0.044712718	3.3E-05
1984	0.010349065	6E-05
1985	-0.000447912	0.0001
1986	0.030712415	7.3E-05
1987	0.021409666	0.00017
1988	0.029164937	7.4E-05
1989	0.02045917	0.00076
1990	-0.016677175	0.0007
1991	0.039592717	0.00016
1992	0.035962757	5.7E-05
1993	0.041119107	7.1E-05
1994	-0.014514901	9.6E-05
1995	0.010031262	5.4E-05
1996	0.004700944	0.00016

Table 4.12: Regression Diagnostics, $VRWR_t = \alpha_0 + \alpha_1 \Delta RWR_t + \varepsilon_t$

	Constant	ΔRWR_t	DW Statistic	R^2
$VRWR_t$	0.0002	-0.001	1.47	0.18†‡
	(2.86)***	(-0.74)		

t-statistics are in parentheses, *** indicates significance at the 1% level, † indicates first-order autoregressive correction, ‡ indicates rejection of normality of residuals DW represents the Durbin-Watson test statistic.

Figure 4.6: RPI-Deflated Real Wage First-Difference Logarithms and Weighted Variability

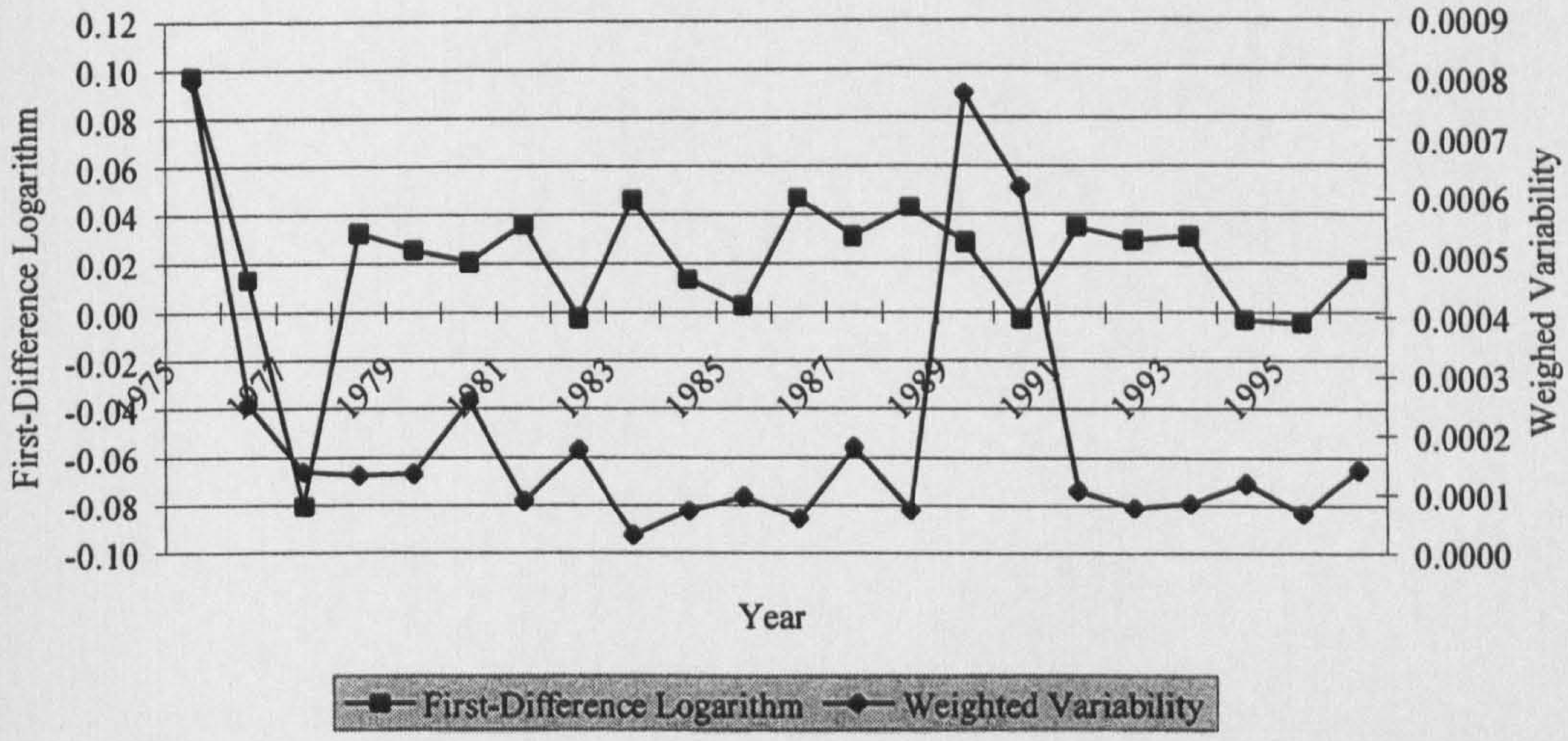


Table 4.13: RPI–Deflated Real Wage First-Difference Logarithms and Variability

	First-Difference Logarithms	Variability
1975	0.097093142	0.00080
1976	0.013207004	0.00025
1977	-0.080784775	0.00014
1978	0.032848507	0.00013
1979	0.025849492	0.00013
1980	0.020765424	0.00026
1981	0.036087826	0.00009
1982	-0.002157008	0.00018
1983	0.046340913	0.00003
1984	0.013646077	0.00007
1985	0.002502453	0.00010
1986	0.046933681	0.00006
1987	0.031323094	0.00018
1988	0.042927525	0.00007
1989	0.028861520	0.00078
1990	-0.003056151	0.00062
1991	0.034909770	0.00011
1992	0.029530934	0.00008
1993	0.030917146	0.00008
1994	-0.003293719	0.00012
1995	-0.004762928	0.00007
1996	0.017224452	0.00014

Table 4.14: Regression Diagnostics, $VRWP_t = \alpha_0 + \alpha_t \Delta RWP_t + \varepsilon$

	Constant	ΔRWP_t	DW Statistic	R^2
$VRWP_t$	0.0002	0.002	1.31	0.06‡
	(2.95)***	(1.14)		

t-statistics are in parentheses, *** indicates significance at the 1% level and ‡ indicates rejection of normality of residuals.

Adopting Parks (1978) methodology of comparing the first-difference logarithm of an aggregate series against the weighted variability of its sub-components, Tables 4.7-4.14 and Figures 4.3-4.6 present results for nominal wages, unemployment and the two measures of regional real wages. The main point of this was to examine whether periods of inter-regional variability across the three variables were apparently correlated both in space and time. In all cases with the exception of nominal wages increased inter-regional variability is evidence around the late 1980s and early 1990s.

Tables 4.8, 4.10, 4.12 and 4.14 present regression results of the regional variability measure against the changes in the aggregate movements for each regional variable using all 11 regions. Each regression is based on equation (4.2), reproduced from Chapter Three:

$$VP_t = \alpha_0 + \alpha_1 \Delta P_t + \varepsilon_t \qquad (4.2)$$

where the inter-regional variability measure of the regional variable (V) is regressed against a constant and the first difference logarithm of the aggregate series. Here P is replaced with W, U, RWR and RWP representing nominal wages, total unemployment, regional price-deflated real wages and RPI-deflated real wages respectively.

As discussed in Chapter Two, variation in each of the regional series greater than the weights attributed to each region is indicated by a significantly large change in the weighted variability series. In the cases of prices from Chapter Two, nominal wages and both real wages series there is evidence of increased inter-regional variability from 1989-1991, for unemployment however the period is taken to be 1991-1993. The reason why unemployment would adjust after real wage adjustment would indicate some sort of sluggish labour market adjustment process. What is of interest, however, is that the nominal wage variability is comparatively weak given the real wage variability, this suggests that real wage inter-regional variability comes much more through prices than through wages. On face value it would appear that the two different regional real wage measures of inter-regional variability are different, but they both measure the same effect of a rise from 0.0002 to 0.0008. What is most interesting about these results, is that over the late 1980s / early 1990s wages and unemployment display a direct relationship between increased inter-regional variability and first differences but both measures of real wages show a negative relationship. Over the 1989-1991 period, real wages were falling but disproportionately so across regions.

Unlike regional prices it was possible to reject the presence of a unit root at the 10% level in all four cases for both sets of variables. However, according to the Jarque-Bera statistic it was also possible to reject the hypothesis of normality of residuals at the 1% level of significance. This appears to have been due to a noticeable structural break around the 1990s.

Rejection of normality implies that the estimated parameters in each of the regressions are inconsistent. The impression gleaned from the Figures is, however, one in which, other than for nominal wages, there appears little support for a causal relationship between the inter-regional variability of unemployment and both measures of regional real wages and the first-difference logarithm of the national average.

The results suggest that the inter-regional variability of unemployment and real wages increased over the late 1980s and early 1990s. The extent of this variability and how this relates to labour market interactions and the regional labour market economy is the focus of the next section.

4.3 Regional Labour Market Analysis

The use of a region-specific price index allows the construction of an explicit regional real wage variable. Within the context of regional real wage behaviour the hypothesis that the regional economy is not significantly different from the national average can be tested and compared with the findings on the more commonly used RPI-deflated measure of regional real wages. It is thought that the inclusion of a region-specific price variable improves the modelling of regional labour market interactions In the context of this thesis this relates to trying to model and understand the apparent changing regional unemployment landscape of the early 1990s. Analysis of the regional labour market, however, involves the issue of identifying deterministic processes, in particular is the issue: are regional economic variables driven by the region or by the wider economy?

The idea that regional markets be modelled as separate / identifiable economic entities was implicitly brought to attention by Lipsey (1960) with his so-called aggregation hypothesis and rests uneasily within a neo-classical framework. The neo-classical model fails to explain persistent differences in regional economic variables, unless it is assumed either institutional factors are preventing the operation of free markets, or such economic differences are actually consistent with regions being in equilibrium. This latter conjecture has, however, been widely disputed (see Blackaby and Manning (1987)). Nonetheless the notion of regional unemployment differences being compatible with regional labour market equilibrium has been considered with respect to the industrial structure (e.g. Thirlwall (1966), Forrest and Naisbitt (1988)) and unemployment structure (e.g. Brechling (1967)) of each region. Such examinations offer the possibility of explaining regional economic behaviour and an understanding of the mechanisms at work. Regional labour market models have been developed by a number of authors.

4.3.1 Labour Market Models

This section explores the evidence for explicit regional economic relationships existing in the context of simple wage determination models.

The application of the original Phillips curve to the regional economy is first based on Lipsey's (1960) attempt to rationalise the Phillips relation and the non-linear effect that unemployment was assumed to have on wages. The Phillips curve was applied to regions and generated regional Phillips curves. Lipsey's so-called aggregation hypothesis argued that the aggregate Phillips curve would lie above its regional versions when regional unemployment rates differed due to the averaging process involved in calculating the aggregate unemployment rate. As a result the more diverse regional unemployment rates, the greater the distortion between the aggregate and the regional versions of the curve.

Lipsey argued that rationalisation of the Phillips relation in terms of the unemployment rate and the rate of change of money wages at the regional level, implied differing regional Phillips curve due to differing regional unemployment rates. As a result it was argued that this implied the regional economy was being driven by factors separate to the national average. Whilst there were a number of early studies trying to estimate regional Phillips curves (see Chapter Five) these have since died down and are now much fewer in number, (recent estimated models include Johnes (1989) for the UK and Payne (1995) for the US)). Why this should be the case in part relates to the difficulty in establishing, both empirically and theoretically the case for regional economies operating separately from the national, particularly with notions of equilibrium unemployment and price expectations introduced by Phelps (1970) and Friedman (1968).

The notion of a regional labour market determined by region-specific factors has recently been developed using cross-sectional data by Blanchflower and Oswald (1990) and called the wage curve. The model supports the notion of a non-linear relationship between a region's unemployment rate and its real wage level, called the unemployment elasticity of pay.

4.3.2 The Wage Curve

The wage curve is the development of work by Blanchflower and Oswald (1990) using panel data analysis to establish a relationship between the real wage level for a given sector, e.g. industry, region etc., and its unemployment rate. The work is based on the earlier work of Sargan (1964) and others in relation to the Phillips curve. Within the context of a wage bargaining model, Blanchflower and Oswald argue that the bargaining power of the worker is proportional to the probability of gaining temporary employment elsewhere and to the value of leisure. They argue that there is a non-linear relationship between the worker's bargaining power and the unemployment rate, such that at low levels of unemployment the unemployment elasticity of pay is higher than at high levels of unemployment. Their findings lead them to believe that they have found support for the view that "wage flexibility is greatest when unemployment is low" (p. 232 (1990)).

The reasoning behind such a model is simple and consistent with any general wage bargaining model in which lower unemployment forces up real wages. Such a model predicts that each region's relative real wage-unemployment relationship varies according to the differing regional unemployment rates. Assuming the wage curve to be stable through time and that regional wage curves are similar to each other then the non-linear relationship modelled between the unemployment rate and regional real wage levels implies that the dispersion of regional real wages is determined by the dispersion of regional unemployment.[5]

4.3.3 The Aggregation Hypothesis

The aggregation hypothesis first proposed by Lipsey, argues that the national Phillips curve will lie above each of the regional Phillips curves if regional unemployment rates differ. This hypothesis is based on the premise that the regional wage inflation unemployment relationship is non-linear. Proportionate changes in regional unemployment rates will lead to disproportionate changes in wage inflation. As noted by Thirlwall (1970, p.19), this relationship suggests that aggregate wage inflation will fall for a given national unemployment rate if the dispersion of regional unemployment falls.

The aggregation hypothesis and the wage curve model stress the relationship between the regional unemployment rate and [real] wages. What differs between the two, or is made rather more explicit in the case of the wage curve, is that its regional findings are assumed determined at the regional level. Whilst the aggregation hypothesis incorporates the idea of regional unemployment rates differing it does not explain why this might be the case, regional economics statistics might simply be an arbitrary division of the national economy and as such implies no deterministic processes occurring at the regional level. What both the aggregation hypothesis and the wage curve model do, however, is question the representation of the national real wage-unemployment relationship at the regional level. The notion, however, that regional markets have a wage inflation-unemployment relationship within them but

[5] Blanchflower and Oswald (1990) later argue that an unemployment rate greater than around 12.5 % would fail to exert any influence on the determination of the real wage level (p. 230) However, this was based on industrial data. In their book in which they examine regional wage curves they produce

not across them can be considered problematic (see Hanson (1970) and Smith and Patton (1971). It implies that regional labour markets are frictionless, cost-less wage-unemployment adjustments but that this does not occur out side of the region at the national level. However, evidence of the existence of a wage curve at the regional level, and studies into regional wage determination do support the case for the existence of regional variables being determined in regional markets. These findings suggest that intra-regional mobility is greater than inter-regional mobility.

The point made by the aggregation hypothesis is also made by Jackman and Savouri's (1991) study into regional wage determination for the UK, not only with respect to the dispersion of unemployment but also in the context of regional versus national wage-setting. Jackman and Savouri (J&S hereafter), examine how average wage inflation can be reduced against a constant average unemployment, or average unemployment reduced against a constant wage inflation rate. The model they present, (first introduced in Jackman *et al*, (1990)) is given below as Figure 4.7.

J&S compare the regional dispersion of unemployment across a national economy that comprises two regions that differ in productivity. Setting employment in each regional economy equal to 1, the regional wage and unemployment rates can be determined according to the wage determination process assumed to prevail given the labour demand curves D^1D^1 and D^2D^2.

J&S consider three scenarios of wage determination. The first scenario is that wages are set independently in each region, as a result regional unemployment rates will be the same and there will be no regional dispersion of unemployment. In Figure 4.7 these two points are depicted as wage rates W_1^* and W_2^* with unemployment given by L^*. The second scenario takes the opposite extreme in which the prevailing regional wage rate is set as a national average. Differing productivities lead to a relatively large dispersion of unemployment, unemployment is thus given as $(1-\overline{L}_1)$ and $(1-\overline{L}_2)$ for regions 1 and 2 respectively. J&S, however, assume that the third scenario is the most likely, this is where they posit regional wages being determined

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a less non-linear relationship in which unemployment exerts an influence on the regional real wage rate throughout (Blanchflower and Oswald (1994), p. 277).

by a combination of regional and national characteristics thus producing a curved wage function given by *WW*. Here the wage and unemployment equilibrium for regions 1 and 2 are given by (W_1, L_1) and (W_2, L_2) respectively. The curvature of the wage function determines the relationship between the average wage rate and the average unemployment rate more precisely it answers the question as to whether the overall level of unemployment in the economy as a whole, for given average wages, is affected by the dispersion of unemployment between the two regions.

Figure 4.8 demonstrates this by comparing the average unemployment rate and the average wage rate for two scenarios – a linear wage function and a non-linear wage function.

> "If the wage function is a straight line, the average wage in the economy depends only on the average level of unemployment but if the wage function is curved, the more dispersed the regional unemployment rates, the higher the average wage for any given overall level of unemployment," (p. 5)

The more it is assumed that unemployment exerts a non-proportional effect on wages, the more curved the wage function is and the higher the average wage will be for given average unemployment.

Figure 4.7: Wages and Employment in Two Regions[6]

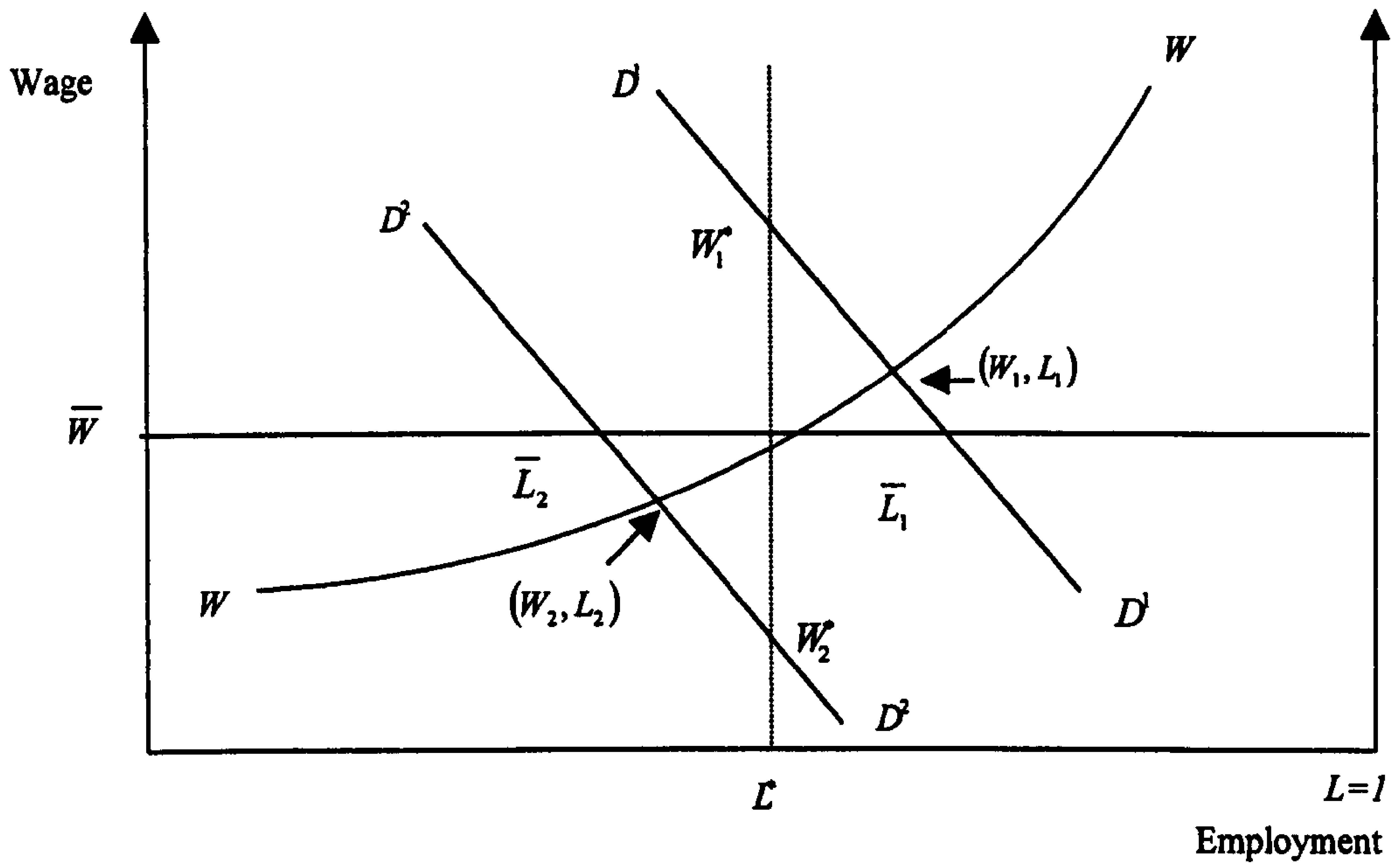
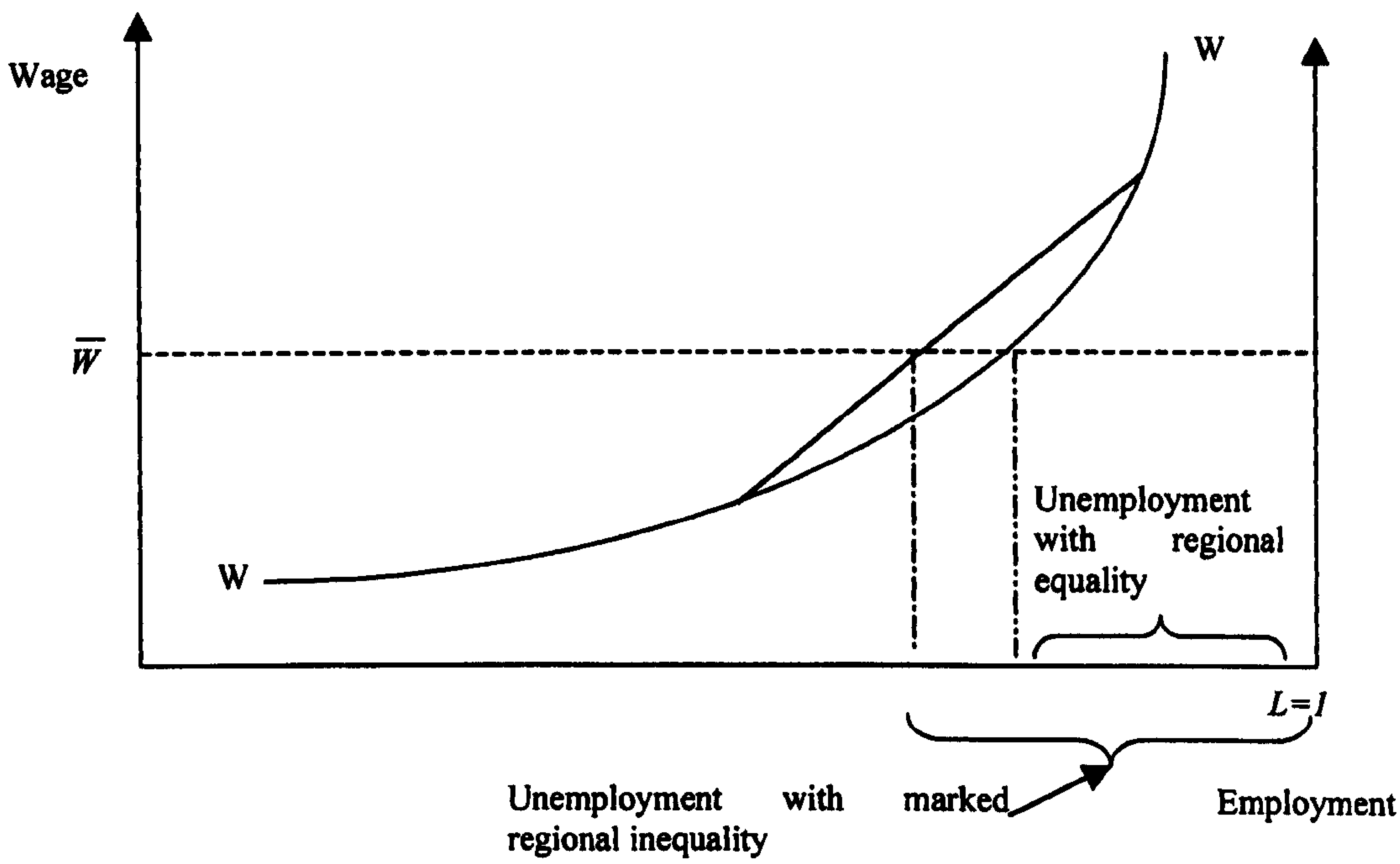


Figure 4.8: Regional Inequality and Unemployment[7]



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[6] Taken from Jackman and Savouri (1991), p.70.

