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Immigration and the Local Housing Market in England and Wales

Jiazhe Zhu

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Abstract

Motivated by an ever-rising share of foreign immigrants in England and Wales, the thesis investigates its economic impacts on the local housing market as well as their own housing choices and experiences once they arrive at the destination. Over the last two decades, several major events with respect to foreign immigration have taken place in the UK, ranging from the A8 accession countries entering the European Union (EU), the refugee crisis of the EU to the most recent event of Brexit: all of them mark an increasingly complex migration profile of foreign immigrants into the UK. While it is important to study the overall effect of immigrants on key economic indicators at the macro level, it is also crucial that we understand the local dynamics, e.g. how new arrivals interact with the indigenous population, already established immigrants and local space in a variety of dimensions.

While most of the literature has focused on labour market impact of immigration, the thesis concentrates on its effect on the housing market. Through testing their effects on a range of housing market outcomes, key underlying interaction processes between native households and immigrants can be understood in-depth, e.g. segregation, native flight, substitution and complement in the workforce, culture led differences and similarities in housing practices, and how different types of space would allow groups to interact differently etc..

Key findings include that the density of employment activity in an area plays a crucial role in the immigration-house price link. Immigrants while contributing to the overall housing demand but could depress housing values at the local level. The primary reason documented in the literature has often pointed towards a process of native flight and residential segregation. In the thesis, additional insights are gained about how increased rate of free renting could also be a cause for housing value depreciation and some empirical evidence has been provided for it. This is perhaps a process more useful in explaining price reduction in more economically active areas than the argument of native flight. When it comes to overcrowding and housing deprivation experiences of immigrants, distinctions in regional patterns are not salient and immigrants tend to depress flat prices more than prices of attached and owner-occupied properties due to their larger presence in the former tenure. Lastly, ethnic minority groups generally could mitigate their housing deprivation experiences in the long term as overcrowding tends to be found to concentrate mostly in recent arrival cohorts while established settlers tend to reduce overcrowding. Apart from their own improvements in financial circumstances, internal migration and potential mutual support through co-ethnic ties are considered effective means for alleviating housing deprivation experiences for some Asian and Black groups; each group's housing deprivation outcomes in response to local housing attributes (e.g. different tenures, sizes and prices) are also examined at length in the research project.

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Chapter 1

Introduction

1.1 Motivation

The Ph.D. thesis primarily investigates the economic effects of immigration in England and Wales, especially with respect to the housing market. Just as the labour market, the housing sector is also a crucial sector in which immigrants could have a strong impact but is under researched in the UK literature. Additionally, the rate of immigrant inflows has been found on the rise over the last two decades with several major events taking place, ranging from the opening of the labour market to the A8 accession countries in 2004, refugee crisis of the EU countries to the most recent event of Brexit. From there, one should expect their collective influence on the lives of native population to increase, at both the national level and at a local level. On the other hand, the ethnic and country of origin profiles of immigrants are also varied from time to time. Over the census period 2001 – 2011, there is sustained rise of population from almost all ethnic groups. Those which are particularly large at a national level include the other White group containing many accession country members as well as other Asians and Pakistani migrants, carrying with them distinct socioeconomic backgrounds and ethnic traditions to settle in the UK. Therefore, it is not only important to study the overall effect of immigrants on key economic indicators at the macro level, but also vital to understand the local dynamics, i.e. the specific interactions between indigenous households and immigrant households, between newly arriving immigrants and long-established immigrants, and immigrants' interaction with local space. All of them could potentially lead to distributional changes through different markets, for example, the local residential housing market and the labour market.

The thesis picks up the strand of immigration research carried out from several prominent economists. Works include Altonji & Card (1991), Card (2001), Dustmann, Fabbri & Preston (2005), Dustmann, Frattini & Glitz (2008), Dustmann, Frattini & Preston (2013), Dustmann & Frattini (2014), Saiz (2003), Saiz (2007), Saiz & Wachter (2011), *Sá* (2014), and Braakmann (2016). It continues to adopt a spatial variation approach to quantitatively measure the effects of immigration over some important economic variables. The use of instrumental variables (IVs) is also continued to control for endogeneity. There are a number of IVs developed in the immigration literature and the most classic one is the past settlement pattern IV, originally appeared in Altonji & Card (1991) and Card (2001). The method was used to examine labour market effects of immigrants including native wages and unemployment rate. For the UK context, the approach has been frequently adopted in the works of Dustmann, examining the effect of immigration on a variety of outcomes: wages, employment, benefit claimant rate and social housing occupation. In recent years, one has seen the settlement

pattern IV to be used to examine the effect of immigration in the housing market, first appeared in Saiz (2003) and Saiz (2007). It was also from Saiz's work that opposing outcomes could be reached due to different dynamics taking place at different spatial scales. Therefore, it comes to a realisation that one potentially needs to distinguish macro effects from micro effects on the housing market led by foreign immigrant shocks. UK studies include *Sá* (2014) and Braakmann (2016) examining similar topics. The thesis aims to investigate related issues in immigration and housing while using spatial econometric techniques developed and applied by previous researchers.

1.2 Structure of Thesis

Following the chapter of Introduction, chapter 2 outlines the current econometric methods used to estimate the economic outcomes of immigrants in the literature. The spatial variation approach together with various designs of instrumental variables to reduce endogeneity problem are reviewed in detail in this chapter. The chapter also discusses more generally the topics of quantitative methodology in social sciences, causal inferences as well as the categorisation of immigrants in the context of UK. The next three chapters include the main content.

Chapter 3 Summary

Chapter 3 firstly revisits the empirical study by *Sá* (2014) which examined the impact of immigration on local house prices over an extended period and from there builds two further extensions based on her model, data and results. Theoretically, at a macro level, an inflow of immigrants would generally contribute to the overall housing demand in an area in which they settle, therefore lead to a higher house price regionally and nationally; however, local dynamics may suggest the effect of immigrants on house prices to be otherwise. Specifically, the argument of native flight is widely documented in the literature as relatively affluent native households move out of their neighbourhood in response to immigration inflows. As a result, the overall income of the neighbourhood would reduce, causing local housing values to depreciate through a weaker total demand. To establish this causal relationship, i.e. to interpret the correlation causally, a range of models is used to estimate the impact of immigration and these models are the classic OLS, the pooled OLS, the fixed effect model, the random effect model, a first differenced model as well as a first differenced model with a suitable instrument. While all findings from these models will be summarised, it was regarded that the first differenced model with an application of instrument used in *Sá* (2014) would yield a consistent estimate for interpretation.

Data from several sources are pulled together including the Quarterly Labour Force Survey, Crime Stats UK, Land Registry and the British Household Panel Survey, to derive area level variables

such as a change in net immigrant and native inflows, change in house prices and so on. The final dataset is a panel with 170 local authorities over 13 years between 2003 and 2015. For the use of instrumental variable, the historical settlement pattern instrument continues to be applied as it was the case in *Sá* (2014). The effects on house prices, native out-mobility, and local wage distribution of immigrants are revisited.

By extending *Sá*'s work, the impacts of immigrants on house prices and native out-migration response are re-examined by disaggregating the immigrant group using further their regions of origin. It is recognised that immigrants are not a homogenous group along many dimensions. population from different regions of origin would exhibit unique interactions with the local people, e.g. within a housing space practicing different housing habits or exhibiting different preferences towards certain local amenities, which ultimately lead to varying degree of native tolerance (hence different rate of out-migration responses) and house price effect. I report some of the results on this.

The house price effect under different labour market structures is examined subsequently. The area types are classified with respect to employment density and average socioeconomic profile of the population into four distinct sub areas: the high density and high skill areas, the high density and low skill areas, the low density and low skill areas, and lastly the low density and high skill areas. Only some types of areas exhibit house price decrease and explanations were searched in additional to the native flight argument.

To report the results over the extended period, it was found that across the whole range of models, the OLS and the random effects models produce positive estimates while the first differenced models with or without instrumental variable show negative but non-significant effects of immigration on house prices. This demonstrates the potential positive bias of the OLS estimates due to common fixed influences and reverse causality. After extending the period of analysis from 2003-2010 to 2003-2015, the negative house price effect is statistically insignificant and evidence of native displacement effect of immigration in England and Wales has been partial. However, the literature from *Sá* (2014) and Braakmann (2016) both show statistically significant negative house price reduction and native displacement effect. In fact, when examining the shift in the income distribution of the areas, an increase in excess fraction of low wage households and a decrease in the excess fraction of high wage households are found in areas with higher immigrant density, which is mainly due to a larger share of low wage natives in the former and a smaller share of high wage natives in the latter. Different reasons could contribute to the result as to explain why over the extended period, a generally downward shift in the local income distribution of the area is not reflected in the house price changes. Further evidence needs to fill the gap including searching for alternative processes that has led to the difference in results or otherwise.

When looking at the immigrant population across region groups, positive house price effects tend to come from individuals from regions of Indian, Indian Sub-Continent and Middle East and A8 countries, and significantly negative house price effects tend to come from population from Far East and South East Asia, Central and South America, and Africa over the analysis period concerned. However, no evidence indicates that this is a result of native out-migration response towards the inflows of these individual groups, therefore alternative explanations need to be sought before any substantial conclusion could be made.

The second extension looks at the house price impact of immigration under different labour market structures. Specifically, local authority units of England and Wales are divided along the lines of employment density and average socioeconomic profile (skill) of workers. Over the period of analysis 2003-2015, the negative house price effect of immigration is found only for the areas with high employment density and high skilled professions and this might be due to a type of tenure "transition" in the area as immigrants increase the rate of private renting and free renting. Those who accommodate free renters and the free renting households would become less likely to participate in the housing market themselves; landlords are less incentivised to maintain properties when owner-occupied dwellings are split up and refurbished into smaller units to accommodate newly arrived immigrants (Braakmann, 2016), which further drive down housing quality of the area. Both these mechanisms would suppress demand leading to a fall in house prices. Additionally, an increase in housing units offered on the market by landlords in response to increases in immigrant inflows would drive down prices through supply side changes.

Chapter 4 Summary

Chapter 4 investigates the impact of immigration on local housing market in England and Wales using neighbourhood spatial scales – primarily the lower layer super output area (LSOA). It aims to test empirically the effect of immigrants on several key housing market variables including house prices, housing supply, native out-migration response, overcrowding and other submarket house prices by dwelling tenure and types. The size of the geographical unit has a mean population of 1,500 which is equivalent to an average number of households of 400 (ONS Administrative Data Statistics); the unit constitutes the closest to the concept of a neighbourhood which allows an examination of local interaction between immigrants with indigenous households as well as with local environments.

To formulate the empirical model, a range of datasets are pulled together again to form an LSOA by year panel. The sources include Census Data 2001 and 2011, Land Registry, Ordinance Survey and other data. Specifically, I regress the change in the stock of immigrants between year

2001 and year 2011 as a percentage share of 2001 LSOA level population on the change in house prices. Area level covariates that could potentially influence house prices are also included which cover the socioeconomic and demographic characteristics of the area, dwelling attributes and physical geographies of the area. Once these factors are controlled, the spatial units are believed to be comparable such that we can explain house price differentials by differences in immigrant stocks from area to area. This to some extent reduces the level of endogeneity present in the immigration variable. However, one cannot control for all variables related to immigration in the model, and the problem of reverse causality leads to the usage of the instrumental variable from Saiz and Wachter (2011). Since immigrants tend to reside in close proximity to other immigrants, in order to take advantage of being part of the same national, ethnic, linguistic or socioeconomic group (Borjas, 1995; Mobius, 2002), past settlement pattern of immigrants in surrounding LSOAs could partially predict the rate of immigrant inflows in the LSOA of interest. From this intuition, a gravity pull measure is constructed using 2001 immigrant densities of surrounding neighbourhoods.