[7] *Ibid*

J&S thus argue that for a given non-linear wage function, a reduction in the dispersion of regional unemployment while maintaining the average unemployment rate will reduce aggregate real wage pressures. They thus reach similar conclusions to those drawn by Lipsey and his aggregation hypothesis.

J&S's non-linear wage function is also similar to that of the wage curve:

> The unemployment differentials that are created are, thus, asymmetric in their effect. Higher unemployment rates in the depressed regions do relatively little to reduce wage pressure in such areas, but lower unemployment rates in more prosperous areas add significantly to wage pressures in those regions. (Jackman and Savouri, (1991, p. 5).

The major difference between these two models is in how they reconcile the behaviour of real wages and unemployment. The wage curve model is based on a union wage bargaining model and whilst unemployment determines real wage levels in both models, J&S argue that unemployment and productivity differences across the two regions initially set the differing real wages in theirs.

The J&S model makes no explicit assumptions regarding real wage – unemployment behaviour but it does have implications for relative wage and unemployment behaviour similar to those of the wage curve. These implications make it possible to predict relative unemployment and real wage levels based on the assumed non-linear wage function and can therefore be tested. The real wage-unemployment relationship in both models implies that the low unemployment / high real wage regions have a much greater unemployment elasticity of pay than the high unemployment / low real wage ones (Jackman and Savouri (1991) p. 5). As a result if the economy is subject to economic shocks (demand or supply-side, region–specific or national shocks), this will lead to changing *relative* unemployment and real wage levels, depending on the type and nature of the shock.

The hypothesis that regional unemployment determines regional real wages lies at the heart of all three models: Lipsey's aggregation hypothesis, Blanchflower and Oswald's wage curve and J&S's non-linear wage function. More importantly they all make similar predictions of changes in relative real wages and unemployment. With estimates of regional real wages it is possible to test the predictions of the wage curve model based on the changing regional unemployment dispersion over the sample period. Examining the regional real wage – unemployment relationship it is possible to indirectly test the hypothesis that the unemployment elasticity of real pay is a function of the unemployment rate, i.e. that regional real wage differences will widen (narrow) and regional unemployment differences narrow (widen) from a common positive (negative) shock.

The first step to testing this hypothesis is to examine whether over the sample period economic shocks in which changes in regional unemployment are identified can be characterised as demand or supply and regional versus national.

4.3.4 Regional Real Wages and Unemployment

As noted earlier the dynamic relationship between real wages and unemployment is a difficult one to establish. The neo-classical model predicts diminishing marginal productivity of labour against fixed factors of production such that the (producer) real wage will fall as employment increases. In the context of the measured regional real wage an issue can be made of differentiating between consumer real wage and producer real wages. Using a cost of living or retail price index as a deflator, implies examination of the consumer real wage variable. Whether this is strictly problematic, however, depends on how closely the producer real wage and consumer real wage series track each other as well as which is the most relevant. Whilst no data can be offered in comparing the regional equivalent of a producer real wage series, the consumer real wage series is modelled here as a labour supply variable. Any labour market adjustment process will strictly speaking be referring to labour supply decisions.

4.3.5 Modelling Regional Real Wages and Unemployment Behaviour

Regional labour market models do not make explicit predictions of the cyclicality of real wages. More importantly the analysis of real wage - GDP cyclicality fails to examine and incorporate the determination of real wage behaviour at the regional level, (a point made by Abraham and Haltiwanger (1995)). Nonetheless the literature on real wage behaviour is vast and its importance as Brandolini (1993) states, can be as significant as that of helping to distinguish between competing macroeconomic models of the economy.

This section hopes to throw light on the regional labour market dynamics between real wages and unemployment over the 1974-1996 period with the innovation of using the constructed regional price deflator. The added difficulty with this, however, is in predicting the real wage-unemployment relationship given by the models of Blanchflower and Oswald and J&S. The wage curve is one of a variety of models in which union wage bargaining predicts procyclical real wage behaviour against real GDP, (countercyclical against unemployment). The J&S model is, however, more difficult given the presumption of real wage levels initially determined by marginal productivity differences, however, their assumptions of regional real wage differences and unemployment influencing real wage behaviour similarly predicts a counter-cyclical real wage-unemployment relationship (procyclical against real wage-GDP).

To examine the real-wage unemployment relationship for the UK as a whole, equation (4.3) was regressed for the periods 1974-1996, 1980-1983 and 1990-1993, for all regions using both the regional price deflator and the RPI deflator:

$$\Delta RW_{it} = \beta_0 + \beta_1 \Delta U_{it} + \varepsilon_{it} \tag{4.3}$$

where RW_{it} represents the logarithm of the real wage rate in region i at time t, and U_{it} the unemployment rate in region i at time t and ε_{it} is a random error.

Table 4.15: Real Wage-Unemployment Relationship Regional Price-Deflated,

$$\Delta RW_{it} = \beta_0 + \beta_1 \Delta U_{it} + \varepsilon_{it}$$

	Years	Constant	Unemployment
All Regions	1975-1996	0.01	0.01
		(3.10)***	(0.58)
All Regions	1980-1983	0.03	-0.04
		(6.05)***	(-2.04)**
All Regions	1990-1993	0.02	0.09
		(4.34)***	(5.40)***

t-statistics are in parentheses for the full sample z-statistics are in parentheses for each of the sub-sample period (see footnote on p. 160), *** indicates significance at the 1% level and ** at the 5% level.

Table 4.16: Real Wage Unemployment Relationship; RPI-Deflated,

$$\Delta RW_{it} = \beta_0 + \beta_1 \Delta U_{it} + \varepsilon_{it}$$

	Years	Constant	Unemployment
All Regions	1975-1996	0.02	0.01
		(5.49)***	(1.01)
All Regions	1980-1983	0.02	0.02
		(3.14)***	(1.41)
All Regions	1990-1993	0.02	0.06
		(5.40)***	(4.02)***

t-statistics are in parentheses for the full sample z-statistics are in parentheses for each of the sub-sample period(see footnote on p. 160), * ** indicates significance at the 1% level and ** at the 5% level.

Residuals from each regression were tested for normality, serial correlation and heteroscedasticity. Residual test results indicated that it was not possible to reject the hypothesis of no serial correlation in the full sample period. For all sample periods it was not possible to accept the null hypothesis of normality and the presence of no heteroscedasticity. In the case of the two small sample periods, equations were estimated using GLS (Generalised Least Squares)[8].

Estimations of the parameters in equation (4.3) and variations thereof can be found in a number of studies, (e.g. Bodkin (1969), Bils (1985) and Barsky and Solon (1989)). The sign and significance of the coefficient β_1 is interpreted as indicative of the relative behaviour of unemployment. The pooled estimate results are given in Tables 4.15 and 4.16.

The hypothesis that regional real wages and unemployment are negatively related with unemployment, as predicted by the two wage determination models, was tested over the recessionary periods 1980-1983 and 1990-1993, and over the full sample period. The reason for focusing on the two recessionary periods is that they are most closely identified with negative economic shocks. The results for the two periods are compared with those over the full sample period.

For each real wage variable, over the full sample period, it was possible to reject the null hypothesis that regional real wages and unemployment are negatively correlated. For the two sub-sample estimates the results are mixed. Whilst it was not possible to reject the hypothesis of a countercyclical real wage-unemployment relationship in the case of the regional price-deflated real wage series, this hypothesis was rejected for the RPI-deflated series. Over the 1990-1993 period, both real wage series rejected the hypothesis and both predicted a procyclical real wage unemployment relationship.

The results from Table 4.15 highlight a number of issues. The inability to capture a clear real wage–unemployment relationship over the full sample period is consistent with the economy being subject to both demand-side and supply-side shocks over the

[8] Due to the small sample size regressions on pooled data estimations were performed using the statistical package STATA and the method of Generalised Least Squares

period, countercyclical and procyclical real wage behaviour could then be cancelled out. In the context of the wage determination models a demand-side shock would elicit a countercyclical real wage-unemployment relationship, a supply-side shock the reverse. Determining the behaviour of the real wage variable is a function of the time period and therefore of the shocks within that period (see Abraham and Haltiwanger (1995), p.1259). Secondly, and related to the first point, the failure of the RPI-deflated real wages to exhibit any significant relationship with unemployment is curious for the 1980-1983 period. This finding could be considered consistent with some of the debates in the literature regarding the cause of the shock that led to the rise in unemployment. The literature, however, tends in general to support the notion of a negative demand-side shock causing unemployment to rise in the early 1980s, based on the prediction of the wage determination models the regional price-deflated real wage series supports this notion[9]. Of more interest, however, is the failure to accept the null hypothesis of a countercyclical real wage-unemployment relationship in the recessionary period of 1990-1993. Whilst a number of authors identify this particular period as characterised by a negative demand-side shock (Morgan (1996), Evans and McCormick (1994) and, McCormick (1997)), the behaviour of real wage and unemployment do not support this.

The pooled regression estimates in Tables 4.15 and 4.16 produce real wage-unemployment coefficients for the 1990-1993 period that conflict with the predictions of the wage determination models in the context of a negative demand-side shock. How robust these estimates are, is open to question. The estimated relationship is only a reduced-form equation without any specific analysis of causality. Furthermore it was not possible to reject the null hypothesis of the presence of cross-sectional correlation[10] amongst the residuals at the 5% level which

[9] For the 1980-1983 period the distinction between a negative supply-side shock that causes deindustrialisation against a rising effective exchange rate, and a negative demand-side shock that causes high interest rates is difficult. According to Dimsdale a combination of the two is the most realistic scenario with a tight monetary policy coincident with rising oil prices and domestic costs (1991, p. 132-133). However, Broadberry attributes the large rise in unemployment to the deflationary policies pursed by the then Conservative Government (1991, p. 230).

[10] Breusch and Pagan (1980) suggest a Lagrange-Multiplier (LM hereafter) test for testing whether the variance-covariance matrix of the error term on a system of equations is diagonal, rejection of the null indicates the presence of cross-sectional correlation amongst the residuals.

affects the efficiency of the estimates.[11] Nonetheless the results taken as they are imply that over the recessionary period of 1990-1993, relative real wage-unemployment behaviour, according to both measure of the regional real wage rate, are inconsistent with the predictions of the wage curve and J&S's model of regional real wage behaviour.

This section tested the hypothesis that the real wage-unemployment relationship was countercyclical, using both the regional price series and the RPI as nominal wage deflators over the two recessionary periods 1980-1983 and 1990-1993. The results have to be interpreted in the context of the nature of the economic shock presumed to have impacted the economy. In the context of a supply-side shock both wage determination models predict a procyclical real wage-unemployment relationship and the reverse with a demand-side shock. Only with the regional-price deflated real wage series was evidence found in support of a countercyclical real wage-unemployment relationship, thus indicating that the 1980-1983 shock was a negative demand-side shock and therefore supporting the validity of the wage-determination models.

The negative demand side shock of the 1990-1993 recessionary period, however, leads to the wage-determination models predicting a negative real-wage unemployment relationship. This prediction is not supported by the estimated coefficients of either real wage series. Consequently the wage curve and J&S models of wage determination fail to predict the real wage-unemployment relationship over this period. Why these wage models fail to accurately predict this relationship over the 1990-1993 recessionary period is of interest. What makes this recessionary period different from all others, however, is the changing regional unemployment profile that characterises it. The wage determination models' expected real wage – unemployment relationship comes from the predicted curvature of their respective wage functions and the regional dispersion of unemployment. This is examined in the next section.

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[11] In models of the wage curve model, no attempt to test for the presence of cross-sectional correlation in the residuals across sectors is made. Rodesh (1990)) argues that this alone affects the level of confidence that can be placed in its results.

4.3.6 Regional Real Wages and the Dispersion of Unemployment

The aggregation hypothesis argues that the greater the dispersion of regional unemployment, the higher is the wage inflation-unemployment relationship in the aggregate Phillips curve against each of the regions. In the context of both the wage curve and J&S model, higher real wage levels are associated with lower unemployment rates. All three models in predicting regional real wage behaviour predict that regional real wage relativities are inversely related to regional unemployment relativities based on the curvature of the wage function. The assumption is that lower unemployment regions have higher real wage levels and hence a higher unemployment elasticity of real wage and vice versa for high unemployment regions. The implication is that common aggregate demand side shocks will change the relative dispersion of both the regional unemployment and real wage rates: a positive demand-side shock will reduce the dispersion of unemployment but widen the regional dispersion of real wages, and for a negative demand-side shock the reverse. In the previous section, the estimated coefficients on the real wage-unemployment relationship over the 1990-1993 period, for both real wage series, were inconsistent with the predictions of the wage determination models. However, this 1990-1993 period consisted of a dramatic shift in the regional dispersion of unemployment and this might be the cause of this predictive failure.

To examine the relationship between the regional real wage and unemployment dispersion the hypothesis that the dispersion of the regional real wage rates is a function of the dispersion of regional unemployment rates was estimated over the sample period 1974-1996, using both measures of regional real wages. The predictions of the wage models, however, depend on the sources of the changes in unemployment, whilst demand-side shocks predict a negative relationship, a supply-side shock gives the reverse. Given the changing regional unemployment relativities of the 1990s, equation (4.4) was also estimated over the 1974-1989 period. The two sets of regressions were then compared by means of trying to determine what impact regional unemployment in the 1990-1996 period, had, if any on real wages.

$$\Delta ARW_t = \beta_0 + \beta_1 \Delta AU_t + \varepsilon_t \qquad (4.4)$$

where ARW_t is the absolute dispersion of regional real wages deflated by either the regional price index or the RPI in period t, AU_t the absolute dispersion of regional unemployment and ε_t is a random error. The results are presented in Tables 4.17 and 4.18.

Table 4.17: Regression Results: Absolute Dispersion of Regional Real Wages and Regional Unemployment, Regional Price-Deflated 1976-1996,

$$\Delta ARW_t = \beta_0 + \beta_1 \Delta AU_t + \varepsilon_t$$

Years	Constant	Unemployment	R^2
1975-1989	0.08	-0.54	0.49†
	(3.16)***	(-2.20)**	
1975-1996	0.03	-0.04	0.26
	(1.98)*	(-0.35)	

t-statistics are in parentheses, *** indicates significance at the 1% level, ** at the 5% level, * at the 10% level and † signifies Cochrane-Orcutt correction for serial correlation.

Table 4.18: Regression Results: Absolute Dispersion of Regional Real Wages and Regional Unemployment, RPI-Deflated 1976-1996,

$$\Delta ARW_t = \beta_0 + \beta_1 \Delta AU_t + \varepsilon_t$$

Years	Constant	Unemployment	R^2
1975-1989	0.25	-0.88	0.13‡
	(3.64)***	(-1.40)	
1975-1996	0.14	0.06	0.002‡
	(3.76)***	(0.21)	

t-statistics are in parentheses, *** indicates significance at the 1% level and ‡ indicates non-normal residuals.

For each variable it was not possible to reject the hypothesis of a unit root at the 10% level. All series were therefore logged and first-differenced stationary. Residuals from each estimated equation were tested for first-order serial correlation, heteroscedasticity and normality. It was not possible to reject non-normality of residuals in the regression estimates of the RPI-deflated real wage series.

The estimated regression results differ according to the measure of the real wage and the sample period. For the full sample period neither measure of the real wage is found to be significantly related to the dispersion of unemployment, though the inability to reject non-normal residuals in the case of the RPI-deflated series implies that these results cannot be interpreted with a great amount of confidence and to all intents and purposes identify a weakness in using the RPI for regional real wage analysis. The inability to find any significant relationship between the dispersion of real wages and unemployment is expected if the period is characterised by both demand and supply-side shocks. However, the result for the 1975-1989 period indicates evidence of a negative relationship between the regional dispersion of real wages and unemployment, the estimated coefficient is significant at the 5% level in the case of the regional price-deflated real wage series. Furthermore 49% of the dispersion of regional price-deflated series is associated with unemployment. This latter result is in keeping with the predictions of the curvature of the wage function given in both wage determination models. Comparing the regression results for regional price-deflated-real wages series over the two periods indicates that the relationship between the dispersion of real wages and unemployment appears to have significantly weakened from 1990 onwards.

The estimated relationship given in equation (4.4) is simplistic, possible problems with errors in variables might explain the results as well as a possible simultaneity bias between real wages and unemployment. The relatively small number of observations coupled with correction for the presence of serial correlation, non-normal residuals and low t-values means that the results are unreliable and caution should be exercised in the interpretation of these results. However, the results with the regional price-deflated series indicate a fairly strong inverse relationship over the 1975-1989 period. The poor reported results of the RPI-deflated regional real wages questions the use of the RPI as a regional price deflator.

This section has explored the relationship between real wages and unemployment in the context of examining regional real wage behaviour. More specifically it tested the predictions of two wage determination models of regional real wage and unemployment relativities. It found support for the hypothesis that regional real wages and unemployment dispersion are related but only when regional real wages are deflated by the regional price series and only over the 1975-1989 period. Modelling over the entire sample period produces insignificant results. The post-1990 period appears to deserve special attention. Evidence provided in the previous section indicated support for the hypothesis that the large rise in the national unemployment rate in the context of a negative demand shock was consistent with rising real wages. This contradicts the predictions made by the two models of wage determination. It would appear, however, that the changing pattern of regional unemployment relativities, unique to the 1990-1993 period was the main reason for this.

The 1990-1993 period is characterised as a period in which the unemployment rate rose in all regions. In the context of a common negative demand-side shock, the wage determination models of Blanchflower and Oswald (1990, 1994) and Jackman and Savouri (1991) predict that this would lead to a relatively larger real wage adjustment in the low unemployment regions and a relatively higher unemployment adjustment in the high unemployment regions. As a result regional unemployment differentials are predicted to increase. The fact that regional unemployment differentials narrowed despite regional unemployment rates rising over the 1990-1993 period suggests that the economic shock might not have been symmetrical in its impact on the UK economy. This possibility might be the key to understanding why the predictions of the wage determination models are not realised.

To examine the regional impact of the economic recession of the early 1990s, what needs to be established is why did regional unemployment differentials narrow as unemployment rates rose? In all previous demand-side recessions unemployment rates rose whilst differentials widened. Two hypotheses can be ventured in seeking to answer this question. The first is that the wage-determination processes across the regions of the UK differ from one another. As a result a given aggregate wage determination model cannot adequately explain the behaviour of regional real wages and unemployment. The second is that regions differ in the impact of an economic shock, in the case of the early 1990s this ties in with the belief that the economic recession hit the south more than the north.

Both of the above hypotheses try to explain why the dispersion of regional unemployment narrowed over the post-1990 period when unemployment rose. In relation to Chapter Two this corresponds to the issue of a north-south divide in explaining regional unemployment relativities. To investigate this issue and test these hypotheses over the post-1990 period the small number of available observations implies the need to begin pooling the regional data. To examine the regional–specific characteristics of the 1990-1993 recession it was decided that the data be split along the regional north-south divide of Chapter Two, based on relative regional unemployment rates.

4.4 The North-South Divide

Dividing the UK regions into a north and a south was, in Chapter Two, based on relative unemployment differences over the period 1974-1996. The north was defined as those regions in which the unemployment rate was consistently higher than the national average: the North, the North-West, West Midlands, Yorkshire and Humberside, Northern Ireland, Scotland and Wales. The south then was defined as those regions in which unemployment was consistently below the UK national average: East Anglia, East Midlands, the South-East and the South-West. Dividing the regions up in this way for the sake of comparing regional economic behaviour across the two groups implies that differences are greater across groups than within.[12] This section examines the relative regional economic behaviour of the two regional groups against each other and against the national average (pooled estimates). The regression results presented in the previous two sections identified estimation problems with the use of the RPI-deflator as a result only the regional price-deflated real wage series were used for estimation purposes.

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[12] This is a controversial subject and raised by Blackaby and Manning (1990a), they cite Green (1987a, 1987b) as providing evidence of the UK being clearly divisible into two distinct geographical areas developing over and above within-regional differences.

To test the hypothesis that the real wage-unemployment relationship is not significantly different across the regional groups and that the underlying real wage–unemployment processes are similar. Equation (4.5) was estimated using pooled regional data for the periods 1975-1996, 1975-1989 and 1990-1996 for all regions, the north and the south:

$$\Delta RW_{it} = \alpha_{0i} + \alpha_{1i}\Delta U_{it} + \varepsilon_{it} \tag{4.5}$$

where RW_{it} represents the logarithm of the regional price-deflated real wage rate in region i in period t, and U_{it} is the logarithm of the regional unemployment rate and ε_{it} is a random error.

Initially all data were tested for the presence of a unit root. Using the ADF test it was not possible to reject the null hypothesis at the 1% level. As a result the data were logged and first-differences taken. As with earlier regressions the residuals were tested for serial correlation, heteroscedasticity, and normality. The notion of dividing the region up into a north and a south, however, led to consideration of the presence of regional interactions within the regional groups themselves. By definition the division suggests that there are economic characteristics particular to each group greater than the across all regions as a whole. The notion that regions might influence each other contemporaneously was first introduced by Marcis and Reed (1974) using Zellner's estimation technique known as the Seemingly Unrelated Regression (SUR hereafter).[13]

[13] SUR consists of writing a set of individual equations as one equation. Assuming there are N equations described as $Y_i = X_i\beta_i + \varepsilon_i$ where the subscript i refers to the ith equation, Y_i, β_i and ε_i are vectors and X_i is a data matrix. If the residuals are contemporaneously correlated across equations, such that for example, the tth error term in the ith equation is correlated with the tth error term in the jth equation, the variance-covariance matrix of the residuals will not be diagonal. Estimating these error correlations and the diagonal elements (by using the residuals from each equation estimated separately) should allow estimation of the variance-covariance matrix of ε^* and generation of estimated generalised least squares estimates of β^* SUR will be identical to OLS if a) the X_i are all the same or b) the variance-covariance matrix of the error terms is diagonal.