Under the instrumental variable specifications, for effects on house prices, a 1% increase in the stock of immigrants between 2001 and 2011 would lead to a 0.5% decrease in log median house prices. When searching for any evidence on native out-mobility, at the lower layer super output area level, native households were not found to move out on net in response to immigrant inflows. In contrast, a 1% increase in the stock of immigrants leads to around 0.7% increase in the native population. At the LSOA level, I conclude that a displacement effect of natives is not found. Other neighbourhood scales are also used such as the output areas and census wards. No native net out-migration evidence has found for these geographical scales suggesting some alternative processes could be responsible for this small house price reduction, e.g. supply-side factors which were examined subsequently. Additionally, the distance of out-migration for those displaced natives has also been investigated and it was found that if natives were displaced by immigrants, they are more likely to move long distance rather than to another location within the same neighbourhood.

To examine the immigration effects on housing supply, a similar model to that of house price is used. I regress the change in the dwelling stocks on the change in the share of immigration between year 2001 and 2011. With respect to the findings, an increase in immigrant stocks equal to 1% of the 2001 population would lead to around 0.1-0.2% increase in the share of housing stocks. In addition, findings on immigration impact on overcrowding are also consistent with past literature. The resulting increase in the share of overcrowded households led by immigrant inflows is around 0.5% on average across England and Wales. Regional patterns of overcrowding contributed by immigrants are not much different from each other when using occupancy rating measure. With respect to price effect of immigration by different types and tenure, it was found that the largest price reduction caused by immigration come from flats and leasehold properties.

Chapter 5 Summary

Chapter 5 investigates overcrowding outcomes experienced by different ethnic groups in England and Wales and it also considers several ethnic group specific characteristics and area level housing determinants of overcrowding. The motivation behind examining this issue across ethnicities is an increasing concern about the detrimental impact of overcrowding on household members' wellbeing, health, education and family relationships in an overcrowded living conditions. Specifically, 10 ethnic groups are considered ranging from White British, White Irish, Other White, Indian, Pakistani, Chinese, Other Asian, Black Caribbean and Black African. Using mostly the census aggregated data, a set of fractional logit models are used to examine the effects of lengths of settlement, ethnic group specific factors and local housing attributes on overcrowding rates of these ethnic groups.

To test whether there is any persistency in overcrowding outcomes experienced by any ethnic group, each population inflow by different periods of arrival is regressed on their corresponding overcrowding rate and insight was gained into how the housing experience of each ethnic group develops over time. In general, as immigrants settle for longer in the destination country, they are more likely to improve on their financial circumstances as well as resembling the indigenous households in terms of housing practices. Over time, households should be able to find suitable housing to accommodate their family members therefore their overcrowding experiences should be mitigated. From the results, long term settlers tend to reduce the group's overcrowding rate while majority of the overcrowded population concentrates in the most recent arrival cohorts. The pattern is prevalent across most ethnic groups. Slightly more persistent experience of overcrowding is found for the Other White and Chinese groups. Bangladeshi shows the most persistent experience of overcrowding as households from all periods of arrival show positive contribution to overcrowding although not all coefficients are significant.

Subsequently, the effect of ethnic group specific factors on the overcrowding rate is examined. They include both financial and cultural elements (hence examining at the level of ethnic group is appropriate) and they are individual household size, internal mobility, residential clustering, occupational ranking while age, gender and marital compositions of each ethnic group in the areas are kept as controls. From the findings, an extra person in an average household raises the overcrowding rate for almost all groups while negative relationship is found between one's occupational ranking and overcrowding rate. It is valid for some groups ranging from the White groups, Bangladeshi, other Asian to Chinese. Ethnic groups that find mobility helpful in mitigating overcrowding problem include the Chinese, Caribbean and the Other White.

Turning to the strength of co-ethnic group enclave, on one hand, for White Other, Pakistani and African communities, there is evidence showing that the presence of larger enclaves tends to reduce overcrowding. One explanation for this is that, these communities in the UK are more collectivistic, therefore, new arrivals are more likely to receive support from co-ethnic members to obtain a better housing condition than that in the case of moving into a neighbourhood and living alone. The latter situation is more likely to make the household experience cash strained condition and practising dwelling sharing with non-family households. On the other hand, the degree of clustered-ness is positively associated with overcrowding for the White Irish. This potentially suggests that , due to more individualistic nature of the ethnic group, a larger co-ethnic enclave would not have much of an effect on alleviating housing deprivation for new arrivals. It might be just an indication of a generally lower socioeconomic aspirations of the group. For other groups, the strengths of spatial clustering have no effect on changing the group's average overcrowding outcomes.

Within the same model, I also looked at how each ethnic group would interact with different local housing market attributes ranging from house prices, property size mixes across tenures and tenure compositions of the areas. With respect to changes in house prices, the White British and White Other groups tend to benefit from these rises through capital gains (hence reduce overcrowding/deprivation) due to their disproportionate presence in the owner-occupied sector. Statistically significant overcrowding response towards high house prices has only been found for the Bangladeshi group. In addition, places with a higher share of extra-large size properties tend to see a lower rate of overcrowding in the owner-occupied sector and the social housing sector with the effect of building extra-large sized stocks in the privately rented sector being limited, but building small raises overcrowding regardless of tenure sector and which ethnic group dwells in.