The Breusch-Pagan test for the presence of cross-sectional / contemporaneous correlation was used over all 6 regional groupings over all three sample periods. In all cases the null hypothesis of no cross-sectional correlation was rejected. This result implies that the estimated coefficients in each equation would be inefficient if using OLS, instead each equation was estimated using the method of SUR.[14]

The exact interpretation of this result is discussed in a number of papers but Greene (1997) gives an excellent discussion. Essentially, in the case of regions it implies that the estimated equations share a common omitted variable affect which in this case would refer to variables such as national wage policies, taxation or monetary factors etc.

It is arguable that SUR estimation techniques should have been applied in all previous regional equation estimates. Furthermore when it comes to estimating systems of equations that panel data techniques should be adopted. A system of equations relates to, in this context, the pooling of identical regional equations that are jointly estimated. The literature, however, sub-divides these into two types of model estimations, panel data and pooled. Both models refer to cross-sectional observations on data through time and whilst the literature has become less distinct between the two they can be differentiated with respect to the relative size and frequency of the number of cross-section units against time series. Panel data estimations typically involves a relatively large number of cross-sectional variable over a short time period and in which the time periods are viewed as "transitions" or discrete changes of state. That is the data are typically modelled as specific to the period in which they occur and are not carried across periods within a cross-sectional unit.[15] As a result this modelling of differences across variables has led to the development of two different models, the so-called Fixed Effects model in which the variables modelled are assumed to represent the entire population of that variable and Random Effects model in which the estimated variables are assumed to be a sub-component of all possible variables. Of these two models only the Fixed Effects

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[14] The computer software package used was Eviews but it was unable to calculate estimates on the pooled smaller sample 1990-1996 using the SUR technique. In its stead the package STATA was used to generate GLS estimates whilst correcting for the presence of cross-sectional correlation. For the full sample period GLS estimates in STATA were comparable with Eviews

[15] As a result of this heterogeneity across units is an integral part and often a central focus of the analysis, (Greene (1997)).

model can be applied to estimations using the SUR technique but only in the estimations involving all 11 regions. The Random Effects model cannot be used along with the SUR technique because this assumes that the random error associated with each cross-section unit is uncorrelated with the other regressors. (See Kennedy (1999)).

Whilst the SUR technique is most commonly applied to pooled data estimations, in which there are typically fewer cross-sectional variables than time periods and in which the dynamics of the equations are captured over time, application of a Fixed Effects estimator might be warranted on the grounds that differences in the intercept term can be captured with the use of dummy variables. In all regressions the null hypothesis that the estimated coefficients on the dummy variables for the intercept term were significantly similar could not be rejected[16][17], and Fixed Effects estimation not adopted.

The regression results from the SUR are given in Table 4.19.

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[16] Kennedy (1999) discusses N. Beck and J. N. Katz's paper "What to do (And not to do) with Time-Series Cross-Section Data". American Political Science Review, 1995, Vol. 89 pp. 634-647. In their paper they analyse the results from estimating time-series cross sectional data in which fixed effects models are estimated assuming the presence of contemporaneous correlation between the errors of different cross-section units and autocorrelation. They find that they produce poor estimates because the error variance-covariance matrix is poorly estimated.

[17] Greene (1997) mentions in a footnote (pp. 615) that the Fixed Effects model might be adapted to control for regional differences in the slope coefficient, this was not possible to do with the packages available, and raises a number of methodological

Table 4.19: Real Wage-Unemployment Relationship, $\Delta RW_{it} = \alpha_{0i} + \alpha_{1i}\Delta U_{it} + \varepsilon_{it}$

Region	Period	Constant	Unemployment	R^2	No. Obs
All Regions	1975-1996	0.01	0.01	0.00	242
		(3.10)***	(0.58)		
North		0.01	0.02	0.03	154
		(2.53)**	(1.31)		
South		0.01	0.01	0.12†	88
		(4.63)***	(1.03)		
All Regions	1975-1989	0.01	-0.00	-0.04††	165
		(3.57)***	(-0.49)		
North		0.01	-0.00	-0.03	105
		(2.66)***	(-0.24)		
South		0.01	0.01	0.09†	60
		(3.38)***	(0.78)		
All Regions	1990-1996	0.01	0.09	Na	77
		(5.05)***	(9.65)***		
North		0.01	0.13	0.47	49
		(13.25)***	(18.45)***		
South		0.01	0.06	0.52†	28
		(20.24)***	(20.03)***		

t-statistics are in parentheses for full and pre 1990 sample, *z*-statistics are in parentheses for the post-1990 sample *** indicates significance at the 1% level, ** at the 5% level, * at the 10% level and † indicates Cochrane-Orcutt AR(1) correction for the presence of first-order serial correlation. †† indicates that serial correlation could not be removed.

For the pre-1990 sample period it was not possible to remove the presence of serial correlation in the case of the *all regions* measure. The null hypothesis of normality in the residuals was rejected over the full sample period. The results are presented in Tables 4.22 and 4.23. The presence of serial correlation implies a mis-specification problem with the equation, the residuals could be picking up a missing variable(s). The inability to remove it makes the estimated residuals inefficient and therefore need to be interpreted with care.

On face value, the results imply that there was a strong and positive association with regional real wages and unemployment over the post-1990 period, (supporting the countercyclical real wage-GDP hypothesis). Although this relationship was not found to be significant over either the 1975-1989 nor 1975-1996 sample periods. The estimated coefficients on unemployment over the 1990-1996 period are more than double that for the north than for the south. The Wald test on the restrictions that these coefficients are of the same value was rejected at the 1% level. The interpretation of these estimated coefficients is that a 1% rise in the unemployment rate in each of the regional groups leads to a 0.13% rise in the real wage rate in the north and a 0.06% rise in the south.

These results imply that the direction of the relative real wage response to changing regional unemployment was similar across the two regional groups. However, the results are those of a procyclical real wage-unemployment relationship contrary to the predictions of both the wage curve and J&S models of wage determination. Furthermore this counter prediction combined with the estimated coefficients indicates that regional real wages over this period were more responsive to unemployment in the north than in the south. An equal increase in regional unemployment, leads to slower real wage growth in the south than in the north. This procyclical result confirms the findings of the pooled regressions of Tables 4.15 and 4.16, and lends support to the neo-classical model of a procyclical real wage – unemployment relationship. This procyclical result runs contrary to the predictions of both the wage curve and the J&S models in which real wages are predicted to increase as unemployment falls. What is particularly striking is the significant difference in the real wage coefficients on unemployment. Assuming that the wage determination models hold up until 1990 with the high unemployment regions operating with a lower average real wage than the low unemployment regions, these estimated coefficients post-1990 imply that if the north and south experience an equal increase in unemployment, regional real wage differences would narrow. The failure for this to happen as captured in Figures 4.1 and 4.2 might be because the south experienced a much greater rise in unemployment than the north, the recession was asymmetric in its impact and as a result regional real wage differences merely stopped growing. Nonetheless, ceteris paribus, the results in Table 4.19 implying that over the 1990-1996 period real wages are more responsive to unemployment in the north than the south, that the unemployment elasticity of pay is greater the higher is the unemployment rate.

The inability for the wage determination models to accurately predict the real wage-unemployment behaviour indicates that the post-1990 period needs further investigation. Indeed the changing pattern of regional unemployment adjustment processes in the early 1990s implies that aggregate modelling of the UK economy is misleading.

4.4.1: Aggregate versus Region-Specific Shocks

The previous section tested the hypothesis that the regional response to the negative demand-side shock in the 1990s could be modelled in terms of a north-south divide within the context of real wage adjustment processes. Whilst a north-south split on the estimated real wage coefficient on unemployment was found these results only indicated some support for the hypothesis that regional real wage determination processes were statistically significantly different across the regional divide as suggested by Martin (1996). The findings on the estimated coefficients are, however, observationally equivalent with the hypothesis that the negative demand side shock may have been significantly greater in the south than in the north. This implies that although regions share similar real wage–unemployment processes, the negative demand-side shock of the early 1990s led to a narrowing of regional unemployment rates because the south experienced a greater negative shock than the north but real wages should have fallen by more, (see McCormick and Evans (1994)). To assess the relative regional real wage response to the change in demand in light of the changing unemployment patterns, and whether aggregate modelling of the economy is relevant, it is necessary to try and establish what type of shock hit the UK – aggregate or region-specific.

In the context of a common aggregate shock a simple examination of the relative nominal wage and price adjustments within a north-south context can be used to determine whether price and wage adjustment processes are statistically significantly different from each other. Assuming price and nominal wage setting to be similar across regions, asymmetrical adjustment in prices and wages can be taken as indicative of asymmetrical adjustment processes.

For the period 1975-1996 and 1975-1989 and 1990-1996, the hypothesis that north-south regional prices and regional wages are not significantly different from the national average were tested using equations (4.6) and (4.7):

$$\Delta P_{it} = \alpha_{0i} + \alpha_{1i}\Delta RPI_t + \varepsilon_{it} \tag{4.6}$$

$$\Delta W_{it} = \alpha_{0i} + \alpha_{1i}\Delta W_{UK,t} + \varepsilon_{it} \tag{4.7}$$

where P_i is the logarithm of the regional price series for group i over time t, RPI is the logarithm of the published RPI, i represents north and south regional groups. In equation (4.7) W_i is the logarithm of regional nominal wages and W_{UK} the logarithm of UK average nominal wages. In both equations ε_{it} is a random error term.

The results are provided in Tables 4.20 and 4.21.

All of the data were tested for normality, first-order serial correlation and heteroscedasticity. Inability to reject the null hypothesis of no cross-section correlation amongst the residuals meant that the 1975-1989 period was estimated using the SUR technique whilst the 1990-1996 was estimating using GLS and correcting for the presence of cross-sectional correlation.

Table 4.20: Regional Prices and the National Average Price (RPI),

$$\Delta P_{it} = \alpha_{0i} + \alpha_{1i}\Delta RPI_t + \varepsilon_{it}$$

Regions	Period	Constant	Prices	R^2
North	1975-1989	0.01	0.97	0.91
		(1.56)	(20.61)***	
	1990-1996	0.01	0.94	0.70
		(1.44)	(11.08)***	
South	1975-1989	0.02	0.91	0.92
		(2.34)**	(15.07)***	
	1990-1996	-0.01	1.12	0.83
		(-1.22)	(9.66)***	

t-statistics are in parentheses, *** indicates significance at the 1% level and ** at the 5% level.

Table 4.21: Regional Wages and the National Average Wage Rate,

$$\Delta W_{it} = \alpha_{0i} + \alpha_{1i}\Delta W_{UK,t} + \varepsilon_{it}$$

Regions	Period	Constant	Wages	R^2
North	1975-1989	-0.01	1.022	0.95
		(-2.98)**	(58.35)***	
	1990-1996	0.01	0.82	0.72
		(10.96)***	(47.70)***	
South	1975-1989	-0.00	1.00	0.91
		(-0.51)	(23.17)***	
	1990-1996	0.01	0.80	0.69
		(2.42)**	(9.19)***	

t-statistics are in parentheses, *** indicates significance at the 1% level and ** at the 5% level.

The results from Tables 4.20 and 4.21 are similar across the two regional groupings for the two periods. It was not possible to reject the null hypothesis that the coefficients were significantly different from one another, using the Wald test at the 1% level in all cases except for prices over the 1990-1996 period.

What the tables do is compare the relative growth rates of prices and nominal wages over the two periods and for the regions of the north against the south. Comparing the estimated coefficients the results indicate that over the post-1990 period, unlike nominal wages, significant regional price growth differences are estimated across the regional divide. Such a result is consistent with the hypothesis that the magnitude of the negative demand shock differed regionally, over the 1990-1996 period. If negative demand-side is assumed to hit the regions of the UK equally it would be expected that similar price adjustments would occur, the fact that this is not borne out by Table 4.20 fuels the debate regarding the symmetry of the impact of and / or the response to the 1990-1993 recession.

If it is the case that differences in prices are evidence of economic shock asymmetries given that similar wage adjustments are recorded across the two regional groups then the results in the two Tables imply that asymmetric real wage adjustment has come more through price changes than wages. This suggests that regional variations in prices are greater than wages. More importantly, if nominal wage differences do not change across regions then this finding suggests that the increased dispersion of regional real wages found earlier is a function of the behaviour of regional prices. The failure for nominal wage adjustments to match changes in prices implies the source of the breakdown in the predicted behaviour of real wages and unemployment by the wage determination models. This can explain why unemployment patterns changed in the post-1990 period and that the south responded poorly to the shock.

4.4.2 Wages, Prices and the Dispersion of Unemployment

The wage determination models of the wage curve and J&S argue for a non-linear relationship between real wage levels and unemployment. The models argue that real wage adjustment is far more sensitive to changes in unemployment in the relatively low unemployment regions. In the context of Thirwall's (1966) analysis of the cyclical sensitivity the predictions of these models are borne out, on the basis that low unemployment regions, at least up until 1990, exhibit a much smaller variation in unemployment to the national. The wage determination models argue that for regions with relatively lower unemployment than the national average, a greater emphasis on labour market adjustment takes place through real wages. The 1990-1993 recession led to a narrowing of regional unemployment differences whilst the national unemployment rate rose and the economy fell into a recession. Chapter Two verified this to be due to the inordinate rise in unemployment in the south and yet as established in this chapter, real wage differences, under both measures, did not significantly narrow.

The non-linear relationship of the above-named wage determination models posits greater unemployment-labour market adjustment in the high unemployment regions, against greater real wage-labour market adjustment in the low unemployment regions. This relationship is demonstrated in Figure 4.7 above. An equal increase in labour demand will ceteris paribus lead to a greater increase in employment in Region 2 than Region 1. This is not however, accompanied by so great an increase in real wages. As such increases in demand are predicted as leading to a narrowing of regional unemployment dispersion, but increased real wage dispersion. The estimated real wage – unemployment coefficients from Table 4.19 indicate that real wage rates grew against rising unemployment contradicting the predictions of the J&S model in the context of a negative demand-side shock. Regional real wage growth should have slowed as unemployment rose, and more so in the south than in the north. Given that the real wage comprises nominal wage and prices, the dispersion of unemployment can be analysed in the context of regional wage and price adjustment processes. The theoretical reasoning behind this is that whilst there is a simultaneity issue between unemployment dispersion and wage and price movements a comparison of the estimated coefficients across the north and south can be analysed in seeking to decompose regional real wage movements. This can provide a better idea of how unemployment dispersion narrowed in a recession and why regional real wages failed to fall.

The hypothesis that the dispersion of regional unemployment is determined by movements in regional wages and prices across the two regional groups of the north and the south is tested using both the regional price indices as well as the RPI over the full sample period and for 1990-1996 using equation (4.8):

$$AU_t = \alpha_{oi} + \alpha_{1i}\Delta P_{it} + \alpha_{2i}\Delta W_{it} + \varepsilon_{it} \tag{4.8}$$

where AU_t represents the absolute variation in total unemployment rates at time t, P_{it} is the regional price in region i, W_{it} regional real wages, and ε_{it} is a random error.

Each price and wage series was logged and first-differences taken to remove the presence of a unit root, it was possible to reject the presence of a unit root for the absolute variation of unemployment. All data were subject to tests for the presence of first-order serial correlation which could not be removed from the south over the full sample period, heteroscedasticity and normality. The residuals were also tested for the presence of cross-sectional or contemporaneous correlation using the Breusch-Pagan test. Unlike earlier regressions the dispersion of unemployment was being modelled as a system equations dependent on the relative regional wage and price series. Failure to accept the null hypothesis of no cross-sectional correlation can imply that there are omitted variables in the estimation that are common to all regions and as a result the estimated coefficients will be inefficient.

To overcome this problem equation (4.8) was estimated using Zellner's (1962) Seemingly Unrelated Regression (SUR hereafter) technique.

The null hypothesis of normality in the residuals was rejected over the full sample period. The results are presented in Tables 4.22 and 4.23.

Table 4.22: Regional Unemployment Point Differentials: Regional Prices,

$$U_t = \alpha_{oi} + \alpha_{1i}\Delta P_{it} + \alpha_{2i}\Delta W_{it} + \varepsilon_{it}$$

Regions	Time Period	Constant	Prices	Wages
All Regions ‡	1975-1996	0.02	0.12	-0.04
		(0.69)	(0.97)	(-0.61)
North		0.01	0.14	0.00
		(0.39)	(0.80)	(0.03)
South		-0.00	0.37	-0.05
		(-0.15)	(1.40)	(-0.51)
All Regions	1990-1996	0.02	0.74	-3.06
		(0.90)	(1.47)	(-7.41)**
North		0.08	0.94	-3.88
		(7.81)*	(14.84)***	(-22.41)*
South		0.04	1.65	-3.68
		(1.05)	(2.10)**	(-4.71)**

t-statistics in parentheses for the full sample estimation by SUR, z-statistics in parentheses for the post-1990 sample estimation via GLS. *** indicates significance at the 1% level, ** at the 5% level, * at the 10% level, ‡ indicates Cochrane-Orcutt AR(1) correction for serial correlation and ‡ indicates rejection of normality.

Table 4.23: Regional Unemployment Point Differentials: RPI,

$$U_t = \alpha_{oi} + \alpha_{1i}\Delta P_{it} + \alpha_{2i}\Delta W_{it} + \varepsilon_{it}$$

Regions	Time Period	Constant	Prices	Wages
All Regions	1974-1996	-0.05	0.89	-0.03
		(-1.27)	(2.37)***	(-0.72)
North		-0.05	0.89	-0.03
		(-1.17)	(2.16)**	-(0.45)
South		-0.05	0.88	-0.02
		(-1.08)	(1.98)*	(-0.28)
All Regions	1990-1996	0.05	-1.32	-1.95
		(1.64)	(-1.86)*	(-4.61)***
North		0.07	0.50	-3.65
		(12.02)***	(3.35)***	(-37.72)***
South		0.04	-1.69	-1.26
		(0.65)	-(1.37)	(-1.83)*

t-statistics in parentheses for the full sample estimation by SUR, *z*-statistics in parentheses for the post-1990 sample estimation via GLS. *** indicates significance at the 1% level, ** at the 5% level, * at the 10% level, ‡ indicates Cochrane-Orcutt AR(1) correction for serial correlation and ‡ indicates rejection of normality.

Over the 1990-1996 period the results based on the two different price deflators are mixed. Across the regional groupings Tables 4.22 and 4.23 offering contrasting relative priced and wage sensitivities to the dispersion of unemployment.

Table 4.22 which presents regression estimates using the regional price series as an independent variable finds no significant relationship between the dispersion of unemployment and price and wages over the full sample period. For the post 1990-1996 period the results are mixed. Whilst the estimated coefficient on prices is significant for the north and south regions this is not found to be the case for the pooled regional estimate. This finding is curious and suggests an aggregation bias is introduced when all regions are grouped together. For the north and south over the 1990-1996 period, however, nominal wages are found to exhibit a significantly negative but similar effect on the dispersion of unemployment, but prices are modelled as being significantly different. The dispersion of regional unemployment on regional prices in the south are modelled as being much more sensitive than in the north. Given the relatively large rise in unemployment in the south that led to the narrowing of unemployment this result is intuitively appealing. Although causality is a particular problem with possible simultaneity bias being introduced, Table 4.22 suggests that over the 1990-1996 period the relatively large rise in unemployment in the south was due to a highly sensitive real wage-unemployment relationship. A rising real wage rate in the south due to relatively slower price growth led to a relatively large rise in unemployment.

The RPI – based results in Table 4.23, however, contrast with those of Table 4.22 over the 1990-1996 period. Again whilst there might problems with a possible simultaneous bias in the estimation, the sensitivity of wages and prices against the dispersion of unemployment is estimated as being higher in the north than in the south. On its own this suggests that unemployment dispersion narrowed because of relatively higher wage and slower price growth in the north than in the south. This is not, however, intuitively obvious, the coefficients, however, might be suffering from an aggregation bias, both in terms of the dispersion variable as well as the use of the RPI. Over the 1990-1996 period, given the relatively large rise in unemployment in the south relative to the north, the estimated real wage – unemployment relationship from Table 4.19 predicts that, ceteris paribus, absolute real wage growth rates will be similar, the coefficient estimates on the absolute dispersion of unemployment suggest in Table 4.22, however, suggests that unemployment differences narrowed through relatively higher wage and slower price growth in the north relative to the south.

Which of the findings in Tables 4.22 and 4.23 is the more accurate is difficult to establish. The price asymmetry analysis in Table 4.20, however, supports the notion of relative price growth differences contributing to a greater real wage sensitivity in the south relative to the north. This result is also intuitively appealing, it suggests that unemployment differences narrowed through the relatively large rise in unemployment in the south because real wage growth rates were too high in the south.

In the context of an equally – impacted negative demand-side shock the above-named models of wage determination predict greater real wage adjustment in the low unemployment regions of the south relative to greater unemployment adjustment in the high unemployment regions of the north. The recession of the early 1990s, however, appears to have been unequally distributed with a much greater rise in unemployment in the south. It would appear that the dispersion of regional unemployment, based on the regional price estimates, narrowed because regional real wages were relatively insensitive to changes in unemployment in the south relative to the north (see Table 4.19), thus contradicting the predictions of the wage determination models when in fact it should be the reverse etc. The relative size of the increase in unemployment in the south appears to have slowed real wage growth relative to the north thus leading to a slowing in the absolute and relative dispersion of regional real wages. These results are not supported by the RPI estimates of Table 4.22, here the absolute dispersion of regional unemployment is attributed to changes in wage and prices of greater effect in the north than the south and it is not clear why this should be the case.

This section argues that the wage determination models so far examined are unable to accurately predict regional real wage and unemployment relativities in the context of asymmetric shocks across a national economy. The findings presented so far, also suggest a weakness in analysing such asymmetries at the regional level with the use of an aggregate price index.

4.5 Conclusion

Chapter Four constructed regional real wages by deflating AGHE including overtime for all adults 1974-1996 using both the constructed regional price indices from Chapter Three and the published RPI. Examining the dispersion of regional real wages indicated that differences in real wages across the regions grew throughout the 1980s but these differences were less marked in the case where real wages were constructed using the regional price series than using the RPI. These differences, however, appeared to have stopped under both definitions of dispersion from 1990.

An analysis of both measures of regional real wages indicated support for rejection of the hypothesis that regional real wages are not, statistically significantly different from the national average over the sample period. This result led to an investigation into the inter-regional variability of unemployment, nominal wages and both measures of real wages against movements in their national averages, in trying to identify periods in which regional real wages became more volatile.

Whilst a strong link appeared to exist between nominal wage rate changes and nominal wage variability this was not supported by the findings of unemployment nor on either measure of real wages. These results implied that the early 1990s was associated by increased regional variability in unemployment, prices and real wage rates suggesting regional adjustment processes occurred at the same time but not linked to movements in the national series.

Examining the behaviour of regional real wages and unemployment over the sample period of 1975-1996, support was found in treating the post-1990 period as separate to the full sample. The reason in doing so was partly supported by problems associated with attempting to explain real wage adjustment with respect to unemployment in the context of a recession leading to a narrowing of regional unemployment rates.

Analysing the regional real wage-unemployment relationship, in particular over the 1990-1996 period, meant that wage determination models that supported Thirwall's

(1966) analysis of the cyclical sensitivity of regional unemployment were used in forming predictions and testing hypotheses as to the expected relationship between the dispersion of real wages and the dispersion of unemployment. Predicting the relationship between real wages and unemployment was deemed difficult in that changes in unemployment can be attributed to either demand-side or supply-side shocks, and in the context of real wage dispersion to a national or regionally-based shocks, these issues had first to be addressed. Predictions from these models rely heavily on these assumptions.