1.3 Methodology and Data

Causality is a central concept in my thesis as it helps disentangle complex economic relationships between one variable and another, namely, the effect of an event on an outcome. In the field of economics and econometrics, many models and approaches are designed to reduce the level of endogeneity of the variable under investigation. Between immigration flows and certain housing outcomes, the effects of immigrants on, for example, house prices could be multi-faceted. On one hand, immigrants raise house prices due to their direct contribution to the housing demand in an area and these are examined in various literature including Saiz (2007), Degen & Fischer (2010) and Gonzalez & Ortega (2013); on the other hand, local interactions with the indigenous population could lead to a decrease in house prices because of a change in the income distribution in a neighbourhood. This is because many affluent native households would respond to inflows of relatively deprived

immigrant households by moving out of the area (Saiz & Wachter, 2011; *Sá*, 2014; Braakmann, 2016), potentially causing a decrease in overall income of the neighbourhood, hence a drop in housing demand and prices. The contradictory effects of immigrants are often found by carrying out empirical studies at different spatial scales, reflecting differences between macro and micro level influences of immigration on housing values.

The methodology used in the thesis considers the problem of endogeneity and in order to mitigate the problem, the regressions are treated through several means such as first differencing, instrumenting by IVs, or de-meaning while the ordinary least squares (OLS) specification is used as benchmark. Results are often compared between the OLS specification and the IV specification. A battery of tests is also conducted to validate the use of the instrument, and they include Hausman Test that tests whether the variable is actually endogenous, Stock Yogo Test that tests the explanatory power of the IV, and Sargan Test that tests the over-identifying restrictions. Detailed review of methodological issues encountered in the thesis could be found in the Methodology Chapter – Chapter 2.

The thesis has received immense support from the UK data service in enquiring, searching, applications of various data sources. While some of the data are publicly available, such as the aggregated Census data, benefit claimant data, Annual business Inquiry data from NOMIS – the official labour market statistics, house price data from Land Registry and spatial boundary data from UK Geography Portal, some require more complex application processes for data that are potentially disclosive of sample members' personal information; agreements need to be reached between the researcher (together with the supervisor) and the data depositor . In addition, appropriate training needs to be undertaken to access and use the secure data. The ones used in the thesis include the Quarterly Labour Force Survey special license access, the English Housing Survey secure access, and the Understanding Society secure access as well as its predecessor, the British Household Panel Survey special license access. Each analysis is carried on a final dataset that is often a combination of multiple data sources. Details of data usage are explained in each chapter.

1.4 Contribution to Literature

Labour market outcomes of immigrants have been extensively studied in the UK and the range of notable works includes Dustmann, Fabbri & Preston (2005); Dustmann, Frattini & Glitz (2008); Manacorda, Manning & Wadsworth (2012); Dustmann, Frattini & Preston (2013) and Dustmann & Frattini (2014). Native wage and unemployment rate are examined in most of the cases, followed by immigrant and native differences in job search methods and educational outcomes. However, analysis

on immigration and housing is rather limited especially those that use econometric models to measure quantitative estimates.

Differing from most of the descriptive and qualitative literature, hypotheses are formulated by deriving mechanisms from economic and social theories and relationships are tested through empirical models, providing more robust quantitative evidence to support the hypotheses. Some of past research examine housing experiences and housing choices of immigrants, within ethnic or country of origin groups (Peach, 1998; Tomlins, 1999, Ferrari & Lee, 2008), evolution of immigrant households' housing career – typically from private rented accommodation or social housing to homeownership and many more. Other types of research focus more on the mechanisms behind the interaction among various agents through different local markets and space, in which the author believes the thesis fits. The approach is considered to have a high level of internal validity that allows one to choose one explanation over another, while also possessing a high level of external validity due to its applicability to other settings, e.g. alternative geographical locations or different time periods.

However, the thesis does not look at specific regions, for instance, the Greater London area where immigration issue is perhaps more relevant; to name a few important pieces of research: Whitehead (2011) looked at migrants' housing consumption behaviour across different visa statuses; Johnson et al (2016) looked specifically at housing densification in London and treated overcrowding as a response of foreign households towards London's high house prices.

Overall, there are two main contributions to the literature in this thesis: firstly, it carries out more spatial studies in the topic of immigration effect on housing markets, making more applications of the empirical models in this area; secondly, the use of instrumental variables frequently adopted in the past literature demonstrate the successful applications of the methodological design outside the labour market literature. Similarly, the IV methods could be extended to examine the immigration effects of various outcomes in other less researched areas such as local amenities, transport services and so on.

Specifically, chapter 3 firstly follows the work of *Sá* (2014) by extending the period of analysis from 2003-2010 to 2003-2015, which allowed us to check their robustness. The two extensions were built further on the model: the first extension looked at the effect of immigrant subgroups by region of origins; although disaggregation caused some data issues such as small counts, the breakdown of immigrant population by regions of source countries allow us to examine further whether the house price effects and local interactions with the native households are homogenous across country groups, clearly the results indicate otherwise. The second involves the role of area level labour market structures, different types of natives and immigrants select themselves into

different types of labour markets, after controlling for labour market characteristics of the area, the author could search additional channels through which immigrants depress local housing values.

Differing from chapter 3, the contribution of chapter 4 lies in the fact that it used a lower spatial unit that resembles more of a neighbourhood; it allowed an examination of a more local effect of immigrants on several key housing market variables, which range from house prices, housing supply stocks, native out-mobility response, overcrowding, and house prices in submarkets divided by different types of dwelling and tenure. Additionally, by using multiple neighbourhood spatial scales, native displacement effect of immigrants is examined further and through analysing the migration distances of displaced natives, different incentives to move are also investigated at length.

Chapter 5 contributes mainly through an examination of housing deprivation experienced by different ethnic minority groups. The construction of the model permitted disentanglement of ethnic group specific factors and local housing attributes that potentially influence overcrowding. Considering ethnicity specific case allowed the author to consider the role of each group's distinct cultures as well as their financial circumstances in their experience of overcrowding. It also considers various factors that affect housing deprivation, such as the length of settlement, income, household size and the degree of residential clustering within one's co-ethnic community, which would have important implications on future housing policies and the design of housing development programmes.

Chapter 2

Discussion of PhD Methodology: Quantitative Methods within the Broader Social Science Perspectives

2.1 Introduction

Modern Econometric techniques used to study the effect of immigration have heavily relied on causal inference models that attempt to disentangle multiple effects of one variable on another. The central idea behind these models uses the concept of the counterfactual world, where the effect is often interpreted as the difference between the case in which one particular event has taken place and the case in which the event has not taken place. However, in reality, only one possible scenario could be observed and this is where the estimation techniques come in. While causality will be examined further in a later section, the approaches adopted in recent economic literature will be summarised in this chapter. A much more detailed review is given by Dustmann, Frattini & Glitz (2006) specifically focusing on immigration.

In this chapter, we also discuss more generally about quantitative methods used in social sciences, the idea of causality and on the definition of immigrants.

2.2 Approaches used in Immigration Analysis

To study the impact of immigration, the economics literature has traditionally adopted three approaches. The most commonly used is the spatial correlation approach that examines the correlation between changes in the stock of immigrants and changes in the outcome variables, e.g. house prices. The rationale is as follows: if the two labour markets are identical in every aspects but only differ in house prices, and immigrants flow into one area but not the other, then one could safely explain house price differentials to be directly caused by the immigrants. One way to make these labour markets represented by local areas as "identical" as possible is to control many area level covariates in a model equation while using an instrumental variable to predict exogenously the degree of presence of immigrants in an area. The classic instrument is constructed based on the historical settlement pattern of immigrants since the underlying assumption is that immigrants tend to spatially cluster due to their preferences towards residing close to those from their own ethnic background, therefore established immigrant concentration could be useful in predicting future streams of immigrants. Past studies using spatial correlation include Altonji & Card (1991), Hunt (1992), Card (2001), Card & Lewis (2005), Dustmann, Fabbri & Preston (2005) and Dustmann, Frattini & Preston (2013). In addition, the approach has been applied in the context of housing in recent papers such as Saiz (2003), Saiz (2007), Saiz & Wachter (2011), *Sá* (2014) and Braakmann (2016).

The second approach uses simulation-based techniques to generate the counterfactual scenario – the labour market conditions in the absence of immigration. The aggregate factors approach compares the actual supply of workers to the one in absence of immigrants. For each skill group, the changed factor proportions due to immigration would lead to different wages and employment conditions for natives. Notable works include Borjas, Freeman & Katz (1997).

The skill-education cell approach is a modification made in Borjas (2003) to search for native wage and employment effects of immigrants by making the two groups as close substitutes as possible. Skill in this paper is captured by years of working experience in the labour market. By fixing years of work experience and education background, the method takes out potential adjustment mechanisms of native mobility in response to wage pressure led by immigrants, hence having estimates of effects on native wage and employment larger than those previously found by the spatial correlation approach. Other studies utilised the skill cell approach range from Card (2001) and Cohen-Goldner & Paserman (2004).

These approaches could be adopted equivalently in analysing the impact of immigration on housing market. The thesis mainly constitutes the first approach.

2.3 General Discussion of Quantitative Methodology in Social Sciences

The quantitative methodology used in the thesis is essentially positivist: "as a philosophy, positivism is in accordance with the empiricist view that knowledge stems from human experience. It has an atomistic, ontological view of the world as comprising discrete, observable elements and events that interact in an observable, determined and regular manner" (Collins, 2010, p38). The perspectives have its roots in physical science. It uses a systematic, scientific approach to research. And it is assumed that unchanging universal laws exist and these laws can be identified to explain the world around us, while a more critical approach (such as a phenomenological or social constructivist approach) would be more sceptical or agnostic about the potential for objective analysis.

2.3.1 Strengths of the Quantitative Approach

One defence for the positivist approach is a practical one – all sources of knowledge can be viewed as ultimately uncertain, not least because every worldview has to begin with a series of unprovable assumptions – "self-evident truths" – so no research philosophy exists that claims access to unquestionable truths. The advantage of the positivist approach is that it allows us to set out a practical and logical way of making good use of available data based on transparent assumptions.

The scientific benefit of this method is that it seeks to include rigorous control of potentially confounding factors, which greatly increases the validity and reliability of the results. Validity,

according to Blaxter et al. (1996, p200) 'has to do with whether your methods, approaches and techniques actually relate to, or measure, the issues you have been exploring'. To measure the impact of immigration on house prices, the adopted method collates data from major national surveys including the Labour Force Survey and ones conducted by the Department of Government and Local Communities on the area level dwelling stock, the benefit rate and other socio-economic indicators. All of these surveys are carefully sampled to ensure their representativeness of the population. In addition, the instrumental variable approach serves as an appropriate statistical treatment of the data.

Another strength of the positivist approach is the potential for and emphasis on replicability. Findings are reliable if other researchers can replicate the findings of a study by using the same methods (Blaxter et al., 1996). To establish the consistency and robustness of the results, the replication of this method is going to be conducted over an alternative period of time and using alternative instruments. Several other extensions will also be made including dividing immigrants into subgroups along occupation lines and ethnic origin lines, as well as geographic divide, e.g. London vs. non-London to see if the findings still hold.