Examining the regional real wage – unemployment relationship led to mixed results dependent on the particular price deflator used to define the real wage variable. For the 1990-1993 period the literature identifies this period as characterised by a large negative demand-side shock leading to the rise in unemployment. Whilst the estimated regression led to an estimated positive real wage-unemployment relationship, such a result runs contrary to the predictions of the wage curve and the J&S models of wage determination. The nature of the shock, however, was examined in the context of price asymmetries to examine whether the reason for the conflict was due to either differing real wage-unemployment adjustment processes or that the 1990-1993 recession was one in which the south was hit harder than the north. To test for this a crude analysis of regional price and wage asymmetries was tested by regressing pooled regional prices against the national average within a north-south split. For the 1990-1996 period, the hypothesis that nominal wages were not significantly different from the national average across the regional north-south divide could not be rejected, however, this was not possible in the case of prices. The inability to accept the null hypothesis that prices were not significantly different from the national, in the context of an integrated economy for the 1990-1996 period presented evidence in support of the negative demand-side shock having an asymmetrical effect across the UK regions.

In dividing the regions into a north and a south asymmetrical wage and price adjustments processes were examined in the context of the dispersion of unemployment. Support was found for much weaker wage and price – unemployment relationship in the south relative to the north. Such a finding suggests that weak or slow real wage adjustment in the south was responsible for the relatively large rise in unemployment than in the north, why this was the case needs further analysis, particularly as it is an implied challenge to the wage determination models and the hypothesis that the lower unemployment rate regions of the south have a higher unemployment elasticity of pay. Not only was the south hit worse than the north, but given weak real wage adjustment, responded poorly to the shock.

This chapter has provided compelling evidence of asymmetric regional real wage-unemployment adjustment processes in the UK over the early 1990s. Modelling of the aggregate labour market both in terms of an aggregate price index or in terms of aggregate wage determination models are difficult to justify when such asymmetries exist. The use of an explicit regional price variable with which to model regional real wages proves to be an innovation that helps explain why aggregate wage determination models fail to explain the behaviour of regional labour markets. It is, however, the issue of weak nominal wage asymmetries in the context of changes in prices, expected prices and wages which is the next focus of attention; modelling regional labour markets based on the Phillips curve.

CHAPTER FIVE

ESTIMATING THE RELATIONSHIP BETWEEN REGIONAL WAGES, UNEMPLOYMENT AND EXPECTED PRICES

5.1 Introduction

This chapter focuses on the examination of the relationship between regional wages, unemployment and expected prices for the UK over the period 1974-1996. In doing so regional Expectations-Augmented Phillips Curves (EAPC hereafter) are produced in examining regional labour market dynamics. The main innovation of this chapter is the construction of an expected regional price variable in estimating regional EAPCs. These curves are produced for different expectations hypotheses and are based on the regional price indices produced in Chapter Three and the RPI.

The incorporation of price expectations in this chapter relates to the modelling of the relationship between nominal wages and unemployment based on price misperceptions. This can be modelled in the context of either a union-wage bargaining or a competitive paradigm. This chapter presents evidence that supports the existence of a short-run and a long-run relationship between wage inflation and unemployment. Regional EAPC estimates are constructed over the sample period and over the 1990-1996 period in which the apparent shift in regional unemployment relativities is examined against wages and expected prices.

Two hypotheses relate to the modelling and existence of regional Phillips curves, and both relate to the operation of the regional labour market. The first hypothesis is the so-called the aggregation hypothesis. This raises the issue of whether regional labour markets can be assumed to be operating along a universal wage-unemployment relationship, (Lipsey (1960), Jackman and Savouri (1991) and Blanchflower and

Oswald (1990, 1994)). The second hypothesis relates to the extent by which regional labour markets can be said to be integrated with one another. That is whether regions are assumed to operate along the same Phillips curves and whether regional labour market differences reflect region-specific factors consistent with the notion of competitive labour market adjustment processes. These two hypotheses lie at the heart of understanding the behaviour of regional markets. Whilst the former implies structural or institutional differences existing at the regional level that produce regional unemployment differences, the latter implies that the UK has a fully integrated labour market in which regional labour markets respond to the free market adjustment of wages and prices. The aggregation and integration hypotheses are both tested in the context of the EAPC model.

5.2 The Phillips Curve

Phillips (1958) was the first to identify an apparently stable and inverse relationship between the rate of growth of money wages and the unemployment rate. Dividing his data period up for the period 1862-1957, Phillips estimated equation (5.1)[1].

$$\frac{\dot{W}_t}{W_t} = \alpha + \beta U_t^{\varphi} \tag{5.1}$$

where $\dot{W}_t/W_t$ is the rate of change of aggregate money wage rates at time t, and U_t is the national unemployment rate.

Phillips own estimated parameters were found to be significant, however, he was not able to formulate a satisfactory model of labour market adjustment processes that would support his empirical regularity. Much of the work in explaining this finding of Phillips is attributed to Lipsey (1960).

Lipsey (1960) attempted to rationalise the Phillips curve in terms of labour market pressures in which excess demand was proxied by unemployment. Lipsey argued that given a stable rate of change of labour productivity and the absence of sizeable import fluctuations money wages rise more rapidly the greater the amount of excess demand in the labour market.

Formally. this is expressed as:

$$\frac{\dot{W}}{W} = f\left(\frac{L^d - L^s}{L^s}\right) \tag{5.2}$$

where $\dot{W}/W$ is the rate of change of the money wage rate and L^d and L^s represent labour demand and supply respectively.

Labour demand consists of those employed plus vacancies and labour supply those employed plus the unemployed. Since vacancies vary inversely with the unemployment rate and did so in a stable way up to the 1960s, unemployment itself could be used as a measure of excess demand in the labour market. This gives the Phillips relation:

$$\frac{\dot{W}}{W} = f(U) \qquad \text{where} \left(\frac{\Delta(\dot{W}/W)}{\Delta U} < 0\right) \tag{5.3}$$

However, this relationship only specifies an adjustment mechanism. It says nothing about whether the disequilibrium which initiates the change in money wages is caused by demand side or supply side factors or both.[2] To the left of full employment the Phillips relation is drawn as having a much steeper slope than to the right. Lipsey argued that this can be interpreted as indicative of a non-linear wage unemployment relationship, indicating increasing wage inflation pressure as unemployment asymptotically approached zero, i.e. as the labour market became 'tighter'.

The Phillips curve along with the associated labour market dynamics came to be called the Phillips-Lipsey hypothesis and was estimated in a number of papers (e.g.

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[1] The Phillips curve model is taken from Lipsey (160). The consequent algebraic representation of the Phillips curve and its consequent developments is adapted from Levacic and Rebmann (1987))

Hansen (1964) and Perry (1970)). However, Friedman (1968) questioned the stability of the relationship and introduced real wage and price expectations into it. This development, aided by others, (e.g. Phelps (1970) and Mortensen (1970)), suggested that the Phillips curve simply captured real wage and unemployment adjustments to movements around full employment. Movements away from full employment are assumed to be a function of workers suffering from money illusion, confusing changes in nominal variables for changes in real ones. Once workers and firms have corrected their decision-making from having suffered from money illusion, the economy returns back to its "natural rate of unemployment." The strong result is that there is no "long-run" trade-off between unemployment and [price] inflation, (i.e. the Phillips curve is not stable).

The present-day analysis of the Phillips curve, due mainly to Friedman (1968) and Phelps (1970) begins by examining the relationship between the level of excess labour demand and the rate of change of real wages.

Instead of equation (5.3) above, this suggests that the Phillips relation should be written as:

$$\frac{\dot{w}}{w} = f(U) \tag{5.4}$$

where $\dot{w}/w$ is the rate of change of real wages.

This implies that the actual rate of change of real wages equals the rate of change of money wages, $\dot{W}/W$ minus the rate of inflation $\dot{P}/P$.

$$\frac{\dot{w}}{w} = \frac{\dot{W}}{W} - \frac{\dot{P}}{P} \tag{5.5}$$

The premise underlying this analysis of the Phillips curve is that each party is really concerned with the real wage rate. The perceived real wage rate implied by a

[2] Kaliski (1964), felt that this issue is not important but it is discussed by a number of papers (see e.g. Lipsey (1960,) Kaun (1965) Kaun and Spiro (1970)).

particular money wage rate then depends on the expected rate of inflation. This means that the appropriate relationship between the rate of change of the real wage rate anticipated by workers and firms and the rate of change in the money wage rate is:

$$\frac{\dot{w}}{w}=\frac{\dot{W}}{W}-E\left(\frac{\dot{P}}{P}\right) \tag{5.6}$$

where $E(\dot{P}/P)$ is the expected rate of price inflation.

It is assumed that if workers are rational they fully adjust the increase in money wages for the expected increase in prices to obtain the resulting change in the expected real wage rate upon which they base their labour supply decision whether to work. Substituting $f(U)$ from equation (5.4) for $\dot{w}/w$ in equation (5.6) and rearranging, then equation (5.7) is produced:

$$\frac{\dot{W}}{W}=f(U)+\alpha E\left(\frac{\dot{P}}{P}\right) \qquad \text{(where } 0\leq\alpha\leq 1\text{)} \tag{5.7}$$

Here a coefficient α is attached to the price expectations variable indicating the extent of price expectations adjustment. If $\alpha=1$ workers fully adjust their money wages to compensate for expected price increases, if $0\leq\alpha\leq 1$ workers only partially, or do not at all, adjust their money wage rate. The model here then presumes that wage demands are determined by both unemployment and price expectations. Workers form expectations as to what they believe prices will be in the given period. In order to maintain real wages it is assumed that price expectations will drive wage bargaining, mistakes in price expectations are assumed to affect unemployment adjustment. If $\alpha>1$ it implies that expected real wages will rise. Workers do not know what the price level will be over the wage negotiated period, and wages are in part determined by it. Equation (5.7) is known as the Expectations Augmented Phillips Curve (EAPC hereafter). In the regional EAPC model any price inflation rate eventually becomes anticipated, and the rate of increase of money wage rates at all levels of employment will adjust to reflect this expectation. This adjustment in money wages will be represented by an upward shift in the original Phillips curve relationship. This hypothesis was able to explain the growth of money wages and unemployment of the late 1960s onwards for the UK and other Western Industrialised Countries.

Whilst a number of studies have largely confirmed the hypothesis of the EAPC that there is no apparent long-run relationship between wages and unemployment, (e.g. Hines (1969), Metcalf (1971) Brinner (1977)), there is still debate as to whether Phillips curves exist or not (see for instance Johnes (1989)). Consequently energies in Phillips curve research have focused on differing estimation techniques, the functional form of the estimated equation, variables to include and the modelling of such variables etc., (see Levacic and Rebmann (1987), p 353-357).

5.3 Regional Phillips Curves

Estimation of regional Phillips curves was initiated by Lipsey's (1960) conjecture that regionally-differing wage-unemployment relationships can exist in an economy with differing regional unemployment rates[3].

Early estimates of regional Phillips curves such as those by Kaun (1965) Kaun and Spiro (1970), Cowling and Metcalf (1967), Kaliski (1964), Smith and Patton (1971) and Thirlwall (1970) regressed a measure of the regional wage rate against the regional unemployment rate or variations thereof. In the majority of cases evidence of a regional relationship between wages and unemployment was found (although the findings of Kaliski (1964), Cowling and Metcalf (1967), and Thirlwall (1970) are mixed). The incorporation of prices as an independent variable led to new estimated coefficients on regional Phillips curves (or more accurately estimation of EAPCs) in which price expectations are either proxied or modelled by actual prices. Early regional EAPC estimates include, Metcalf (1971), Brechling (1973), Marcis and Reed (1974) and Mathur (1976) all of which supported the long-run predictions of

[3] Although Lipsey (1960) stated regions explicitly, subsequent estimations of Phillips curves at the sub-aggregate level have involved estimations at the state and city levels, particularly for the USA. The modelling of regions is questioned by Marcis and Reed (1974, p. 259), who, amongst others, argue that the geographic size of 'regions' is too large to be classed as 'local' in terms of analysing disaggregated labour markets.

the EAPC in finding no significant long-run relationship between wages and unemployment.

Marcis and Reed's (1974) estimates of the EAPC, however, proved to be the next most significant step in regional or sectoral estimation of the relationship between wages and unemployment. Whilst single-equation estimates of regional EAPCs found mixed support for a wage-unemployment relationship, Marcis and Reed (1974) introduced the notion of regional labour markets being jointly determined. Marcis and Reed thus estimated regional Phillips curves using Zellner's (1962) Seemingly Unrelated Regression (hereafter SUR) having not been able to accept the null hypothesis of the presence of cross-sectional correlations in the residuals from single-equation regional estimates. As a result of this the idea that regional Phillips curves and EAPCs are influenced by variables in other regions has become incorporated into sectoral estimations (see Blackaby and Manning (1987), Hyclak and Johnes (1989) and Johnes (1989)).[4]

The theoretical reasoning behind the adoption of the SUR technique in regional labour market modelling relates to the idea that the dependent variable in each regional equation is not solely determined by the variables particular to its region but also by the behaviour of variables in other regions.[5] The notion that regions respond to common economic conditions which translate to jointly-determined variables relate to instances in which include industrial wage bargaining or price-setting cross regional boundaries. SUR has been discussed in Chapter Four above

The inclusion of a price variable into Phillips curve estimation goes back to Lipsey (1960) but was not given stronger theoretical support until Friedman (1968) introduced the notion of expected real wages and from which developed the EAPC model. The incorporation of some measure of price expectations was regarded a

[4] This is not always the case. Hyclak and Johnes (1992) rejected adopting the SUR technique in their estimations having failed to find evidence of a significant transmission mechanism of inflation across regions. Whereas Blackaby and Manning (1987, 1990b), and Payne (1995) neither test for, nor adopt it.

[5] Work on the so-called leading-sector hypothesis relates in part to the idea that regional variables are jointly-determined, here the hypothesis is that the remaining regions of an economy are driven by one other. For the UK the leading-region has been identified as the South-East, (see and Manning (1990a, 1990b), though evidence for this is mixed with some authors finding no evidence of the UK having a leading-sector (see Hyclak and Johnes (1992) p. 193-194).

crucial ingredient in evaluating the wage-unemployment relationship, and in particular the idea of a short-run and long-run relationship. The lack of any UK regional price index, however, meant that the price measure adopted was either an aggregate current or aggregate lagged value, (e.g. Metcalf (1971), Brechling (1973), Marcis and Reed (1974), Mathur (1976), Johnes (1989) and Hyclak and Johnes (1989, 1992)). In a few cases only was the incorporation of a local price index entertained. Kaliski (1964) in his Canadian estimates of sectoral Phillips curves chose the aggregate price series over the local prices, given the inability to reject the hypothesis that the local price series' were significantly different from the aggregate. Blackaby and Manning (1987, 1990a, 1990b, 1992) for the UK, however, used the Reward Group's regional cost of living survey's as an annual measure of regional prices. Nonetheless strong empirical and theoretical support for the significance of the price variable exists in almost all EAPC estimates.

EAPC estimates require the price variable to be representative of price expectations. The incorporation of lagged prices is taken to mean that agents form price expectations adaptively. The exact formation and modelling of price expectations are, however, controversial topics. Not only is it not known for certain how people form expectations, neither is source of the information on which expectations are formed is known let alone how prices are determined. Geographically regional EAPC estimates will produce misleading results if, within an adaptive expectations framework, an aggregate price series is a weak or poor proxy for expected regional prices (see Chapter Four).

Other than the incorporation of lagged prices to model price expectations, more ambitious attempts based on current and past information have also been adopted, (see Johnes (1989) and Payne (1995)). Whilst these studies found some support for regional EAPCs in examining the EAPC relationship under different price expectations processes, neither of these studies examine the issue of local-specific price expectations. Based on the real wage-unemployment findings of Chapter Four the significant omission of local prices and local price expectations may significantly challenge all previous sectoral estimates of the EAPC. This is examined next.

5.3.1 The Aggregation Hypothesis

The aggregation hypothesis was an attempt by Lipsey to explain the empirical regularity of wage-unemployment "loop's" identified by Phillips (1958). Lipsey (1960) argued that regions differed in their wage-unemployment response to a national economic shock. With wage adjustment proportionately greater in the low unemployment regions than in the high, Lipsey suggested that the aggregate Phillips curve will lie above the regional estimates (1960, p. 21-23). Lipsey was not, however, arguing for the existence of different regional Phillips curves per se but that regions operated along different points on the same Phillips curve.

Lipsey estimated the following formulation as his model of the Phillips curve:

$$\frac{\dot{W}}{W_t} = a + bU_t^{-1} + cU_t^{-2} + d\dot{U}_t + e\frac{\dot{P}}{P_t} \tag{5.8}$$

where $\dot{W}$ is the rate of change of money wages, W_t is the money wage rate in period t, U is the unemployment level, $\dot{U}$ is the rate of change of unemployment rate and $\dot{P}$ is rate of change in the cost of living.

As Lipsey's aggregation hypothesis focuses on the aggregate money wage-unemployment relationship for a given dispersion of regional unemployment, the hypothesis that wage inflation is a function of the dispersion of unemployment has been previously tested, (e.g. Thirwall (1968) Brechling (1973)). However, no evidence in support of the hypothesis could be found. This implies that there is no supporting evidence for the aggregation hypothesis. The findings of Blanchflower and Oswald's (1990, 1994) wage curve model, however, offers some empirical support for a link between the real wage level and the unemployment rate at the industrial and regional level. The wage curve relationship implies that the regional dispersion of real wages and unemployment are inversely related and thus offers support for the aggregation hypothesis, (see Chapter Four). Whilst the aggregation hypothesis has been modelled in the context of real wage and unemployment dispersion in Chapter Four, its existence implies support for differing regional Phillips curves, (see Thirwall (1970), p.19).

Why regional unemployment rates differ is a subject of current research. In the context of the EAPC within a neo-classical paradigm this should not be the case unless unemployment differences reflect differing equilibrating forces (for a discussion on this topic see Blackaby and Manning (1987, 1990b) and for regional unemployment estimates see Byers (1989, 1991), and Chapman (1991)). As a result estimates of regional EAPCs can be used to test the aggregation hypothesis that the regional wage-unemployment relationship is statistically significantly different across regions. However, in the context of the EAPC this differing relationship will only be short-lived and the estimated results affected by how price expectations formation are modelled. Regional EAPC estimates can be produced to examine both of these issues, significant regional differences as well as testing the hypothesis that there is no long run relationship between wages and unemployment in the long run. That is short run and long run regional EAPCs can be estimated and analysed.

Implicit in the vast majority of regional Phillips curves results is the assumed influence of the aggregate economy and / or the behaviour of economic variables external to the region being estimated. In the context of the leading sector hypothesis introduced by Cowling and Metcalf (1967), or recognition of the possibility of a high degree of wage bargaining and wage-spread interdependence (Thirwall (1970), p. 68) a high degree of contemporaneous correlation across regions is expected. The explicit inclusion of the aggregate unemployment rate or the aggregate price level in the estimation of regional EAPCs are attempts to capture this contemporaneous correlation. To assume that the regional markets of the UK do not share common features or are unaffected by changes in other markets ignores possible transmission mechanisms across regions in a given time period of trade and prices. Nonetheless a strong case against a highly integrated national economy exists in terms of the persistent regional unemployment disparities identified in Chapter Two. The fact that cross-sectional correlation of the residuals was found in single-equation estimates of regional EAPCs (see for instance Blackaby and Manning (1987)), does imply some degree of regional labour market integration though. That is to assume regions are not integrated assumes that factors influencing the behaviour of regional labour markets are region-specific, cross-sectional correlation implies that this might not be the case for a number of variables. What these variables are and how much influence they bring to bear on regional markets can help determine how closely integrated regions are. Whilst regional EAPC estimates relate to the modelling of the regional wage-unemployment relationship, the existence of significantly different regional EAPCs can be interpreted as being supportive of the aggregation hypothesis i.e. regions differ but not the integration hypothesis i.e. regions do not differ.

5.3.2 Economic Integration and the Integration Hypothesis

The aggregation hypothesis argues that for different regional unemployment rates the national Phillips curve will be estimated as having a higher wage-unemployment relationship than each of the regional estimates. The issue to examine here, however, is how are such regional estimates compatible with an integrated economy? The answer lies in determining the cause of regional differences and relates to testing what is called here, the integration hypothesis.

According to Balassa:

> "....total economic integration presupposes the unification of monetary, fiscal, social and countercyclical policies and requires the setting-up of a supranational authority whose decisions are binding for the member states." ((1965), p. 2)

However, Balassa argues that economic integration is both a process and a state of affairs. But he essentially relates to the degree of economic interdependence between two or more economic areas. In recent years the literature on economic integration has gone hand in hand with the theory on Optimal Currency Areas, a debate began with Mundell (1961). This debate relates to an analysis of the possible costs and benefits of economic areas sharing a common currency and being subject to a common monetary policy.

To what extent the UK economy might be defined as an integrated economy is a moot point. If the above cited Balassa definition of integration is adopted, it calls into question the existence of any restrictions (physical or legal) that prevent the movement of goods and factor services across its regions. Within the context of the labour market this relates to accounting for differences in unemployment and real wages as well as prices. An implication of regional labour markets not being integrated is that adjustment processes to economic shocks will differ across regions, and the cost of a common economic policy possibly increased. Economic policy goals might lead to differing regional market adjustment processes, for instance, a given policy shock could lead to employment changes in one region against real wage changes in another. Asymmetrical labour market adjustment processes may make future economic modelling and policy implementation more difficult to achieve, but differences in adjustments could be a function of the economic characteristics particular to the region. An example would be the industrial make-up affecting the regional real wage-unemployment relationship (see e.g. Strauss (1998)). Evidence of differing regional real wage-unemployment adjustment processes does not necessarily challenge the hypothesis that the UK labour market is integrated.

The empirical literature on the UK labour market, at the sectoral level, however, is sympathetic to the claim that there are restrictions at the least on the mobility of labour that run contrary to conditions necessary but not sufficient for economic integration. Work by Hughes and McCormick (1987), Bover, Muellbauer and Murphy (1989) and McCormick (1997), all argue that the UK housing market provides sufficient barriers to mobility. According to the current literature on integration, the regional adjustment processes are therefore limited to wage and price flexibility, or through fiscal transfers (see Bayoumi (1997)).

The difficulty in establishing how integrated an economy is then depends on the determination of its economic behaviour. To resolve this problem, the literature has opted to try and measure the size of adjustment processes in light of identifiable economic shocks and compare them. It is assumed that significant adjustment processes reflect "within-economy" processes which are compatible with integration (see Bayoumi and Thomas (1995)). For the UK regions no research has as yet been done on this. In part this is due to the lack of regional price data. The existence of possible differing regional real wage-unemployment adjustment processes could then be explored using the regional data from Chapters Two and Three. This is explored later.

5.4 The Aggregation Hypothesis: Regional Phillips Curves

The aggregation hypothesis implicitly identifies regional Phillips curves as being different from one another[6]. This section estimates and tests the hypothesis that regional EAPCs are not statistically different from the national EAPC. However, modelling involves two issues: the first is whether the national average or the regional price variable is relevant for measuring price expectations; and the second, is how are price expectations to be modelled?

5.4.1 Aggregate versus Regional Prices

The adoption of price expectations in the estimation of regional Phillips curves has led, in the majority of cases, to the incorporation of lagged aggregate price indices or some aggregate measure of price expectations. Apart from issues surrounding the accuracy of such measures, the assumption that the aggregate price index is appropriate is questionable. By definition, if the EAPC is regarded as describing a structural relationship, then the inclusion of an aggregate price variable indicates the *a priori* belief in its relevance to wage determination. In the case of modelling regional EAPCs, how useful a proxy the national average price variable is depends on whether or not it is used in regional wage determination and, if it is not, how closely national price movements proxy regional price movements. If neither of these holds true, then a possible mis-specification bias in EAPC estimates will occur if regional price variables are not used. In the absence of available sub-aggregate price data the use of an aggregate price index in the literature might be considered a useful proxy for regional prices but if regional price series or estimates become available then results from both sets of price variables should be compared.

In EAPC estimations whilst a simple adaptive expectations formulation involves lagged actual prices, construction of a rational price expectations formulation will typically involve a two-stage process[7] in which current actual prices are used in the

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[6] By definition, if the aggregation hypothesis holds, regional unemployment rates differ.

[7] This issue is explored later, a distinction is, however, useful to make here between a rational price expectations formulation in which current economic data is used with which to estimate prices e.g. Barro as opposed to a perfect foresight model in which actual prices are used in the EAPC estimation (e.g. Johnes (1989) and Payne (1995)).

first stage of estimation (see later). Which price index is used in estimating price expectations is another consideration.

The incorporation of either current or lagged, aggregate or local prices into models of wage determination have been found to be both empirically[8] and statistically significant (e.g. Lipsey (1960), Blackaby and Manning (1990a 1990b), Hyclak and Johnes (1992), Payne (1995)). In light of regional wage modelling, however, the debate between whether the aggregate or the local price is relevant is difficult to disentangle given the high degree of correlation between these two series (see Chapter Three and Kaliski (1964)). Given this problem alternative EAPC estimates were derived based on the regional price indices of Chapter Three and the RPI in the construction of a price expectations variable.

5.4.2 Incorporating Expectations

This next section attempts to derive a measure for price expectations based on the two hypotheses of adaptive expectations (hereafter AEH) and rational expectations (hereafter REH) respectively. The assumption of incorporating regional price expectations in regional EAPC estimations is based on the hypothesis that expected regional prices are relevant in determining regional real wages and unemployment.

Of the little empirical work done in the UK in using regional prices in regional labour market modelling, the results find that regional prices are significant, ((Shah and Walker (1983), Jackman and Savouri (1991), Blackaby and Manning (1987, 1990a, 1990b, 1992), Blanchflower and Oswald (1994), Hughes and McCormick (1994) and Blackaby and Murphy (1995)) and are all based on the Reward Groups regional cost of living surveys. However, none of these models identify nor correct for the various data problems identified in Chapter Three in the construction of regional prices using the Reward Group data. Furthermore they fail to compare the behaviour of their estimated price variables with any other alternative price index such as the RPI and to date no estimation of region-specific price expectations have been produced.

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[8] Survey evidence from UK wage negotiations rank changes in the cost of living very high in terms of considerations for wage bargaining changes (see Carruth and Oswald (1989), Chapter Three).

Theoretically the hypothesis that regional prices are more relevant than the published aggregate in the modelling of price expectations in EAPC estimation encounters two problems. The first is how closely related are regional prices to the published RPI. Official regional price information is not in the public domain, acquisition of it necessarily incurs a 'shoe-leather' cost. How much information is collected can be assumed to involve a cost-benefit analysis. Secondly, is the problem that a model based on price expectations should involve estimation of a relationship at a higher frequency than annual. Whilst this is a potential criticism in the production of regional prices, and the concept of regional revision to price expectations, regional data other than unemployment and employment are only officially produced annually, regional EAPC estimates are necessarily annual[9]. If it is assumed that agents can access higher frequency published aggregate data but regard local, unpublished price changes as relevant in wage negotiations then it is assumed that agents have to form regional price expectations in order to calculate current expected real wage rates.

5.4.3 Adaptive Expectations Estimation

The AEH form of the EAPC was introduced by Friedman (1968). Construction of price expectations formed under this hypothesis is relatively easy. In its simplest form, the expected future value of a variable is assumed to be equal to its actual value in the current period. As a result the AEH suffers from the criticism that agents fail to learn from expectational errors by failing to use all currently available information That is, agents are assumed backward-looking in forming price expectations, they are not rational, (see Lucas 1972)).

In estimating regional EAPCs assuming adaptive expectations, the AEH is modelled as a simple naïve version in which agents are assumed to believe the current price level and the current inflation rate to be identical to the previous period price level and inflation rate respectively. To construct an AEH price variable for both the

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[9] Annual data can be only be regarded as an approximation to higher frequency regional labour market adjustment processes. A criticism of annual EAPC estimates concerns the frequency in which price expectations enter into wage negotiations. Estimation using annual prices can be justified if it is assumed that regional price expectations relate to annual wage bargaining.

regional and aggregate price series, equation (5.9) was estimated for each region over the period 1976-1996.

$$\Delta P_{it}^{AE} = \Delta P_{it-1} + \varepsilon_{it} \tag{5.9}$$

where P_{it}^{AE} is the logarithm of expected prices in region i, at time period t, P_{it-1} represents the logarithm of the regional price level, and ε_{it} is a random error.

5.4.4 Rational Expectations Estimation

The assumption that agents form their expectations based on current economic information is attributed to Muth (1961). If it is assumed that agents use only currently available information in forming expectations (the orthogonality axiom) then the efficiency axiom of incorporating previous information in expectations estimation is ignored. The majority of rational expectations estimation, however, incorporates both axioms (for modelling aggregate price expectations see for instance Barro (1976, 1978), Atfield, Demery and Duck (1981).at the regional level see Johnes (1989) and Payne (1995)). What information is included is, however, subjective.

In regional labour market modelling, it is assumed that to construct an explicitly regional rational price expectations variable, expectations are a function of current and lagged regional information data. The information set is assumed to include variables correlated with price movements but which can be observed. Modelling expected prices is based on the hypothesis that agents in the region have access to published regional data and that they perceive the region to be a self-contained economic entity, which differs from the national. This is reflected by cost of living, wage and unemployment differences etc.

Without explicitly stating the wage bargaining model it is assumed that workers perceive changes in regional nominal wages, and lagged nominal wages and nominal GDP as describing movements in relative prices, in which labour is a derived demand. It is assumed that a degree of heterogeneity in a region's output prevents the worker from using his / her own firms price and output values to determine prices involved in consumer real wage calculations. It is assumed that current and lagged wages indicate the underlying wage-cost structure to the region from which prices are derived, and nominal GDP reflects changes in demand. Regressing regional prices against wages, lagged wages and nominal GDP for each region gives equation (5.10):

$$\Delta P_{it} = \alpha_{0i} + \alpha_{1i}\Delta W_{it} + \alpha_{2i}\Delta W_{it-1} + \alpha_{3i}\Delta GDP_{it} + \varepsilon_{it} \tag{5.10}$$

where P_{it} is the logarithm of the price variable, in region i in period t. W_{it} is the logarithm of all adult wages (AGHE) and GDP_{it} is the logarithm of nominal Gross Domestic Product, dropping subscript i signifies national average values, and ε_{it} is a random error.

In order to construct a rational expectation of the price variable, a two-stage process was adopted in which equation (5.10) was first estimated and the coefficients used to calculate the expected price variable, ΔP_{it}^{RE}. The final version is given by equation (5.11):

$$\Delta P_{it}^{RE} = \alpha_{0it} + \alpha_{1it}\Delta W_{it} + \alpha_{2it}\Delta W_{it-1} + \alpha_{3it}\Delta GDP_{it} + \varepsilon_{it} \tag{5.11}$$

Estimation was by single-equation OLS and the residuals tested for the presence of first-order serial correlation, heteroscedasticity and normality. In each case it was not possible to reject the hypotheses of no serial correlation, no heteroscedasticity and the assumption of normality. In each equation all the coefficients were found to be significant and there is a high goodness of fit.

As reported earlier, simultaneity bias can be a problem with regional modelling. The Hausman test for endogeneity was used to test for simultaneity between prices and wages. The residuals from OLS regressions of wages against regional employment and lagged employment as instrumental variables, with lagged wages and current and lagged GDP were found not to be significant at the 10% level when included as an independent variable in OLS regressions of equation (5.10). As a result it was concluded that there was not a simultaneity problem with the expected price estimates.

Preference for single-equation estimates is based on the assumption that price formation is based on solely on intra-regional and not inter-regional data. This model therefore assumes that national labour market activities do not enter explicitly into each region's price expectations.

5.4.5 Estimating Regional Expectations-Augmented Phillips Curves

The hypothesis that there is no difference between the regional and the national EAPC is tested over the full sample period 1975-1996 using both the adaptive and rational price expectations formulation for each price variable. The equation tested is (5.12):

$$\Delta W_{it} = \alpha_o + \alpha_1 \Delta U_{it} + \alpha_2 \Delta P_{it}^{E} + \varepsilon_{it} \tag{5.12}$$

where P_{it}^{E} is the logarithm of the expected price variable in region i in time period t. As with the other variables, the ADF test for the presence of unit roots was rejected at the 5% level for each expected price variable.

The formulation of the regional EAPC is based upon similar estimates by Mathur (1976), Blackaby and Manning (1990a), Hyclak and Johnes (1989,), and Johnes (1989) and Johnes and Hyclak (1992). Unlike the first Phillips curve estimates unemployment enters the equation in first difference logarithms, whilst this means that wage changes are now assumed a function of the rate of change of unemployment, it was necessary to work in first differences to make unemployment stationary. Single equation estimates of the regional EAPCs were found to contain significant single-equation bias, based on the rejection of the null hypothesis of the presence of no cross-sectional correlation amongst the residuals using on the Breusch–Pagan test for cross-sectional correlation. The presence of cross-sectional correlation bias implies that the estimated coefficients are not efficient. To get more efficient estimates regional Phillips curves were therefore estimated using the method of SUR. The rate of change of money wages are assumed dependent on the

Table 5.1: Regional EAPCs: Regional Price Rational Expectations: 1976-1996,

$$\Delta W_{it} = \alpha_{oi} + \alpha_{1i}\Delta U_{it} + \alpha_{2i}\Delta P_{it}^{E} + \varepsilon_{it}$$

Region	Constant	Unemployment	Price	R^2
East Anglia	0.01	0.003	1.03	0.87
	(1.99)**	(0.35)	(16.44)***	
East Midlands	0.02	0.02	0.85	0.70
	(2.47)**	(1.28)	(9.70)***	
North	0.01	0.01	0.96	0.90
	(2.92)***	(1.01)	(18.84)***	
North-West	0.02	0.17	0.97	0.83
	(2.48)**	(1.31)	(14.91)***	
South-East	0.02	-0.01	0.97	0.80
	(2.82)***	(-0.60)	(13.75)***	
South-West	0.01	-0.0003	1.03	0.85
	(2.05)**	(-0.03)	(15.83)*	
West Midlands	0.01	0.003	1.04	0.68
	(0.94)	(0.15)	(8.41)***	
Yorkshire & Humberside	-0.002	-0.02	1.29	0.96
	(-0.61)	(-4.13)***	(37.51)***	
Northern Ireland	0.02	0.07	0.94	0.81
	(2.52)**	(2.61)***	(11.00)***	
Scotland	-0.01	0.01	1.13	0.86
	(-1.68)*	(0.30)	(14.60)***	
Wales	-0.001	-0.02	1.38	0.85
	(-0.07)	(-1.36)	(14.74)***	
United Kingdom Average	0.001	-0.002	1.08	0.80
	(3.15)***	-(0.34)	(31.33)***	

Note: United Kingdom Average estimates are based on pooled estimate of all regions. t-statistics in parentheses; *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.

Table 5.2: Regional EAPCs: Regional Price Adaptive Expectations: 1976-1996,

$$\Delta W_{it} = \alpha_{oi} + \alpha_{1i}\Delta U_{it} + \alpha_{2i}\Delta P_{it}^{E} + \varepsilon_{it}$$

Region	Constant	Unemployment	Price	R^2
East Anglia	0.05	-0.02	0.51	0.44
	(4.12)***	(-1.35)	(4.83)***	
East Midlands	0.05	-0.02	0.46	0.45
	(4.74)***	(-0.92)	(5.35)***	
North	0.05	0.01	0.43	0.48
	(4.94)***	(0.25)	(4.73)***	
North-West	0.05	0.04	0.42	0.54
	(5.42)***	(1.74)*	(4.77)***	
South-East	0.05	-0.02	0.47	0.42
	(4.94)***	(-1.52)	(4.80)***	
South-West	0.04	-0.02	0.57	0.52
	(4.08)***	(-1.20)	(6.10)***	
West Midlands	0.05	-0.002	0.46	0.41
	(3.60)***	(-0.07)	(3.20)***	
Yorkshire & Humberside	0.04	-0.01	0.53	0.57
	(4.75)***	(-0.77)	(6.20)***	
Northern Ireland	0.04	-0.02	0.59	0.58
	(4.29)***	(-0.51)	(6.93)***	
Scotland	0.04	0.004	0.57	0.61
	(4.59)***	(0.19)	(7.66)***	
Wales	0.05	0.06	0.38	0.50
	(4.53)***	(2.42)**	(3.62)***	
United Kingdom Average	0.03	-0.02	0.59	0.48
	(4.60)***	(-2.77)***	(9.53)***	

Note: United Kingdom Average estimates are based on pooled estimate of all regions. t-statistics in parentheses; *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.

Table 5.3:Regional EAPCs: Published RPI Rational Expectations: 1976-1996,

$$\Delta W_{it} = \alpha_{oi} + \alpha_{1i}\Delta U_{it} + \alpha_{2i}\Delta P_{it}^{E} + \varepsilon_{it}$$

Region	Constant	Unemployment	Price	R^2
East Anglia	0.02	-0.02	1.05	0.78
	(1.52)	(-1.15)	(8.80)***	
East Midlands	0.03	0.002	0.82	0.66
	(2.38)**	(0.13)	(6.19)***	
North	0.02	0.02	0.89	0.82
	(2.40)**	(0.94)	(8.70)***	
North-West	0.02	0.03	0.89	0.84
	(2.99)***	(1.94)**	(9.27)***	
South-East	0.03	-0.01	0.91	0.71
	(2.59)***	(-1.00)	(7.23)***	
South-West	0.02	0.01	1.01	0.78
	(1.70)*	(0.36)	(8.29)***	
West Midlands	0.02	-0.01	0.96	0.69
	(1.60)	(-0.42)	(6.51)***	
Yorkshire & Humberside	0.02	0.002	0.93	0.89
	(3.08)***	(0.13)	(11.99)***	
Northern Ireland	0.02	0.05	0.89	0.79
	(2.33)**	(1.41)	(7.07)***	
Scotland	0.02	0.01	0.99	0.87
	(2.04)**	(0.61)	(10.34)***	
Wales	0.02	0.04	0.91	0.80
	(1.86)*	(1.93)*	(7.79)***	
United Kingdom Average	0.02	-0.01	1.01	0.77
	(2.74)***	-(0.52)	(14.99)***	

Note: United Kingdom Average estimates are based on pooled estimate of all regions. *t*-statistics in parentheses; *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.

Table 5.4: Regional EAPCs: Published RPI Adaptive Expectations: 1976-1996,

$$\Delta W_{it} = \alpha_{oi} + \alpha_{1i}\Delta U_{it} + \alpha_{2i}\Delta P_{it}^{E} + \varepsilon_{it}$$

Region	Constant	Unemployment	Price	R^2
East Anglia	0.04	-0.03	0.67	0.40
	(2.34)**	(-1.78)*	(4.01)***	
East Midlands	0.04	-0.00	0.55	0.42
	(2.98)***	(-0.15)	(3.69)***	
North	0.04	0.01	0.55	0.46
	(3.02)***	(0.58)	(3.82)***	
North-West	0.05	0.03	0.53	0.52
	(3.43)***	(1.87)*	(3.90)***	
South-East	0.05	-0.01	0.50	0.31
	(3.39)***	(-0.46)	(3.07)***	
South-West	0.04	0.00	0.62	0.43
	(2.61)***	(0.09)	(3.90)***	
West Midlands	0.04	-0.01	0.58	0.34
	(2.53)**	(-0.37)	(3.13)***	
Yorkshire & Humberside	0.04	-0.00	0.58	0.49
	(3.18)***	(-0.10)	(4.33)***	
Northern Ireland	0.05	0.07	0.51	0.49
	(3.16)***	(1.59)	(3.16)***	
Scotland	0.04	0.03	0.56	0.49
	(2.97)***	(1.46)	(3.74)***	
Wales	0.05	0.07	0.43	0.43
	(3.12)***	(2.76)***	(2.61)***	
United Kingdom Average	0.03	-0.02	0.67	0.41
	(3.14)***	(-1.70)*	(6.70)***	

Note: United Kingdom Average estimates are based on pooled estimates of all regions. t-statistics in parentheses; *** indicates significance at the 1% level, ** at the 5% level, * at the 10% level.

rate of change of unemployment and expected prices The results from estimating equation (5.12) are given in Tables 5.1 and 5.4.

All four models produced mixed results as to the significance of the unemployment variable. Whilst all four models indicate common support for a significant wage–unemployment relationship in the regions of North and Wales (though counter-intuitively a positive relationship, see later), in the majority of cases unemployment is not found to be significantly related to wage behaviour. What is also of interest is the UK national average AEH estimated equation. Here the wage-unemployment relationship is found to be significant despite the rejection of a significant wage-unemployment relationship in the majority of regional cases. Such a result suggests that the aggregate wage-unemployment relationship differs from the regional and that national estimates of the EAPC are not representative of the regional estimates though this might be due to possible estimation problems highlighted above.

With regards to the price expectations coefficient, the relationship between wages and expected prices under the REH formulation is closer to unity than under the AEH formulation. Indeed the "goodness of fit" measures are significantly greater under the REH than the AEH. Whether anything can be gleaned with regard to relative nominal wage growth against price growth and the wage-unemployment relationship is open to conjecture. In all cases under the AEH there does not appear to be any relationship between relative price and wage growth, although there is some evidence of higher wage rate growth being correlated with falling unemployment.

In the majority of cases the coefficient on unemployment is not significant at the 10% level. This result signifies that wage adjustment processes are a function of expected prices (and as a result expected real wages). This is a result consistent with labour supply-side responses to labour market participation.

Compared with similar regional EAPC estimates of Blackaby and Manning (1987), and Hyclak and Johnes (1992) in which lagged RPI is taken as the expected price variable over the period 1964-1984 and 1971-1985 respectively, they both find unemployment to be significantly related to wages in almost all regions, this is not supported by any of the results presented in the Tables. Johnes (1989) compares EAPC estimates based on two different function forms and under different price expectations hypotheses, the REH model and perfect foresight. Whilst his results are much more similar (he finds unemployment to be insignificantly related to wages over the sample period with the exceptions of the North, Yorkshire and Humberside, East Anglia and Wales)) his linear model does not, however, produce EAPC estimates under the assumption of AEH.

The EAPC model assumes that wages are determined by unemployment and expected prices. Unemployment adjustment occurs when actual and expected prices differ. The assumption that the EAPC is only a short-run phenomenon suggests that price expectations errors are temporary as workers attempt to determine their real wage rates, employment both labour demand and labour supply operates around the expected real wage rate. Inferring an expected real-wage-unemployment relationship from the EAPC regressions implies a wage-bargaining process as a function of expected price variables. The regressions may be considered long-run estimations, given the sample period, as such the results can be masking short-run adjustment processes. In estimations in which the REH in price expectations formation is assumed, the estimated coefficients imply a weak or non-existent wage – unemployment relationship. The results based on the AEH are, however, mixed. Both across both regional and published RPI-price expectations estimates. Positive and negative relationships between expected prices and unemployment are found to be significant. The majority of cases, however, posit a negative relationship between unemployment and expected prices consistent with a union-wage bargaining model (see Johnes (1989)) but nonetheless the positive coefficients are interesting and suggest a labour supply adjustment process in which labour supply falls as wages rise implying expected real wages to be higher than actual. Conclusions as to whether there is a relationship between wages and unemployment therefore appear to depend on how it is assumed price expectations are measured.

Comparing the EAPC estimates across the regional price and the RPI price estimations, two differences are of note. The first is that the "goodness of fit" is higher with the use of the regional price variable than the published RPI. This might indicate that regional prices in constructing price expectations more accurately explains the behaviour of the regional labour market and are therefore more relevant than the use of the published RPI. The second relates to the REH estimates of the EAPC in which the published RPI presents overwhelming support for the notion of there being no relationship between wages and unemployment. Regional price estimation was unable to reject this hypothesis in two of the regions.

Whether or not a significant wage–unemployment relationship exists using the different measures of price and price expectations, can be formally tested using the Wald test on the restrictions of the coefficients. Johnes (1989) argues that a joint-test of significance on the coefficients on unemployment and expected prices in regional EAPC estimates can indicate whether a wage–unemployment relationship exists. However, he argues that this ought to be considered in the context of the significance of the coefficient on the price variable

The theoretical regional EAPC equation being estimated is repeated in equation (5.12):

$$\Delta W_{it} = \alpha_{oi} + \alpha_{1i}\Delta U_{it} + \alpha_{2i}\Delta P_{it}^{E} + \varepsilon_{it} \tag{5.12}$$

In each case the hypothesis being tested is that there is no relationship between wages and unemployment. This is identical to testing the restrictions on the unemployment and expected price coefficients that $\alpha_{1i} = 0$ and $\alpha_{2i} = 1$. Failure to reject this hypothesis is consistent with the notion of the natural rate or non-accelerating inflation rate of unemployment hypotheses (Friedman (1968)). This hypothesis argues that the unemployment rate will remain constant if price expectations are correct. Assuming this to be the case unemployment and nominal wages should not be related in the long-run, as price expectations absorb changes in nominal wage rates. According to Johnes, a trade-off between unemployment and wages implies $\alpha_{1i} < 0$ and $\alpha_{2i} < 1$, and such a result is consistent within a union wage-bargaining framework, (see Johnes (1989 p. 23)).

By imposing the restrictions of $\alpha_{1i} = 0$ and $\alpha_{2i} = 1$ in each of the EAPC estimates it was possible to perform a Wald test of these joint-restrictions of the hypothesis that

Table 5.5: Wald Test Results of the Wage-Unemployment Relationship in the EAPC

Region	Regional REH	Regional AEH	Published REH	Published AEH
East Anglia	0.81	0.00***	0.51	0.01***
East Midlands	0.14	0.00***	0.39	0.01***
North	0.51	0.00***	0.46	0.01***
North-West	0.42	0.00***	0.13	0.00***
South-East	0.71	0.00***	0.38	0.00***
South-West	0.88	0.00***	0.93	0.06*
West Midlands	0.92	0.00***	0.81	0.02**
Yorkshire & Humberside	0.00***	0.00***	0.67	0.01***
Northern Ireland	0.03**	0.00***	0.36	0.01***
Scotland	0.10*	0.00***	0.81	0.01***
Wales	0.00***	0.00***	0.16	0.00***
United Kingdom Average	0.08*	0.00***	0.87	0.00***

*** indicates rejection of the null hypothesis at the 1% level, ** at the 5% level and * at the 10% level.

there is no relationship between wages and unemployment for each of the SUR estimates given in Tables 5.1-5.4. The associated probability values in non-rejection of the null hypothesis are given in Table 5.5.