2.3.2 Criticisms of the Quantitative Approach

One of the criticisms is that the researcher is assumed to be an independent observer who has no influence on the world he/she studies. However, this is unlikely to be true: the researcher's very own perceptions, beliefs and experiences could potentially affect how they interpret the evidence and limit how they think about the research question they are looking at. For example, my own ethnic background from China may prompt me to reflect on the immigrants' incentives and behaviours mostly from this ethnic origin as some sort of reference point. This could potentially influence the direction and the approach taken when formulating research questions and gathering data. However, a wider reading around immigration in the context of the UK could help provide more angles from which to look at the same problem. Furthermore, the quantitative models used in the project are used to explore the implications of immigration in general for the housing market, and it is important to not over-interpret the findings.

A further criticism of positivism is that it tends to apply the kind of mechanistic models developed in the physical sciences and apply them to human behaviour. Unlike purely physical phenomena such as gravity, human subjects are self-aware; they can reflect on the world around them and make decisions accordingly. So, it can be argued that "human agency" undermines the simple **deterministic** nature of mechanistic models: we are not just molecules, we have free will.

In light of this argument, one could conclude that, although the regression approach has mimicked the experimental setting on observational data, it could never have the equivalent

experimental interpretation. If the findings are that, for example, 1% increase in the number of immigrants reduces house prices by 1%, it does not mean that in real life if we place an extra 1% of immigrants into an area, we will see a 1% drop in price, simply because we cannot "control all other factors" in the real-life situation.

Quantitative methods are unable to predict individual behavioural responses, but often collectively, people behave in remarkably predictable ways. Therefore, the aim of these models is to predict the likely response on average to particular stimuli. And the results can be interpreted in a probabilistic manner. Such models are useful for policy makers who do not need to know the idiosyncrasies and nuances of individual-level decision making but rather the overall outcomes as a guide to how best allocate resources.

Lastly, since spatial analysis uses aggregated data, it forgoes the opportunity to examine individual attitudes and feelings towards a particular issue. These incentive mechanisms of individuals are unlikely to be explored by quantitative methodology, which could be important in helping us understand the reasons behind behaviours which ultimately lead to changes in the housing market. For example, we could arrive at a good estimate of how many natives are "driven out" by immigrants, but this will not tell us about the reasons for this; or, we could derive an accurate estimate of the supply response of house building to price from a well-specified supply equation, but we would not know what the interplay between different agents among the housebuilding industry is like which may lie behind this estimate. Qualitative methodology has an advantage over this as it focuses on describing experiences and exploring the nature of an issue (Coolican, 2004, p49). Methods such as interviews and focus groups do a better job at helping us understand individual level incentives and behaviours.

Overall, while the quantitative approach adds validity and reliability to the research, its scientific tone inevitably relies on certain assumptions. Whether these can be agreed upon ultimately depends on each individual researcher's own perspectives. For instance, positivists tend to believe objective universal laws exist somewhere out there for researchers to discover, but one should acknowledge that researchers themselves are not complete "outsiders" and their perceptions and experiences would more or less influence the research direction and methodology. One should take caution of the limitations of the approach when interpreting the results. In conclusion, while well-established empirical methods will be utilised, they will be applied in a critical and reflective way.

2.4 Instrumental Variable Analyses within the Econometrics Literature

The idea behind using an instrumental variable is to find a variable correlated with the main independent variable of interest and at the same time uncorrelated with the error (hence the omitted variables in the error). By using the variation within the instrument, one can estimate the effects of the independent variable on the dependent variable consistently. A valid instrument needs to satisfy three requirements:

(1) The instrument should be uncorrelated with the error term in the model;
(2) The instrument is sufficiently correlated with the independent variable;
(3) The instrument will be made redundant in the structural model, i.e. the instrument will only affect the dependent variable through the main independent variable of interest.

2.4.1 Instrument based on Historical Settlement Pattern of Immigrants

In the model, the expected change in the stock of immigrants across area units is used to instrument the observed change in the stock of immigrants (Card, 2001; Sa, 2014; Braakmann 2016). The IV is constructed based on the historical settlement pattern in each area, i.e. using the past share of immigrants multiplied by the national immigrant inflow figures. On the other hand, the errors include a random part and year controls to capture the current macroeconomic conditions. For the instrument to be valid, the historical settlement pattern should be uncorrelated with recent changes in the economic performance of each individual geographic area; similarly, the annual change in the national stock of immigrants should be exogenous to the economic conditions of the various local authorities. This may be reasonable as the number of immigrants legally allowed in the UK is subject to strict immigration controls; in principle, changes in local area economic conditions cannot and should not influence the overall level of immigrant inflows nationally although there is a tendency to. Overall, it can be argued that the instrument is uncorrelated with the error term if it applies to immigration in general. However, if one looks at the specific subgroups of immigration, this assumption could potentially fall apart; for example, EU workers may be attracted by more promising local economic conditions in the UK and their relative flexible mobility could make them less dependent on the political and administrative decisions of the Government, i.e. no visa restrictions.

The instrument should also satisfy the second condition as explained by the network argument made earlier. In general, immigrants are more likely to settle in places where the presence of the immigrants from the same ethnic origin is already strong. However, this is only plausible when there is no further disaggregation of immigrant groups. It might be argued that immigrants with better education or with higher socio-economic status tend to be less reliant on ethnic ties and the clustering

effect of this group of immigrants may not be salient. One counter example against this assumption would be London, where immigrants do not tend to cluster within their own ethnic groups therefore the IV set up falls apart as a result of a very weak first stage.

Lastly, the expected change in the stock of immigrants is assumed to influence the change in house prices only through its effect on the current change in stock of immigrants. That is, it has no direct effect on house price changes and it does not affect the dependent variable through any other exogenous variables (or controls) and the error term. The exclusion restriction holds. This is also a reasonable assumption in our model.

2.4.2 Instrument based on Spatial Diffusion

The spatial diffusion instrumental variable was recently designed in Saiz and Wachter (2011) that utilises the power of past immigrant settlement pattern in neighbourhoods to predict the change of immigrant stocks in the actual neighbourhood of interest. The argument behind is one of spatial diffusion: newly arriving immigrants tend to live in close proximity to other immigrants in order to take advantage of being part of the same national, linguistic, ethnic and socioeconomic group. This suggests that neighbourhoods which are close to existing immigrant enclaves are more likely to be future immigrant enclaves themselves. From this intuition, a gravity pull measure is constructed as a weighted average of past immigrant densities of surrounding neighbourhoods, directly proportional to its area size and inversely proportional to its distance in between, due to the reason that the larger the area and the shorter the distance, the neighbourhood would exert a much bigger influence.

To assess the validity of the instrument, it firstly needs to be uncorrelated with the error term. Since the IV is based on past immigrant densities outside the study period, it is unlikely to be correlated with the error in its differenced form therefore the omitted variables contained in the error. Specifically, in chapter 4, the model is in its first differenced form using data between Census 2001 and Census 2011 to eliminate time constant attribute of the unit of observation; in this case, the IV based on immigrant settlement pattern in year 1991 is not correlated with either year 2001 error or year 2011 error, therefore it satisfies the first condition.

Secondly, a strong correlation between this gravity pull measure and the actual immigrant net inflows is justified by the assumption that immigrants tend to spatially cluster to form immigrant enclaves. The geographical locations of these enclaves are good at predicting future streams of immigrants and communities are likely to expand to surrounding neighbourhoods over time. Thus, it satisfies the second condition for the IV to be a valid instrument.

However, its exogeneity cannot be tested empirically and it's very likely that immigrants could be attracted by certain characteristics which are common among several neighbourhoods and these factors also tend to negatively influence house prices. That is, the spatial diffusion instrument that draws past immigrant patterns in neighbouring spatial units might have an effect on house prices through other variables either present or not present in the model equation. In this case, the condition of exclusion restriction has been violated. The two solutions proposed in Saiz and Wachter (2011) draw insights into the spatial dynamics of immigrant settlement processes, mimicking the process of spatial diffusion in epidemiology and directly generating new exclusion restrictions. In particular, the first new instrument interacts the gravity pull measure with the actual immigrant density in the area under investigation, assuming that if the neighbourhood already has a large proportion of immigrants, surrounding neighbourhoods are less likely to predict well about the future rate of inflows of immigrants. The second new instrument interacts the gravity pull measure with the size of immigrant inflows in a larger region in which the neighbourhood is contained. In this case, for those regions seeing larger inflows of immigrants one tends to have a better prediction for neighbourhood net inflows of immigrants than regions which do not generally receive immigrants.

To add further empirical evidence as to show that the IV approach is necessary and valid, we may also need to test the following:

1. The "suspected" endogenous variable is indeed endogenous.

Comparison of the results from OLS and IV models is important. If the estimates differ a lot from each other then there may potentially be an endogeneity issue. A more systematic way is to conduct the Hausman Test. The essential idea is to put the first stage residuals (i.e. treat them as an explanatory variable) in the original model and see if the coefficient is significantly different from zero, if it is, then there is likely be an endogeneity problem.

2. The instrument is not a weak one.

When the explanatory power of the instrument is weak, the standard errors of the 2SLS estimator tend to be quite large. This would potentially cause the 2SLS estimate to be insignificant. To test if the instrument is weak or not, one can conduct the Stock-Yogo test; considering there is only one endogenous variable, this is equivalent to the F-test of the first stage regression.

3. Test of over-identifying restrictions.

The equation is said to be over-identified if the number of instruments is greater than the number of endogenous variables. Usually we do not want too many instruments to estimate the parameter as it increases the likelihood of invalid instruments, i.e. it runs a higher risk that not all instruments are uncorrelated with the error term. To test for over-identification, one can perform the Sargan Test. The main idea behind this test is that the exogenous variables including the instruments should not explain the residuals from the IV regression very well; otherwise, the instruments are not exogenous in the main equation and the exclusion restriction fails. If alternative IVs are used in later extensions, the test would come useful.

Before interpreting the results, it is preferable to run OLS and IV to compare results. While OLS estimates can be biased due to omitted variables but they tend to have relatively smaller standard errors; the IV estimate is consistent but could be imprecise (due to its large standard error) that nothing interesting could be concluded. It's important to examine if the results fit the intuition.

2.5 Causal Inferences and Causality

Causality is a type of relation between one event (the cause) and another (the effect) in which the former is held responsible for the latter to take place or to change. The subject has received rigorous philosophical treatment over millennia from the West (the Aristotelian philosophies) and the East (the Buddhist philosophies). During the 18th century, the Scottish philosopher David Hume (1748) has defined causation from two dimensions: " (1) a cause is an object followed by another, and where all the objects, similar to the first, are followed by objects similar to the second. (2) Where, if the first object had not been, the second never had existed." The first one has dominated the related philosophical literature until the 20th century such that the focus of the examination is on regularity: one event succeeds another in a causal sense if it reveals some kind of regularity and of course there are differences between proper "causal laws" and accidental regularities of succession (this is considered as a great improvement in perspective at the time). It is not until the late 20th century that the ideas of alternative possible worlds (or potential outcomes) starting to develop, the perception on causality has been reworked towards the second definition of Hume, i.e. the evaluation of counterfactual conditionals. For example, Lewis (1973)has provided a modified version of definition on causal dependence by applying a more counterfactual thinking:

"An event E *causally depends* on C if, and only if, (i) if C had occurred, then E would have occurred, and (ii) if C had not occurred, then E would not have occurred."

Then causation could be defined as a chain of causal dependence. That is, C causes E if and only if there exists a sequence of events C, D_1, D_2, ... D_k, E such that each event in the sequence depends on the previous. This type of counterfactual analysis adds additional elements of relations

compared to the regularity analysis, which states that "a cause is defined as any member of any minimal set of actual conditions that are jointly sufficient, given the laws, for the existence of the effect."