The results in Table 5.5 indicate a clear split between rejection and non-rejection of the null hypothesis according to the price expectations operator employed rather than whether regional prices or the RPI are used. Given the small sample size, however, the Wald test results need to be interpreted with care. For the price AEH estimates in almost all cases the null hypothesis $\alpha_{1i} = 0$, $\alpha_{2i} = 1$ cannot be rejected for both the regional and the published RPI series. These results, however, appear to reflect the wage – expected price relationship more than the wage – unemployment, given the relatively large discrepancy in the coefficient estimates. In the case of the REH test results it is possible to reject the null hypothesis only in the case of the regional price estimates for three regions and the UK average. Again this seems to be due to the wage – expected price relationship.

Based on the results presented in Table 5.5 it is not possible to categorically come out in support of, or against evidence of a relationship between wages and unemployment. What can be said is that the relationship between wages and unemployment implied by the competitive wage bargaining formulation (See Johnes (1989)) is inconsistent with the results based on the AEH formulation and in a few cases with the REH. Furthermore, in the case of regional price expectations the UK national average results differ from those of the majority of regions. There does not appear to be a universally acceptable EAPC specification that fits all of the regional results satisfactorily.

The regional EAPC estimates are not formally derived within the context of any model of wage determination. In the majority of cases unemployment was insignificantly associated with wages. Such a finding is not, however, in common with a number of regional EAPC estimations, though the functional form and the sample period differ. What can be explored here, however, is whether regional EAPCs are statistically significantly different from the national average estimate, and whether this is a function of the different price variables employed.

The aggregation hypothesis assumes that regional Phillips curves differ from the aggregate. Using the EAPC estimates this hypothesis is tested by setting the coefficient values for each of the four different expected price variables on the UK Average as joint-restrictions on the regional estimates. The associated probability values on the computed Wald test statistic of the estimated regional coefficient being statistically significant to the UK Average are presented in Table 5.6.

Table 5.6: Wald Test Results of the Hypothesis that Regional EAPC Estimates are not significantly different from the National Average

Region	Regional REH	Regional AEH	Published REH	Published AEH
	UK Coefficient Values: $\alpha_{1,UK} = -0.002$ $\alpha_{2,UK} = 1.08$	UK Coefficient Values: $\alpha_{1,UK} = -0.02$ $\alpha_{2,UK} = 0.59$	UK Coefficient Values: $\alpha_{1,UK} = -0.01$ $\alpha_{2,UK} = 1.01$	UK Coefficient Values: $\alpha_{1,UK} = -0.02$ $\alpha_{2,UK} = 0.67$
East Anglia	0.65	0.61	0.89	0.82
East Midlands	0.02**	0.33	0.74	0.69
North	0.05**	0.21	0.32	0.36
North-West	0.14	0.02**	0.03**	0.01***
South-East	0.22	0.34	0.92	0.73
South-West	0.76	0.96	0.55	0.41
West Midlands	0.94	0.65	0.96	0.94
Yorkshire & Humberside	0.00***	0.77	0.62	0.54
Northern Ireland	0.02	0.99	0.26	0.12
Scotland	0.58	0.46	0.50	0.07*
Wales	0.01***	0.01***	0.06*	0.00***

*** indicates rejection of the null hypothesis at the 1% level of significance, ** at the 5% level and * at the 10% level.

The critical value in rejecting the null hypothesis is taken as 10%. The probability values on the computed F-statistic indicate a majority support for non-rejection of the null hypothesis that regional EAPC estimates are statistically similar to the national average. This finding questions the aggregation hypothesis and is consistent with the early analyses of Thirwall (1968) and Brechling (1973) in failing to find support for the hypothesis that that regional wage inflation is a function of the dispersion of unemployment. However, in a small number of cases it is possible to reject the null hypothesis particularly in the case of regional price-REH estimates. Indeed there is very little conformity across the different price estimates as to which regions most closely follow the UK Average. The mix of results in Table 5.6 raises questions concerning the estimation techniques and in particular the robustness of the Wald test statistics given the small sample size. Ignoring the regional price-REH results suggest that regional labour market adjustment processes differ significantly from the national average, and that any similarities are simply a matter of construction than indicative of national wage determination practices. That is there does appear to be some support for the aggregation hypothesis based on the former conjecture.

5.4.6 Pooled Estimation of Regional EAPCs

SUR estimation of single-equation regional EAPCs attempts to correct for the presence of cross-sectional correlation amongst the residuals. However, each of the estimations include only 21 observations on annual data (corrected sample 1976-1996 inclusive). Data limitations prevent the number of observations from being increased. Furthermore the efficiency of estimation is seriously called into question if a smaller sample size is used. Pooling data increases the number of observations for estimation. For 11 regions over 21 years there is a total of 231 data points for which a regional EAPC can be estimated. Also, pooling regions allows shorter periods to be analysed. Single equation estimation might suffer from bias due to simultaneity if wages and unemployment are jointly-determined. Formalising a complete regional labour market model here is however not the focus of attention.

Of the previous regional Phillips and Expectations-Augmented Phillips Curves estimates only Cowling and Metcalf (1967) attempted pooled estimation. They divided the UK regions into two groups of high and low employment. Their results and policy conclusions conform with those of the Blanchflower and Oswald's (1992) namely that differing regional wage-employment sensitivities imply that national anti-inflationary polices in reducing labour demand will have little impact on prices in the low employment regions ((1967), p. 38).

Whilst Cowling and Metcalf's study simply observed employment data to determine their "high-low" split, it is possible to perform a simple Chow test to try and validate a split into a high unemployment north against a low unemployment south.

Pooling the EAPC estimates across the four different price measures based on the north–south divide defined in Chapter Two, a Chow test of the hypothesis that there is no difference in the regional estimates of the EAPC was undertaken for the full sample period. Annual data estimates over the time period, however, might lead to short-run regional differences filtered out. Given the significant change in regional unemployment behaviour over the 1990-1996 period, it was decided that a short-run EAPC process might be captured with respect to a significant wage-unemployment relationship over this period, so the Chow test was performed for both the full and the 1990-1996 periods.

Table 5.7 presents the computed F-statistic on the Chow test of the hypothesis that there is no difference in the EAPC relationship across the high and low unemployment regions over the 1976-1996 period and the 1990-1996 period.

Table 5.7: Chow Test Results of North versus South Expectations-Augmented Phillips Curves

Price Variable	Expectations	1976-1996		1990-1996	
		F-Statistic	No. of Observations	F-Statistic	No. of Observations
Regional	AEH	††	231	3.61†**	77
	REH	2.13	220	4.03†***	77
RPI	AEH	††	231	2.67†**	77
	REH	††	231	††	77

*** indicates rejection at the 1% level of significance and ** indicates rejection at 5%, † indicates Cochrane-Orcutt AR(1) correction for serial correlation, †† indicates serial correlation could not be removed violating Chow test assumptions.

For the Chow test to be valid residuals have to be normally distributed with no serial correlation or heteroscedasticity. For the full sample period, the residuals for all three equations in each estimate on the four different price variables were tested. The hypothesis of no serial correlation in the residuals was rejected in the south, and the *all region* AEH-RPI estimates. Whilst the presence of serial correlation was corrected for in the case of the regional price-REH variable, it was not possible in the case of the AEH-RPI. As a result the Chow test could only be performed on the full sample regional price-REH estimations of the EAPC. For the 1990-1996 period, given the relatively small sample size and the presence of serial correlation in the full sample an AR(1) process was added to the pooled estimates. It was decided that the Cochrane-Orcutt procedure of adding the AR(1) term as correction for serial correlation if not relevant was less of a problem than excluding the term when it is.

The results indicate support for the existence of significant regional differences in the 1990-1996 period but for the full sample period there is no evidence of a north-south split in the EAPC. However, the power of the tests, and the estimated functional form given the need to correct for serial correlation need to be considered when interpreting these results.

Given these findings pooled regional EAPCs were estimated, for each of the expected price variables, over two sample period (1976-1996 and 1990-1996) for all regions, the north and the south. The results are presented in Tables 5.8-5.13.

Table 5.8: Pooled Regional EAPCs: All regions, 1976-1996,[10]

$$\Delta W_{it} = \alpha_{oi} + \alpha_{1i}\Delta U_{it} + \alpha_{2i}\Delta P_{it}^{E} + \varepsilon_{it}$$

Price Variable	Expectations	Constant	Unemployment	Price	Obs
Regional	REH	0.01	0.00	1.08	231
		(3.15)***	(-0.34)	(31.33)***	
	AEH	0.03	-0.02	0.59	231
		(4.60)***	(-2.77)**	(9.53)***	
RPI	REH	0.02	-0.01	1.01	231
		(2.70)**	(-0.52)	(14.99)***	
	AEH	0.03	-0.02	0.67	231
		(3.14)***	(-1.70)	(6.70)***	

t-statistics are in parentheses, *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.

[10] All data were estimated using pooled SUR, though in the case of the 1990-1996 period, due to the small sample period SUR estimation was not possible. Instead estimation for the 1990-1996 period, given in Table 5.9 was taken from computer software package STATA using GLS and correcting for cross-sectional correlation. For the full sample period both techniques yielded the same results.

Table 5.9: Pooled Regional EAPCs: All Regions, 1990-1996,

$$\Delta W_{it} = \alpha_{oi} + \alpha_{1i}\Delta U_{it} + \alpha_{2i}\Delta P_{it}^{E} + \varepsilon_{it}$$

Price Variable	Expectations	Constant	Unemployment	Price	Obs
Regional	REH	0.10	0.01	1.19	77
		(1.90)***	(0.85)	(12.71)***	
	AEH	0.02	0.01	0.66	77
		(17.30)***	(3.22)***	(24.08)***	
RPI	REH	0.01	-0.01	1.36	77
		(2.55)***	(-0.33)	(12.85)***	
	AEH	0.00	-0.02	1.11	77
		(0.53)	(-2.01)**	(24.82)***	

t-statistics are in parentheses. * indicates significance at the 1% level, ** at the 5% level and *** at the 10% level.

Table 5.10: Pooled Regional EAPCs: North, 1976-1996,

$$\Delta W_{it} = \alpha_{oi} + \alpha_{1i}\Delta U_{it} + \alpha_{2i}\Delta P^{E}_{it} + \varepsilon_{it}$$

Price Variable	Expectations	Constant	nemployment	Price	R^2	Obs
Regional	REH	0.01	-0.00	1.05	0.80	154
		(2.62)**	(-0.11)	(19.96)***		
	AEH	0.05	0.02	0.43	0.50	140
		(5.74)***	(0.91)	(5.30)***		
RPI	REH	0.02	0.01	0.92	0.80	154
		(3.26)***	(0.74)	(12.05)***		
	AEH	0.05	0.01	0.54	0.44	140
		(3.76)***	(0.56)	(4.27)***		

t-statistics are in parentheses, *** indicates significance at the 1% level, ** indicates significance at the 5% level, * indicates significance at the 10% level and † indicates Cochrane-Orcutt AR(1) correction for serial correlation.

Table 5.11: Pooled Regional Phillips EAPCs: North, 1990-1996,

$$\Delta W_{it} = \alpha_{oi} + \alpha_{1i}\Delta U_{it} + \alpha_{2i}\Delta P_{it}^{E} + \varepsilon_{it}$$

Price Variable	Expectations	Constant	Unemployment	Price	R^2	Obs
Regional	REH†	0.01	0.05	0.99	0.68	77
1		(4.70)***	(9.06)***	(18.21)***		
	AEH†	0.02	0.05	0.70	0.64	77
		(12.05)***	(6.46)***	(21.05)***		
RPI	REH	0.01	0.03	1.29	0.72	77
		(3.44)***	(3.97)***	(14.90)***		
	AEH	0.01	0.03	0.98	0.73	77
		(5.47)***	(12.37)***	(40.64)***		

t-statistics are in parentheses, *** indicates significance at the 1% level, ** at the 5% level, * at the 10% level and † indicates Cochrane-Orcutt AR(1) correction for serial correlation.

Table 5.12: Pooled Regional EAPCs: South, 1976-1996,

$$\Delta W_{it} = \alpha_{oi} + \alpha_{1i}\Delta U_{it} + \alpha_{2i}\Delta P_{it}^{E} + \varepsilon_{it}$$

Price Variable	Expectations	Constant	Unemployment	Price	R^2	Obs
Regional	REH†	0.01	-0.01	1.06	0.80	154
		(1.68)*	(-0.64)	(12.96)***		
	AEH	0.04	-0.02	0.60	0.48	140
		(3.06)***	(-0.89)	(4.51)***		
RPI	REH†	0.02	-0.01	0.98	0.73	154
		(2.04)**	(-0.29)	(8.49)***		
	AEH††	0.04	-0.02	0.55	0.38	140
		(2.74)***	(-0.71)	(3.11)***		

t-statistics are in parentheses, *** indicates significance at the 1% level, ** at the 5% level, * at the 10% level and † indicates Cochrane-Orcutt AR(1) correction for serial correlation.

Table 5.13: Pooled Regional EAPCs: South: 1990-1996,

$$\Delta W_{it} = \alpha_{oi} + \alpha_{1i}\Delta U_{it} + \alpha_{2i}\Delta P_{it}^{E} + \varepsilon_{it}$$

Price Variable	Expectations	Constant	Unemployment	Price	R^2	Obs
Regional	REH†	0.01	-0.003	1.24	0.86	84
		(3.04)***	(-0.03)	(11.94)***		
	AEH††	0.02	-0.03	0.92	0.64	80
		(3.16)***	(-1.70)*	(8.81)***		
RPI	REH††	0.01	-0.01	1.43	0.77	84
		(2.43)**	(-1.42)	(10.70)***		
	AEH††	-0.01	-0.05	1.40	0.82	80
		(-3.65)***	(-8.47)***	(30.25)***		

t-statistics are in parentheses, *** indicates significance at the 1% level, ** at the 5% level, * at the 10% level, † indicates Cochrane-Orcutt AR(1) correction for serial correlation and †† indicates serial correlation could not be removed.

The results across all 6 equations for the full sample period indicate strong support for there being no regional wage-unemployment relationship. These results are only consistent with the regional REH or PF EAPC estimates (see Johnes (1989) for the UK and Payne (1995) for the USA). The results are, however, more striking with regard to the 1990-1996 period in which there is far more support for a wage-unemployment relationship existing. The results are mixed, however, in that there is a much a greater support for this under the price-AEH variable than under the REH. Again this result confirms the single-equation estimates from earlier and implies that the specification of the price variable influences the results. However, the size of the coefficient is very small in all cases, which raises the question as to how meaningful this relationship is.

From the Tables what is also interesting is the sign on the unemployment coefficients in the 1990-1996 period across the three different groups. Over this relatively small period unemployment rose across all regions but much more in the south than the north. Here the pooled regional EAPC's for the north, in all cases, unlike in the south, indicates a direct relationship between nominal wage growth and unemployment. In the south, as well as for the full regional sample the relationship is in reverse. To the extent that the aggregate result might be dominated by the relatively larger south sheds some light on the aggregation hypothesis in that whilst regional wage processes differ the UK Average fails to capture this. However, the difference in the estimated coefficients needs explaining. The single-equation estimates over the full sample period indicated that this positive wage and unemployment relationship prevailed in the North-West and Wales. This result is, however, counterintuitive. EAPC estimations predict an inverse relationship between wages and unemployment, through changes in labour demand. A positive relationship implies labour supply adjustments Whilst it is possible that a bias has been introduced into the estimation of the single-equation coefficients and that the estimated functional relationship is incorrect the result needs further thought. The EAPC estimates for the North West and Wales appear to be picking up a supply-side response in which the employed become unemployed through some form of inter-temporal substitution (see e.g. Lucas and Rapping (1969, and for a summary Blanchard and Fischer (1994)), e.g. in which future lower expected real wages leads to a reduction in labour supply. If this is the case then it would appear that the north and south differ with regard to expected future real wages with the south having a much higher expected future real wage rate.

Comparing the estimated coefficients on each of the price expectations hypotheses according to the price variable used, there is a much greater variation in the estimated values with the RPI than the regional price series. These large variations would be consistent with the RPI measure failing to pick-up regional price differences and thus producing different coefficient estimates on the wage-unemployment relationship.

The reason for such wage–unemployment differences might be tied to the expected price variable in more ways than one. Whilst there is support for differences existing this is related to the formation of expectations assumed. The wage–expected price estimates over the 1990-1996 indicate wage growth being greater than expected prices suggesting this leads to falling unemployment (expected real wages rise). This is a result consistent with the hypothesis that changes in unemployment are linked to expected prices, here the results suggest that unemployment falls in the context of higher expected real wages.

As with the single-equation estimates a more formal test of significance of a wage-unemployment relationship for both sample periods for all EAPC estimates was performed using the Wald test on the joint-restriction of $\alpha_{1i} = 0$, $\alpha_{2i} = 1$ in the equation $\Delta W_{it} = \alpha_{oi} + \alpha_{1i}\Delta U_{it} + \alpha_{2i}\Delta P_{it}^{E} + \varepsilon_{it}$. The probability values on the F-statistic of rejection of the null hypothesis are presented in Table 5.14.

Table 5.14: Wald Test Results on the Hypothesis that Pooled EAPC Estimates are not significantly different from the National Average

Year	Region	Regional Price REH	Regional Price AEH	RPI REH	RPI AEH
1976-1996	All	0.08*	0.00***	0.87	0.00***
	North	0.58	0.00***	0.54	0.00***
	South	0.68†	0.00***	0.93†	0.00***††
1990-1996	All	0.05**†	0.00***†	0.00***	0.02**
	North	0.00***	0.00***	0.00***	0.00***
	South	0.03**†	0.09*††	0.00***††	0.00***††

*** indicates rejection of the null hypothesis at the 1% level, ** at the 5% level and * at the 10% level, † indicates Cochrane-Orcutt AR(1) correction for serial correlation, and †† indicates serial correlation could not be removed.

With the exception of the 1976-1996 REH regional price and RPI estimates, Table 5.15 indicates that in all other cases the hypothesis: $\alpha_{1i} = 0$, $\alpha_{2i} = 1$ is rejected at the 1% level. These results again confirm the hypothesis that EAPC estimates appear to be a function of the price expectations variable assumed. Furthermore the hypothesis is not rejected for the 1990-1996 period, indicating support for some short-run relationship in all cases. Support for regional EAPCs seems to be borne out by the wage and price expectations results in the short-run. As a result there is some support for the aggregation hypothesis holding over shorter time periods than the full sample period. What is also of note is that over the full sample period, regional price-REH estimates for the all regions measure, fails to reject the null hypothesis that there is no wage-unemployment relationship, unlike in the north and the south. The implication again, is that estimated regional EAPCs are different from the aggregate, implying an aggregation bias in aggregate EAPC estimates.

The Wald test results confirm the EAPC estimates presented in Tables 5.8-5.13. These results support the existence of a wage-unemployment relationship across the regions but which appears to be a function of the time period under consideration and the particular price expectations variable assumed. Comparisons of EAPC estimates can also be drawn with respect to a north-south split. But the implications are rather more startling than those suggested elsewhere with respect to the extent of this wage-unemployment relationship. Whilst from Tables 5.8-5.13, there appears to be unanimous support for there being no wage-unemployment relationship over the full sample period there is support for such a relationship over 1990-1996 period. Here there appears to be two different wage-unemployment patterns occurring across the north and south under both price variables. Wage rate growth appears to be negatively related to unemployment in the south, but positively related in the north, this is certainly the case under the AEH assumption. Ceteris paribus an equal increase in unemployment across the two divides will lead to rising wage growth in the north and falling wage growth in the south. Again this is suggestive of differing demand-side and supply-side effects across the two regional groups along with a number of different processes, such as different wage-bargaining / wage determination processes occurring throughout the economy, which has not been discussed in the literature, and / or differing industrial processes. What these differing wage-unemployment relationships indicate is that the aggregate EAPC estimations are misleading. These findings also raise the issue of what role price expectations might play in the wage-unemployment relationship, and more interestingly if labour market processes differ in the context of a national shock does this threaten the assumption that the UK labour market is integrated? The Integration Hypothesis is explored next.

5.5 The Integration Hypothesis

Whether the UK labour market can be regarded as integrated with respect to inter-regional economic activity was examined in Chapter Three and discussed above. Differences in regional labour market adjustments as evidenced by the wage curve, and the regional EAPC estimates above do not, however, necessarily imply that the UK labour market is not integrated. Whilst regional economic activity can be identified it does not necessarily mean that economic activity is region-specific and that regional divisions in real wages and unemployment are due to restrictions on the movements of goods and services. Evidence of regional differences in real wages and unemployment against the high degree of conformity in regional relativities at least until 1990 highlights the problems that arise in determining whether regions interact and exhibit some degree of cross-regional integration. Furthermore there is the issue of whether this is stable through-out time or not. In the literature, integration relates to how well regions adjust to region-specific shocks. An integrated national economy implies equal price and wage responsiveness to an economic shock subject to economic factors specific to the region. Whilst the event of changing regional unemployment differences occurred post-1990 there is still insufficient evidence to argue that this is symptomatic of weak economic adjustment forces operating across regions.

The existence of cross-sectional correlation in the regional EAPC estimates and evidence of high collinearity in regional economic data imply that regions are best modelled as highly interactive economic units prompting estimation using the method of the SUR. However, the extent by which regions may differ in their interactions with one another and whether this relationship is dynamically stable has not been investigated and implies that the degree of economic integration might change over time.

Whilst the development of the integration hypothesis is beyond the scope of this thesis, an exploration into the relative stability of the regional EAPC estimates, for all regions, the north and the south can be undertaken. This is to examine whether the post-1990 era might herald a significant development in regional labour market adjustment processes. Evidence of increased firm-specific wage bargaining processes might imply increased reliance on regional economic conditions and a switch to much greater within-region adjustment processes. Using the Chow test it is possible to compare the regional EAPC models over the two sample periods, 1976-1989 and 1990-1996 to test whether these estimates have remained stable over the full sample period.[11]

A Chow test on the existence of a structural break in 1990 was performed on each of the three regional groupings, the results are in Table 5.15.

[11] Single equation and pooled estimates were tested for structural breaks using the recursive residuals CUSUM and CUSUM squared tests, whilst for pooled estimates there was a break around 1990 the number of regions excluded a test pre 1985, single equation estimates offered greater time period for analysis, and indicated increased variability around the early part of the 1990s,. Unfortunately the test results around the early 1980s-a comparable period–proved too near the start of the estimation

Table 5.15: Chow Test Results on the 1990 Split. EAPC: Various Price Definitions

Price Variable	Expectations	All Regions F-Stat	Obs.	North F-Stat	Obs.	South F-Stat	Obs.
Regional	AEH	9.29	231	6.82	147	††	84
	REH	1.89**	231	1.65**†	140	2.79**†	80
RPI	AEH	12.39	231	8.41	147	††	84
	REH	4.33	231	3.57	147	††	84

† indicates Cochrane-Orcutt AR(1) correction for serial correlation, †† indicates serial correlation could not be removed, ** indicates non-rejection of the null hypothesis at 5%.

The inability to remove first-order serial correlation in the estimates for the south estimates with the exception of the regional REH estimate, prevented the Chow test from producing any meaningful results hence this was not undertaken with the south.

Table 5.15 indicates that the null hypothesis that regional EAPC estimates are the same over the two periods is rejected in a number of cases. Support for the null comes from the regional REH estimates for all three cases. This result is, however, unsurprising if as was expected from the above regional EAPC-estimates, these test results are simply comparing a long run with a short run wage and unemployment relationship. As a result it would be too strong a conclusion to draw that regional EAPCs have changed. What it does suggest, however, is that EAPC estimates differ and therefore the 1990-1996 period should be examined separately from the full sample period.

Differing regional wage-unemployment adjustment processes whilst supporting the aggregation hypothesis offer little insight as to whether the UK labour market is integrated or not. However labour market differences do not necessarily imply that regional labour markets are operating under conditions that are preventing the operation of the free market.

The narrowing of regional unemployment rates in the 1990-1993 recessionary period has been established as due to the relatively large rise in unemployment in the south. Of the few papers that have examined this, the consensus is that this was due to the greater impact high interest rates had on demand in the south relative to the north. The impact of this negative demand-side shock was discussed in Chapter Four. The analysis there led to the suggestion that asymmetric regional price adjustment affected relative regional real wages, and led to the observed pattern of regional unemployment that ensued. Chapter Four attempted to uncover the nature of the negative demand-side shock on the regions of the UK. Evidence there suggested that the shock had a greater impact on the south than the north as evidenced by the existence of price asymmetries, and the south responded poorly to it.

Whilst unemployment differences in the north and south have been discussed in terms of differing wage-unemployment adjustment processes but these in themselves do not challenge the integration hypothesis. What seems to explain why regions apparently respond differently to the same shock is that in fact the regions are responding to different shocks. Regional EAPC estimates for the 1990-1996 period indicate significantly different wage-unemployment adjustment processes across the north-south divide. Whilst the apparent restrictions on regional mobility imply that labour markets are not full integrated, the lack of higher / frequency regional data has prevented the literature from exploring region-specific shocks in the UK. The literature on the leading-sector hypothesis has attempted to address this issue (see Cowling and Metcalf, (1967), Thirlwall (1970), Metcalf (1971) and more recently Layard, Nickell and Jackman (1993) p. 312-315) but the creation of regional prices would allow a richer study into this topic. But this is beyond the scope of this thesis.

5.6 Regional Expectations-Augmented Phillips Curves and Price Misperceptions

5.6.1 Regional EAPC and Price Expectational Errors

One hypothesis explaining any possible short-run wage-unemployment relationship centres around price expectational errors. Determining unemployment as a function of price expectational errors in which both wage and unemployment adjustment occur centres around the theory of intertemporal substitution. Whilst empirically the regional EAPC estimates pick up a short-run relationship between wages, price expectations and unemployment, this is observationally equivalent to price expectational errors driving labour supply decisions.

The notion that price expectational errors lead to adjustments in the real side of the economy goes back to Lucas (1972) in which agents are modelled as adjusting labour supply when they confuse changes in general prices for changes in relative prices. As a result such output and employment adjustments can arise when people make price expectational errors. Such a model has been formulated along the line of Lucas and Rapping's (1969) model of intertemporal substitution between employment and leisure (unemployment) and in the so-called Sargent and Wallace (1975) "Surprise"-supply function

Unlike the EAPC model in which wage adjustment is determined by firm and worker bargaining over unemployment and price expectations within a derived-demand setting, the Lucas-SW supply model assumes both wage and unemployment adjustment based on price expectational errors. What makes the Lucas-SW model attractive to use relates to the positive relationship measure in the regional EAPC estimates of the north between unemployment and wages, suggesting labour supply adjustment. However, it is also that case that the measured real wage and expected real wage variable is the consumer real wage and therefore appropriate for analysing labour supply decisions. The regional EAPC and the Lucas-SW models assume expected real wages drives unemployment adjustment, the wage determination models examined in Chapter Four suggested an asymmetry in the real-wage unemployment adjustment processes across the north-south divide of the UK. If the EAPC holds as a model of wage determination, the evidence presented in Chapter Four suggests that price expectational errors might be significant in explaining unemployment adjustments, and combined with the regional EAPC estimates, that price expectational errors might have differed regionally, thus leading to differing unemployment adjustments. Within a north-south context, the relationship between price expectational errors and unemployment can be examined more closely.

The hypothesis that changes in unemployment are a function of price expectational errors can be tested in the context of Sargent and Wallace (1975) aggregate supply function in which output (replaced by unemployment) is modelled as moving around its 'normal' or expected level U^*:

$$U_t - U^* = \alpha\left(P_t - P^E\right) \tag{5.13}$$

where U_t represents unemployment in period t, U^* the 'normal rate' of unemployment, P_t and P^E actual and expected prices respectively.

Re-specifying equation (5.13) it is possible to test whether deviations in unemployment are a function of deviations between actual and expected prices. If actual and expected prices are equal then this model implies that there would be no change in unemployment.

$$\Delta U_{it} = \alpha_{oi} + \alpha_{1i}\left(P_{it} - P_{it}^{E}\right) + \varepsilon_{it} \tag{5.14}$$

where P_{it} represents the logarithm of actual prices in region i time period t, P_{it}^{E} the logarithm of the expected price and ε_{it} is a random error.

Equation (5.14) was estimated using the SUR technique based on rejection of the null hypothesis of the presence of no cross-sectional correlation. Parameter estimates were calculated for all three regional groups: all regions, the north and the south, for both full and post-1990 sample periods and under all four differing price expectations formulations. All data were tested for the presence of first-order serial correlation, heteroscedasticity and normality. In all cases the null hypotheses could not be rejected at the 5% level of significance. The results from the regressions are presented in Tables 5.16 and 5.17.

Table 5.16: Regional Unemployment and Price Expectational Errors 1976-1996,

$$\Delta U_{it} = \alpha_{oi} + \alpha_{1i}\left(P_{it} - P_{it}^{E}\right) + \varepsilon_{it}$$

Regions	Price	Expectation	Constant	$\left(P_{it} - P_{it}^{E}\right)$	R^2
All	Regional	REH	0.02	-0.83	0.19†
			(1.03)	(-5.10)***	
		AEH	0.03	-2.01	0.27
			(2.62)***	(-10.75)***	
	RPI	REH	-0.02	-0.61	0.12†
			(-1.24)	(-1.01)	
		AEH	0.02	-1.99	0.22
			(1.57)	(-5.74)***	
North	Regional	REH	-0.01	-0.55	0.14†
			(-0.61)	(-3.78)***	
		AEH	0.03	-1.30	0.20
			(1.56)	(-5.22)***	
	RPI	REH	0.01	0.43	0.12†
			(0.54)	(0.59)	
		AEH	0.02	-1.63	0.20
			(1.35)	(-4.16)***	
South	Regional	REH	-0.03	0.12	0.13†
			(-0.54)	(0.24)	
		AEH	0.01	-1.71	0.24
			(0.27)	(-3.19)***	
	RPI	REH	-0.03	-2.82	0.15†
			(-0.58)	(-2.14)	
		AEH	-0.02	-2.1	0.19
			(-0.52)	(-2.58)***	

t–statistics are in parentheses, *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level, † denotes Cochrane-Orcutt AR(1) correction for serial correlation,

Table 5.17: Regional Unemployment and Price Expectational Errors: 1990-1996, $\Delta U_{it} = \alpha_{oi} + \alpha_{1i}\left(P_{it} - P_{it}^{E}\right) + \varepsilon_{it}$

Region	Price Variable	xpectations	Constant	$\left(P_{it} - P_{it}^{E}\right)$	R^2
All	Regional	REH	0.02	-3.08	Na
			(1.18)	(-10.80)***	
		AEH	-0.01	-3.45	Na
			(-0.65)	(-21.58)***	
	RPI	REH	0.07	-6.90	Na
			(7.17)***	(-11.52)***	
		AEH	-0.01	-6.32	Na
			(-0.71)	(-6.11)***	
North	Regional	REH	-0.00	-2.81	0.27
			(-5.76)***	(-94.75)***	
		AEH	-0.03	-2.55	0.30
			(-4.08)***	(-52.74)***	
	RPI	REH	0.05	-6.24	0.44
			(56.87)***	(-117.08)***	
		AEH	-0.05	-6.14	0.64
			(-33.64)***	(-76.64)***	
South	Regional	REH	0.08	-4.38	0.30
			(-3.98)***	(-3.98)***	
		AEH	-0.01	-4.34	0.48
			(-0.34)	(-6.59)***	
	RPI	REH	0.11	-7.27	0.29
			(4.77)***	(-5.16)***	
		AEH	-0.00	-8.05	0.63
			(-0.12)	(-3.94)***	

t–statistics are in parentheses, *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.

In almost all models, price expectational errors are found to be significantly negatively related to changes in unemployment. Furthermore, although theoretically different from the EAPC model the results are similar in that there appears to be a significant difference in the results across the AEH and REH split. The estimated coefficients indicate that unemployment is more sensitive to price errors in the south than the north, and even more sensitive under the regional price model than the RPI. However, there is no clear difference between whether price expectations are formed rationally or adaptively.

The price expectational error model appears to perform better than the regional EAPC estimates, particularly in the south in which unemployment is found to be statistically significant to price errors. Although the reported R^2 is lower for the south than the north (due to the sample size given the method of estimation the *all regions* R^2 could not be calculated). Whilst these type of equations suffer from the errors in variables problems discussed in Chapter Four and there are problems with the specification of the equation there does, however, appear to be a case made that unemployment adjustment differed significantly due to price expectational errors.

The fact that these results appear to perform better than the regional EAPC appears to lie at the heart as to why unemployment rose more in the south than the north. Assuming that that south has a higher real wage sensitivity of unemployment, and given the asymmetric negative demand-side shock. It appears that slower price growth in the south than the north led to price expectational errors leading to rising unemployment. Unemployment rose more in the south than the north because of this higher unemployment elasticity of pay against real wage resistance. The results from above and the regional EAPCs indicate that whilst labour supply adjustments took place in the north, unemployment rose more in the south through falling labour demand in light of nominal wage rigidities. If the workers in the south refuse to take nominal wage rate cuts, falling prices led to higher real wage growth than a constant unemployment rate warranted. As a result unemployment rose, sharply.

Chapter Four identified a positive real wage-unemployment relationship for the post-1990 period across the regional groups, suggesting nominal wage rigidities in the context of slowing price growth. This relationship was found to be smaller in the south than in the north, indicating that real wage resistance was greater in the south than the north. This helps explain why regional real wage differences did not narrow by more than they did. Whilst these results are in the main supported by the regional EAPC estimates, it does not explain why the north pooled regional EAPCs had an estimated positive relationship between wages and unemployment, (see Table 5.11). If these positive coefficients indicate labour supply-side adjustments (rather than poorly estimated equations), then given real wage resistance in the north and the south it implies that expected real wages were higher than actual real wages in the north workers opted to leave employment or found it easier to do so than bargain over real wage adjustments as they did in the south. This is an interesting result.

The results in Table 5.17, however, also raise a number of other issues in terms of the price expectation error-unemployment relationship. Whilst no comment has been made regarding the use of the regional versus the published RPI estimator, there is a relatively stronger price error effect using the RPI than the regional price estimators. The RPI, however, not only fails to distinguish between the two price-expectations hypotheses in terms of significance on unemployment but there is also very little evidence of asymmetrical wage-unemployment adjustment across the north-south divide as picked up in Chapter Four. Whilst the regional price indices also fail to differentiate between price error effects on unemployment across the north and south, the price error effect is, however, clearly differentiable between the north and the south. With regional price expectational errors, price errors exert a greater impact on unemployment in the south to the north.

To put this result into perspective Table 5.18 presents the actual percentage change in unemployment over the 1990-1996 period.

Table 5.18: Percentage Change in Regional Unemployment; 1990-1996

Region	Percentage Change
East Anglia	76.47
East Midlands	50.00
North	22.35
North-West	9.33
South-East	102.78
South-West	66.67
West Midlands	40.00
Yorkshire & Humberside	28.13
Northern Ireland	-13.18
Scotland	-2.41
Wales	30.77
United Kingdom Average	41.82

From Table 5.20 the UK Average percentage rise in unemployment over the 1990-1996 period is 41.82%. However, for the north and the south the percentage change is 16.43% and 73.98% respectively. This shows a relatively greater rise in unemployment in the south than the north – approximately four and half times greater. Whilst such asymmetry is apparently captured by regional prices the size of such differences are not fully apparent.

This section has found evidence of price expectational errors influencing unemployment over the 1990-1996 period. Whilst the Lucas-SW type model of unemployment adjustment as a function of price expectational errors is similar in specification to the regional EAPC, they appear to perform better as they explicitly take into account supply-side adjustments in the labour market. For all estimations, however, a clear north-south price error effect compatible with the relative change in regional unemployment patterns was only distinguishable with the use of the regional price series. However, the results failed to distinguish between the different price expectations hypotheses.

If price expectational errors are significant in the adjustment of unemployment, the relative size of the coefficients, whilst identifying a north-south divide, fail to explain the relatively large rise in unemployment in the south relative to the north. If it is assumed that labour supply and wage bargaining are dominated by price-expectational errors and interpreted as accurate approximations of the operation of regional labour markets, then the process of expectational errors needs further examination.

5.6.2 Switching Expectations

Implicit in the adoption of the price expectations hypotheses in this chapter is that agents use the same information set in each period with which to form expectations. However, this assumption can be relaxed and the formation of price expectations assumed to involve a differentiable cost-benefit analysis of the use of available information in forming expectations. The cost-benefit analysis of information acquisition can be assumed a function of the perceived economic climate. This would suggest that the amount of information collected would vary over the course of a business cycle.

In terms of the above modelled AEH and REH, it can be assumed that these hypotheses are differentiable by the amount of information used when workers form price expectations. Changes in the perceived economic climate will lead to differing use of the information set upon which expectations are formed. That is, agents can be modelled as switching between the two hypotheses.

More formally the hypothesis of expectations switching can be modelled in the context of the REH literature (cf. Cuthbertson and Taylor (1988)). Here the REH can be written as the expected future value of a variable X in period t is a function of the current information set period t for period $t+1$, conditional on information available in period t this is shown in equation (5.15):

$$E_t\left(X_{t+1}\middle|\Omega_t\right) \qquad (5.15)$$

where E represents the expectations operator, X is the variable being forecast and Ω the information set.

The switching of expectations formation is thus determined by use of the information set.

Assuming that expectations formation are a function of the current economic climate, measured by current nominal GDP, either region-specific or national, so that $\Omega_t = f(GDP_t)$, then changes in GDP will lead to changes in the information set and therefore expectations.

Implicit in the REH is the axiom of efficiency in which it is assumed agents use all relevant information available at the time form expectations. It is possible to generate a weak form of this axiom by imposing the condition that agents will only use information based on the perceived marginal benefits and marginal costs of information acquisition and processing. If it is assumed that the amount of information at point of use is endogenously determined by the efforts of the agent, the agent must decide how much information to collect.

If it is assumed that the amount of information collected is a function of the economic climate, then it is possible to hypothesise that during [perceived] economic stability or certainty, expectational errors are perceived relatively less costly under the assumption of the AEH. At times of increased [perceived] economic instability in which forecast errors impose a greater cost then it is assumed that the agent places greater weight on current and previous economic information and therefore the REH is the appropriate model.

To keep things simple it is assumed that rising unemployment engenders uncertainty. Here the cost-benefit analysis of information acquisition is greater through the perceived increased costs of expectational errors. Agents are assumed to pay greater attention to current economic information which is modelled in terms of the REH assumption. This assumption rests on the regional behaviour of unemployment and therefore it is possible to generalise the expectations assumption to the region, or if necessary to the national economy. However, it is assumed that agents are using regional economic information with which to form expectations. As a result of this it is assumed that at times of rising unemployment employment agents form expectations rationally, at times of falling unemployment, in which there is greater confidence in the economy agents form their expectations adaptively.

This process can be modelled in the context of a simple switching regression model where it is possible to specify that the dependent variable is a function of two different regimes, modelled by β_1 and β_2 respectively and determined by *i*. The two regimes are shown in equation (5.16):

$$Y_i = X_i'\beta_1 + u_{1i} \qquad \text{where } i \leq i^* \qquad (5.16a)$$

$$Y_i = X_i'\beta_2 + u_{2i} \qquad \text{where } i > i^* \qquad (5.16b)$$

where *i* represents the value of the index that divides the sample into two regimes.

Modelling the dependent variables as the expected price variable in each region *i* in time period *t*, the independent variables are the REH and AEH price formations determined by a dummy variable *D* in which *D=1* when unemployment is rising and

$D=0$ when unemployment is falling. Estimation of this model is given by equation (5.17):

$$\Delta P_{it}^{E} = \alpha_{oi} + \alpha_{1i} D \Delta P_{it}^{RE} + \alpha_{2i}(1-D)\Delta P_{it}^{AE} + \varepsilon_{it} \qquad (5.17)$$

where P_{it}^{E} is the logarithm of the price expectations variable in region i, time period t, D is the dummy variable, and P_{it}^{RE} and P_{it}^{AE} the logarithmic REH and AEH estimates of the price variable respectively.

The data were tested for the presence of first-order serial correlation, heteroscedasticity and normality in all cases the null hypotheses were not rejected at the 10% level.

Estimates were only performed using the regional price data. The lack of any clear north-south split in the price expectational-unemployment errors for the RPI precluded this from further investigation. The findings of a significant north-south split in unemployment-and regional price expectations sensitivities offer support for regional price modelling as the appropriate price variable.

Price expectations regional EAPC estimates using the switching price expectations variable was estimated. However, due to nature of the switching regression it was not possible to correct for the presence of cross-sectional correlation due to the effect of unbalanced panels. The results therefore have to be treated with caution. OLS estimates of pooled regional EAPC were therefore estimated for all regions, the north and the south over the full and post1990 sample period. The resulting restricted model estimates were compared with the two unrestricted REH and AEH-EAPC estimates The results are given in Tables 5.21 and 5.23.

Table 5.19: Switching Regression Model: Pooled Regional EAPCs 1976-1996,

$$\Delta W_{it} = \alpha_{oi} + \alpha_{1i}\Delta U_{it} + \alpha_{2i}\Delta P_{it}^{E} + \varepsilon_{it}$$

Region	Constant	Unemployment	Expected Price	R^2
All	0.04	0.00	0.54	0.51
	(7.45)***	(0.16)	(10.33)***	
North††	0.06	0.03	0.39	0.49
	(6.75)***	(1.62)	(5.14)***	
South	0.04	-0.00	0.63	0.53
	(3.75)***	-(0.15)	(5.99)***	

t–statistics are in parentheses, *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level, † signifies Cochrane-Orcutt AR(1) correction for serial correlation and †† indicates that the presence of first-order serial correlation could not be removed.

Table 5.20: Switching Regression Model: Pooled Regional EAPCs 1990-1996,

$$\Delta W_{it} = \alpha_{oi} + \alpha_{1i}\Delta U_{it} + \alpha_{2i}\Delta P_{it}^{E} + \varepsilon_{it}$$

Region	Constant	Unemployment	Expected Price	R^2
All	0.02	0.04	0.95	Na
	(3.21)***	(2.46)***	(9.42)***	
North	0.03	0.08	0.72	0.60
	(11.17)***	(13.58)***	(12.36)***	
South	0.02	0.03	1.00	0.74
	(2.89)***	(2.01)**	(7.11)***	

t–statistics are in parentheses. *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.

The results for the full sample period produce a much lower 'goodness of fit' measure than the regional price expectations EAPC estimates of Tables 5.8-5.13. Furthermore no long-run relationship is found to be significant between wages and unemployment over the full sample period though the wage-expected price relationship is much weaker over the full sample than in the post 1990 period. Specifically the Wald test on the joint-restrictions, $\alpha_{1i} = 0$, $\alpha_{2i} = 1$ in the regional EAPC equation $\Delta W_{it} = \alpha_{oi} + \alpha_{1i}\Delta U_{it} + \alpha_{2i}\Delta P_{it}^{E} + \varepsilon_{it}$ was rejected at the 5% level in all estimates, this was primarily due to the coefficient on the wage-expected price relationship. Whilst there appears to be a much stronger wage-unemployment relationship in the north to the south, (i.e. unemployment has a much greater effect on nominal wage movements in the north to the south), the sign and significance of wages and unemployment are similar. However, the inability to remove cross-sectional correlation implies that the estimated coefficients might be inefficient and therefore caution needs to be exercised in interpreting their significance.

The construction of the switching regression model was in response to the apparent failure of the two REH and AEH models of price expectations to adequately explain the relatively large rise in unemployment in the south of the UK in terms of price misperceptions. Price misperceptions are interpreted as responsible for the wage and unemployment relativities in regional EAPC estimates. As a result the unemployment-price expectational errors model of Section 5.6.1 was repeated for the testing the hypothesis that agents switch formation of price expectations on the basis of perceived current economic climate taken to be changing unemployment. The results from the switching regression model of price expectations are presented in Tables 5.21 and 5.22 for the two sample period of 1976-1996 and 1990-1996 respectively.

Table 5.21: Regional Price Errors and Unemployment: 1976-1996

Regions	Constant	REH $(P_{it} - EP_{it})$	AEH $(P_{it} - EP_{it})$	R^2
All	0.04	-1.85	-1.11	0.08
	(2.90)**	(-6.00)***	(-5.99)***	
North	0.03	-0.96	-0.59	0.04
	(1.62)	(-2.65)***	(-2.43)***	
South	0.02	-2.68	-0.75	0.07
	(0.66)	(-2.65)***	(-1.53)	

z–statistics are in parentheses, *** indicates significance at the1% level, ** at the 5% level, and * at the 10% level.

Table 5.22: Regional Price Errors and Unemployment: 1990-1996

Regions	Constant	REH $(P_{it} - EP_{it})$	AEH $(P_{it} - EP_{it})$	R^2
All	0.02	-2.86	-0.53	Na
	(0.71)	(-5.75)***	(-1.13)	
North	-0.00	-2.93	-1.18	0.17
	(-0.49)	(-13.71)***	(-13.48)***	
South	0.04	-7.20	-1.41	0.17
	(0.78)	(-6.58)***	(-2.29)**	

z–statistics are in parentheses, *** indicates significance at the1% level, ** at the 5% level, and * at the 10% level.

The estimated unemployment-price expectational errors regression was using via using (GLS) correcting for the presence of cross-sectional correlation. Tests for the null hypothesis of there being no first-order serial correlation, and no heteroscedasticity could not be rejected at the 5% level.

The results presented in Tables 5.21 and 5.22 compare the price expectational error regional price results with that of the switching regression model formulated above. The switching-regression model is based on the assumption that in periods of rising regional unemployment it is assumed agents form their expectations using the REH, whilst in periods of falling unemployment agents are assumed to form regional price expectations using the AEH. The results for the full sample imply a weak unemployment – price-expectation relationship based on the 'goodness of fit'. The relationship is, however, significant in all cases when unemployment is rising.

Given the REH / AEH split it is difficult to make a direct comparison over the relevant time period with the unemployment–price expectational errors estimates in Table 5.21. This is because the emphasis of each of the expectations variables is a function of the behaviour of unemployment. Nonetheless the REH estimates in the switching regression model provide a much clearer north-south distinction in explaining the relative behaviour of regional unemployment. Over the period 1990-1993 regional unemployment in the north and south rose by 48% and 146% respectively, the coefficients on the REH variable in the switching regression model provides a close approximation to this difference on the unemployment and price expectations errors coefficient.

The behaviour of regional unemployment as modelled within the context of a regional EAPC framework implies that regional price misperceptions can help explain the relative movement in regional unemployment rates. The increased variability of regional prices from Chapter Three in the context of asymmetric wage-unemployment adjustment in the post-1990 recession from Chapter Four suggests that real wage flexibility was not sufficiently high enough to limit the relatively large rise in unemployment in the south. This chapter has presented evidence that regional price expectational errors under the assumption of the REH, did not lead to sufficiently large enough real wage growth restraint in the south relative to the north thus leading to the narrowing of regional unemployment.

5.7 Conclusion

This chapter has explored the relationship between regional wages, unemployment and expected prices using regional EAPC estimations as well as the role of price expectational errors in unemployment adjustment for the UK, and for the UK Average, over the 1974-1996 period. Whilst the issue of simultaneity bias being introduced into single-equation estimates of the regional labour market were noted it was decided for comparative purposes as well as data limitations that the single-equation estimations approach be pursued but the estimated results interpreted in light of this issue.

The hypothesis that regional EAPCs are different from the national average estimate, the so-called aggregation hypothesis, was tested using four different price expectations estimators. These price expectations were formulated using the regional price variable introduced in Chapter Three and the RPI, in which both rational expectations and adaptive expectations operators were generated.

This chapter also explored the hypothesis that the regional labour markets of the UK were integrated with regard to regional labour market adjustment processes. Discussions in the literature centred around the persistent regional unemployment differences and restrictions on the mobility of labour combined with attempts at understanding the dramatic shift in regional unemployment in the early 1990s.

The results in this chapter found evidence supporting the aggregation hypothesis in the regional EAPC estimates, but no clear conclusion could be drawn on whether the UK labour market could be considered integrated. What made both of these issues difficult to address was the relative change in wage-unemployment dynamics in the post-1990 period. Regional EAPC estimates indicated that a significant break had occurred in the post-1990 period but theses estimates could well have been picking up the short-run wage-unemployment adjustment processes that characterise the short-run EAPC hypothesis.

This chapter found that the nature of the regional wage-unemployment relationship was a function of the price expectations hypothesis adopted. Each price expectations hypothesis offered different insights as to how the regional labour markets worked. Whilst there was evidence of a high degree of cross-sectional correlation amongst the residuals in pooled regressions, hence estimation was either through SUR or GLS correcting for cross-sectional correlation, the common characterisation of regions implicit in pooled regressions was questioned and Chow tests supported the notion of a north-south split in the modelling of the regional EAPC was appropriate.

Seeking to explain the relative large rise in unemployment in the south against the north in the post 1990 period, the hypothesis that price expectational errors could explain regional unemployment behaviour was tested. This was in part inspired by the notion that free market labour adjustment can be modelled as a function of price misperceptions and labour supply adjustment processes but also the mixed estimated signs on the coefficients of the north and south regional EAPC estimates. The Lucas-SW surprise-supply model appeared to perform better than the regional EAPC estimates suggesting that quantity adjustment can occur through price misperceptions but the results failed to find a clear north-south split in the case of the published RPI-based expected price errors. Furthermore there no discernible differences across the north-south divide as to which price expectations hypothesis was relevant could be determined. Questioning the assumptions underlying each of the expectations hypotheses it was suggested that price expectations formation by individuals could switch at the regional level as a function of the perceived regional economic climate. This was modelled as agents switching between expectations formation based on the REH and the AEH as a function of movements in the regional unemployment series. A switching regression model of price expectations provided stronger support for the hypothesis that relative changes in regional unemployment was a function of price expectations formed using the REH, i.e. when regional unemployment was rising.

CHAPTER SIX

CONCLUSIONS

6.1 Introduction

This thesis is an empirical investigation into the behaviour of UK regional unemployment, wages and prices.

Analysis of regional economics had historically focused on regional unemployment differentials. The existence of persistent regional unemployment differentials over the past 70 years has led to a number of investigations analysing these differentials and attempting to model regional unemployment in the context of the regional labour market. Each regional labour market for the UK is, however, only one of 11 that comprise the national economy. Studying the region as separate from the national is therefore problematic. Not only is it difficult to determine the source of factors that influence the regional labour market, but for the UK there are a number of data limitations in studying regional labour markets. Regional labour market data are typically annual and are not nearly as complete as data available for the national economy, for instance there are no official data on inter-regional trade, migration or prices.

In seeking to explain the behaviour of regional unemployment over the 1974-1996 period this thesis has constructed a measure of regional retail prices and regional retail price expectations, and estimated regional labour market models of wage determination. In doing so it has examined the predictions made regarding the behaviour of regional unemployment, wages, prices and real wages. In particular it has modelled regions as related regional economic units and compared the predictions of models based explicitly on competing hypotheses of regional price expectations formations.

Focusing on the recessionary period of the early 1990s, this thesis has found evidence of differing regional real wage and unemployment adjustment processes. It has, however, also found evidence supporting the predictions of the wage determination models of Blanchflower and Oswald (1990, 1994) and Jackman and Savouri (1991) These models predict that regions with lower regional unemployment will experience greater real wage adjustment than regions with lower unemployment, but this is only in the context of an aggregate shock. Support for the existence of a long-run EAPC for each region, however, suggests that regional unemployment differences are either structural or institutional, and whilst unemployment adjustment processes can be modelled in terms of asymmetric shocks and price expectational errors these are only temporary adjustment processes. The narrowing of regional unemployment differences across the north-south divide of the early 1990s is assumed only a temporary phenomenon and one particular to the economic shock.

6.2 Summary of the Chapters

This thesis is an empirical investigation into the behaviour of regional variables and regional labour markets, the chief findings of each of the empirical Chapters are as follows.

6.2.1 Chapter Two

This chapter analysed regional unemployment and wage rate behaviour for each of the 11 regions of the UK over the 1974-1996 period for all adults, all males and all females. The purpose of this chapter was foremost to examine the changing pattern of regional unemployment and wages and to examine the relationships in these variables both across regions and against the national average.

The results presented here suggest some degree of regional labour market interaction between wages and unemployment exists as has been found in the literature. Notably the changing of relative cyclical patterns and relative growth rates of unemployment and nominal wages over the course of the economic cycles. These offer some support for estimating short-run regional Phillips curves and wage curves, (Blanchflower and Oswald (1990)).

At the centre of regional or sectoral economics analysis is the assumption that regional markets differ from the aggregate. This implies that there are economic processes relatively more important in some regions than others. For both unemployment and wages it was not possible to reject the hypothesis that the regional economy is not significantly different from the national in the majority of regions. Though there was notably less support for this in the case of unemployment over the 1975-1989 period. Over the sample period unemployment for all three categories demonstrates a clear reduction in the regional dispersion from the early 1990s. This shift in the pattern in regional unemployment relativities led to a number of regions rejecting the hypothesis that the regional unemployment relationship with the national average was stable over the period before and after 1990. Such a result indicated that the post-1990 period is characterised by a change in regional unemployment behaviour significantly different from that before 1990. Examining the changing pattern of regional unemployment, the absolute and relative dispersions of unemployment were calculated and both measures indicated a significant reduction in regional unemployment differences from 1990 onwards.

The differing regional unemployment pattern of the UK is characterised as based on a north-south split in which the regions of the south are defined as having an unemployment rate persistently below the national average: East Anglia, East Midlands, the South-East and the South West, the north regions were therefore based on the remaining seven, who all exhibited clear above average unemployment rates over the full sample period. The changing patterns of regional unemployment dispersion was formally modelled taking Thirlwall's analysis of estimating the slope coefficient of a regression of changes in the region's unemployment rates against the national average. Whilst the estimated regressions supported the hypothesis that regions with below average unemployment exhibited a lower cyclical sensitivity of unemployment than the national average, it was found, in support of the earlier Figures and Tables that, over the 1990-1996 period, the cyclical sensitivity of regional unemployment became more similar, reflecting the narrowing of regional unemployment differences. This narrowing is, however, perplexing as it is the first time in over 70 years in which regional unemployment rates differences narrowed in the context of a recession. Given that regional unemployment rates are affected by changes in the workforce, the notion that relative regional unemployment differences might be significantly influenced, across the regions, by changes in workforce participation was examined for the two recessionary periods 1980-1983 and 1990-1993, (so-defined according to the rise in regional unemployment). Workforce changes alone were not found to be significant in explaining changes in regional unemployment rates.

The analysis of regional nominal wage behaviour for all adults, males and females followed on from the analysis of regional unemployment and is based on a number of empirical studies supporting the case for a regional wage-unemployment relationship. Unlike unemployment, regional wage differences were, however, found to be both highly correlated across the regions and with the national average over the sample time period. However, the hypothesis that the regional nominal wage rate growth was not significantly different to the national average was rejected in a number of regions based on results from the Wald test. There was also no similar clear north-south divide in nominal wage levels, whilst evidence was found of a steady increase in both the absolute and relative dispersion of regional wages over the sample period.

Whilst there was some evidence of regional wage growth rates being influenced by the events of reduced unemployment differences. The literature tends to support the notion that structural or institutional factors prevent nominal wage adjustment reflecting unemployment disparities and the lack of any evidence of a clear relationship between regional wages and unemployment unsurprising. What might then link regional unemployment with regional wages are regional prices and regional real wages, the former of which was left to Chapter Three.

6.2.2 Chapter Three

This chapter focused on the construction and analysis of a regional price variable. A number of alternative techniques in constructing a regional price index were compared with the RPI in the aggregate, and one chosen on the basis of the closest approximate fit to the RPI over the sample data of 1974-1996. The annual indices produced for each of the 11 regions of the UK were a combination of the Reward Group's regional cost of living surveys and the published Housing Price Index, weighted from the Regional Trends estimates of housing expenditure as a proportion of total expenditure. All values were produced to April of each year.

The Reward Group's regional surveys mimic a method of price data collection used in the RPI, providing a fairly close approximation for comparison. However, the use of current house price data in compiling the expenditure totals for each region in the surveys meant that an alternative housing expenditure item was needed. The different methods of producing a regional index similar to the RPI differed with respect to the treatment and addition of this housing component.

Of the method adopted and the regional indices produced, the values and behaviour of each index was compared against the RPI. The cross correlation matrices in levels, logarithm levels and first-difference logarithm levels indicated the extent by which regional prices moved against each other. This result was verified in the regressions of equation (3.8). Here it was not possible to reject the null hypothesis that the first-difference logarithms of the regional price indices and the RPI are not significantly different.

The regression results provided information on the relative growth rates of regional prices against the RPI. The analysis covered both the full sample period and the sub-sample period 1975-1989. Wald test statistics indicated that whilst it was not possible to reject the null hypothesis that the regional price indices are not significantly different from the RPI over the full sample period at the 10% level, this hypothesis was rejected in a number of cases over the earlier period. Together the two regression results suggested that regional price differences have narrowed from 1990 onwards. Whilst the narrowing of regional price differences was supported by calculations of the absolute and relative price dispersion of regional prices the hypothesis of structural stability could not be rejected using the method of recursive residuals. This suggests that these regional price changes were either not significant or more gradual than the regression results suggested.

The hypothesis that regional price variation had changed over the full sample period was tested by applying the literature on relative price variability and inflation. Over the late 1980s to early 1990s evidence presented suggested that there had been a marked increase in inter-regional price variability not correlated with movements in the RPI.

The price variability literature introduces the idea that measured price variability is related to the operation of the regional labour market. Models of wage determination such as the Expectations-Augmented Phillips Curve imply that price expectational errors affect wage determination. If regional price variability is related to uncertainty then it is possible to examine whether regional prices, unemployment and wages can help explain the operation of regional labour markets. Whether existing wage determination models at the regional level are aided by the use of a regional price index is left to the next two chapters.

Growing interest in the disaggregation of economic variables and in particular that of regional labour markets implies that a regional price deflator is of great importance in the examination of real variables at the regional level relative to the national average. A growing concern in economic modelling is that aggregation might be failing to capture subtleties of many economic relationships that occur at a lower level of aggregation (Abraham and Katz (1986), Machin and Manning (1994)). Furthermore the problem could be confounded if economic modelling combines disaggregated and aggregated data. The regional indices are an attempt to go some way in trying to enable the modelling of real and nominal variables at the regional level. Whilst the results so far indicate that at the regional level the behaviour of nominal wages and prices are, highly synchronised the fact that this appears not to be the case with regional unemployment suggests that in order to understand the regional labour market more fully necessitates the calculation of region-specific real wages. The use of a regional price deflator enables a regional real wage variable to be constructed, to be compared to one produced using the RPI and then examined with respect to unemployment. This was the focus of the next chapter.

6.2.3 Chapter Four

Chapter Four constructed regional real wages by deflating AGHE including overtime for all adults 1974-1996 using both the constructed regional price indices from Chapter Three and the published RPI. Examining the dispersion of regional real wages indicated that differences in real wages across the regions grew throughout the 1980s but these differences were less marked in the case where real wages were constructed using the regional price series than using the RPI. These differences, however, appeared to have stopped under both definitions of dispersion from 1990.

An analysis of both measures of regional real wages indicated support for rejection of the hypothesis that regional real wages are not, statistically significantly different from the national average over the sample period. This result led to an investigation into the inter-regional variability of unemployment, nominal wages and both measures of real wages against movements in their national averages, in trying to identify periods in which regional real wages became more volatile.

Whilst a strong link appeared to exist between nominal wage rate changes and nominal wage variability this was not supported by the findings of unemployment nor on either measure of real wages. These results implied that the early 1990s was associated by increased regional variability in unemployment, prices and real wage rates suggesting regional adjustment processes occurred at the same time but not linked to movements in the national series.

Examining the behaviour of regional real wages and unemployment over the sample period of 1975-1996, support was found in treating the post-1990 period as separate to the full sample. The reason in doing so was partly supported by problems associated with attempting to explain real wage adjustment with respect to unemployment in the context of a recession leading to a narrowing of regional unemployment rates.

Analysing the regional real wage-unemployment relationship, in particular over the 1990-1996 period, meant that wage determination models that supported Thirwall's (1966) analysis of the cyclical sensitivity of regional unemployment were used in forming predictions and testing hypotheses as to the expected relationship between the dispersion of real wages and the dispersion of unemployment. Predicting the relationship between real wages and unemployment was deemed difficult in that changes in unemployment can be attributed to either demand-side or supply-side shocks, and in the context of real wage dispersion to a national or regionally-based shocks, these issues had first to be addressed. Predictions from these models rely heavily on these assumptions.

Examining the regional real wage – unemployment relationship led to mixed results dependent on the particular price deflator used to define the real wage variable. For the 1990-1993 period the literature identifies this period as characterised by a large negative demand-side shock leading to the rise in unemployment. Whilst the estimated regression led to an estimated positive real wage-unemployment relationship, such a result runs contrary to the predictions of the wage curve and the J&S models of wage determination. The nature of the shock, however, was examined in the context of price asymmetries to examine whether the reason for the conflict was due to either differing real wage-unemployment adjustment processes or that the 1990-1993 recession was one in which the south was hit harder than the north. To test for this a crude analysis of regional price and wage asymmetries was tested by regressing pooled regional prices against the national average within a north-south split. For the 1990-1996 period, the hypothesis that nominal wages were not significantly different from the national average across the regional north-south divide could not be rejected, however, this was not possible in the case of prices. The inability to accept the null hypothesis that prices were not significantly different from the national, in the context of an integrated economy for the 1990-1996 period presented evidence in support of the negative demand-side shock having an asymmetrical effect across the UK regions.

In dividing the regions into a north and a south asymmetrical wage and price adjustments processes were examined in the context of the dispersion of unemployment. Support was found for much weaker wage and price – unemployment relationship in the south relative to the north. Such a finding suggests that weak or slow real wage adjustment in the south was responsible for the relatively large rise in unemployment than in the north, why this was the case needs further analysis, particularly as it is an implied challenge to the wage determination models and the hypothesis that the lower unemployment rate regions of the south have a higher unemployment elasticity of pay. Not only was the south hit worse than the north, but given weak real wage adjustment, responded poorly to the shock.

This chapter has provided compelling evidence of asymmetric regional real wage-unemployment adjustment processes in the UK over the early 1990s. Modelling of the aggregate labour market both in terms of an aggregate price index or in terms of aggregate wage determination models are difficult to justify when such asymmetries exist. The use of an explicit regional price variable with which to model regional real wages proves to be an innovation that helps explain why aggregate wage determination models fail to explain the behaviour of regional labour markets. It is, however, the issue of weak nominal wage asymmetries in the context of changes in prices, expected prices and wages which is the next focus of attention; modelling regional labour markets based on the Phillips curve.

6.2.4 Chapter Five

This chapter explored the relationship between regional wages, unemployment and expected prices using regional EAPC estimations as well as the role of price expectational errors in unemployment adjustment for the UK, and for the UK Average, over the 1974-1996 period. Whilst the issue of simultaneity bias being introduced into single-equation estimates of the regional labour market were noted it was decided for comparative purposes as well as data limitations that the single-equation estimations approach be pursued but the estimated results interpreted in light of this issue.

The hypothesis that regional EAPCs are different from the national average estimate, the so-called aggregation hypothesis, was tested using four different price expectations estimators. These price expectations were formulated using the regional price variable introduced in Chapter Three and the RPI, in which both rational expectations and adaptive expectations operators were generated.

This chapter also explored the hypothesis that the regional labour markets of the UK were integrated with regard to regional labour market adjustment processes. Discussions in the literature centred around the persistent regional unemployment differences and restrictions on the mobility of labour combined with attempts at understanding the dramatic shift in regional unemployment in the early 1990s.

The results in this chapter found evidence supporting the aggregation hypothesis in the regional EAPC estimates, but no clear conclusion could be drawn on whether the UK labour market could be considered integrated. What made both of these issues difficult to address was the relative change in wage-unemployment dynamics in the post-1990 period. Regional EAPC estimates indicated that a significant break had occurred in the post-1990 period but theses estimates could well have been picking up the short-run wage-unemployment adjustment processes that characterise the short-run EAPC hypothesis.

This chapter found that the nature of the regional wage-unemployment relationship was a function of the price expectations hypothesis adopted. Each price expectations hypothesis offered different insights as to how the regional labour markets worked. Whilst there was evidence of a high degree of cross-sectional correlation amongst the residuals in pooled regressions, hence estimation was either through SUR or GLS correcting for cross-sectional correlation, the common characterisation of regions implicit in pooled regressions was questioned and Chow tests supported the notion of a north-south split in the modelling of the regional EAPC was appropriate.

Seeking to explain the relative large rise in unemployment in the south against the north in the post 1990 period, the hypothesis that price expectational errors could explain regional unemployment behaviour was tested. This was in part inspired by the notion that free market labour adjustment can be modelled as a function of price misperceptions and labour supply adjustment processes but also the mixed estimated signs on the coefficients of the north and south regional EAPC estimates. The Lucas-SW surprise-supply model appeared to perform better than the regional EAPC estimates suggesting that quantity adjustment can occur through price misperceptions but the results failed to find a clear north-south split in the case of the published RPI-based expected price errors. Furthermore there no discernible differences across the north-south divide as to which price expectations hypothesis was relevant could be determined. Questioning the assumptions underlying each of the expectations hypotheses it was suggested that price expectations formation by individuals could switch at the regional level as a function of the perceived regional economic climate. This was modelled as agents switching between expectations formation based on the REH and the AEH as a function of movements in the regional unemployment series. A switching regression model of price expectations provided stronger support for the hypothesis that relative changes in regional unemployment was a function of price expectations formed using the REH, i.e. when regional unemployment was rising.

6.3 Conclusion

This thesis has examined the behaviour of regional markets of the UK in response to economic shocks and the problems that arise in the use of aggregate modelling and aggregate data. The construction of a robust measure of regional prices offers the opportunity for a more accurate analysis of such shocks and is able to lead to further analysis of the degree of labour market integration. Emphasis on non-economic factors preventing the operation of the free market questions the integration hypothesis. Whilst testing this hypothesis relates to the identification of economic shocks and how regions adjust to them, what is of particular interest is whether aggregate modelling forms the basis of national economic policy, if this is the case how does this affect the regional economy if agents anticipate policies that are inappropriate to their economy? Models of the regional economy find that regions are highly inter-related, but differences in the regional economy and the incidence of regional economic shocks imply that the regional economy needs further analysis.

Further areas of research that stems from this thesis would involve an investigation into the regional economy. Such projects would consider the role of regional price expectations in regional economic decision-making; the regional impact of UK monetary policy, the relationship between regional price levels, price expectations and the real interest rate; regional economic decision-making and anticipated government policy; regional productivity and the relationship between traded and non-traded goods and so. All of these are areas for further study and will lead to a greater understanding of how regions operate.

Appendix: Regional Prices 1974-1996

Year	East Anglia	East Midlands	North	North West	South-East	South West	West Midlands	Yorkshire & Humberside	Northern Ireland	Scotland	Wales	RPI
1974	99.5	97.3	96.2	101.8	100.2	99.3	100.8	98.3	104.1	101.3	99.0	100.0
1975	125.4	122.9	121.5	126.6	125.4	125.5	126.4	124.1	132.3	128.3	125.4	121.7
1976	148.9	145.6	145.2	151.2	148.8	149.1	148.1	147.0	157.3	151.9	149.2	144.7
1977	171.5	168.6	168.6	174.5	172.3	172.1	171.3	170.7	179.6	174.5	171.9	169.9
1978	184.3	181.1	180.0	188.1	184.0	183.6	183.7	181.7	197.8	187.9	184.7	183.4
1979	210.0	204.0	203.1	212.4	208.6	207.2	207.6	205.5	221.6	213.2	207.4	201.9
1980	250.0	242.3	241.0	249.7	248.4	246.5	246.2	242.2	263.7	248.9	245.2	245.8
1981	284.7	275.9	274.6	286.7	284.5	284.6	280.5	276.5	297.4	285.9	279.2	275.4
1982	311.7	303.0	300.0	313.1	312.0	310.5	306.5	302.9	326.5	311.5	305.1	301.3
1983	323.4	315.7	314.3	324.2	324.6	324.1	319.4	315.1	339.8	328.3	316.7	313.4
1984	340.8	333.4	329.5	343.1	342.7	341.1	336.8	330.6	358.4	348.0	334.8	329.6
1985	367.2	358.4	351.2	369.9	367.7	367.8	361.3	352.4	381.7	372.3	356.1	352.4
1986	382.7	375.7	366.5	387.7	386.5	386.6	379.9	370.9	396.3	382.1	371.6	363.1
1987	403.1	399.9	383.0	404.0	407.6	402.1	400.5	389.8	421.3	405.4	391.9	378.5
1988	426.3	415.9	403.2	425.3	431.0	424.2	421.8	410.6	441.1	427.4	413.0	393.4
1989	467.6	455.9	438.0	465.9	467.9	458.5	464.7	443.4	469.2	470.2	448.1	425.0
1990	520.1	508.4	483.5	513.5	522.0	514.5	515.6	493.1	516.1	508.1	496.5	465.1
1991	543.0	530.3	510.4	548.3	553.6	541.2	544.1	530.9	545.9	539.4	522.7	494.9
1992	569.4	551.2	537.4	565.1	571.2	562.8	558.9	548.6	570.3	564.2	545.9	516.1
1993	565.7	553.0	536.0	570.1	574.2	560.1	557.3	551.9	571.8	564.7	544.7	522.8
1994	585.6	573.4	556.3	594.2	592.9	578.7	581.4	575.7	597.6	585.8	566.1	536.2
1995	594.9	585.4	563.7	601.8	604.2	588.7	592.1	587.0	605.6	597.6	579.5	554.0
1996	618.0	607.8	585.8	623.1	625.0	612.5	617.9	609.9	620.4	620.0	603.1	567.4

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