It is worth noting that counterfactual dependences may not be reversible. So "if C had occurred, then E would have occurred" does not necessarily imply "if E had occurred, then C would have been occurred"; similarly, "if C had not occurred, then E would not have occurred" does not mean "if E had not occurred, then C would not have occurred". To borrow the example used in Lewis (1973), a list of barometer readings counterfactually depends on the pressure, that is, a higher value of reading should always imply a higher level of pressure, however it is unlikely that the pressure should be counterfactually dependent on the readings, in other words, the readings "affect" the pressure, one would rather violate some laws of certain objects and facts, for example, the barometer could be malfunctioning, than believing in the reversed counterfactual dependence.

The idea of counterfactual serves as the foundation to formulating research questions of causal relationships. Measurement of causal effect of certain event would always have been characterised by the difference in potential outcomes between the event happening and the event not happening. In the classic example of investigating the effect of hospitalisation on health outcomes, event C is the hospitalisation of a person, event E is the person's health outcome to become better, under the definition of causal dependence established in Lewis (1973), the person's health improved because of his hospitalisation if and only if (1) if he's hospitalised, his health improved; (2) if he is not hospitalised, his health would not improve. So to compare his states of health under which he would receive hospital treatment and he would not receive it establishes the causal relationship. However, in reality, we do not observe both sides of the world, i.e. he either gets treated or he does not. If he gets treated, the counterfactual dependence that needs to be established is that if he does not get treated, his health status would not improve. If he actually does not get treated, the counter factual dependence that needs to be established is that if he does get treated, his health outcome would improve. Similarly, taking my research topic as another example, an inflow of immigrants into a local area would on average induce native out-mobility (Saiz & Wachter, 2011), subsequently the outflow would alter the income distribution of the area making it more positively skewed (for the reason that those natives who move out tend to be more affluent than the incoming immigrants), this would in turn reduce the local housing values as the demand for housing drops. This should be considered as a causal chain, particularly, even if just one of the intermediate steps does not take place, the whole causal relationship of immigration reducing house price does not hold. Another potential causal chain is that immigrants could reduce local housing values by lowering the average housing quality of the area (Saiz & Wachter, 2011), for the reason that they may be less prone to spend on housing maintenance and for some ethnic groups immigrants may overcrowd the rooms due to their larger family sizes.

But, how do we establish the causal relationships or causal chains? Yes, we would love to know what would happen to the person's health if he were not hospitalised; and wish to see also whether house prices would drop if there is no such inflow of immigrants into the area. Unfortunately, the other state of the world is never going to be observed on a single individual or a firm. This is where experimental designs coming in to solve the problem. Among the large body of modern empirical work, there are two major classes of experimental designs, which had been long recognised by Haavelmo (1944, p14): "(1) [ones] that we should like to make to see if certain real economic phenomena – when artificially isolated from "other influences" – would verify certain hypotheses, and (2) the stream of experiments that Nature is steadily turning out from her own enormous laboratory, and which we merely watch as passive observers. In both cases, the aim of the theory is the same, to become master of the happenings of real life."

The former has been further elaborated into the form of randomised control trials. It is the most credible and influential research design (Angrist & Pischke, 2008, p11), mostly dominant in health and education research, but we also see a gradual surge in recent years in social welfare and economics research (RCTs material, p6). One problem of naïve comparisons is that it contains selection bias, this is perhaps best explained by an example: suppose we simply compare places with high levels of immigrants with places with low levels of immigrants and impute the house price differentials entirely to differences in levels of immigrants. Immigrants may or may not have led to house price changes, but the evidence per se is not sufficient to conclude causality. It could be the case that the place with high levels of immigrants has low house prices to begin with, due to reasons that might have nothing to do with immigrants (i.e. coincidence). Even if we examine the relationship between changes in local immigration flow on changes in house prices, other problems still exist. In fact, it is very difficult to distinguish a genuine cause, from an epiphenomenon, an effect and a pre-emption. What if immigration is an epiphenomenon, rather than an "initiating" cause? Say, the recent improvement in the economic prosperity had attracted more immigrants to settle in the area, where we are also more likely to see a faster growth in house price. Or what if the level of immigrants is an effect rather than a cause, which is caused by lower house prices because one would in general wish to settle in places where house prices are not so expensive. Another problem is that lots of factors could affect local house prices, if not immigration. And changes in external conditions may also alter the way that immigrants affect house prices.

Randomised control trials would solve these problems by randomly allocating immigrants across regions, in this case, the number of immigrants in each region has nothing to do with any other factors that might potentially influence house price including house price itself. By comparing those places with immigrants (the treatment group) with the places without immigrants (the control group), the detected house price differential would possess causal meaning. In reality such experiment can be very costly and more problematically concerned with ethical issues, and as far as the author knows,

there is no relevant policy programme in the UK which contains random assignment of immigrants for research purposes.

Even if randomised control trials could be conducted for the purpose of shaping policy, they would still face quite a number of implementation problems. Sample attrition and subjects' intention to switch between the treatment and the control group sometimes cannot be avoided. For example, in the STAR project carried out in the U.S. to investigate the impact of class size on pupil performance (Krueger, 1999), pupils are randomly allocated to classes of different sizes. However, the study requires a fairly long period of observation, and often during the period, some students changed schools and also some others were reassigned to smaller classes, possibly because of protests by the parents with children in bigger classrooms, even if they were initially randomly assigned (Angrist & Pischke, 2008, p20). These would break the control environment of the design by introducing alternative selectivity generated by the subjects.

Because of these problems, researchers tend to explore a cheaper and more readily available source of variation. By changing the variable of interest while keeping other factors balanced, it is hoped that a natural or quasi-experiment could be found to mimic the randomised control trial (Angrist & Pischke, 2008, p21). In essence, we wish to analyse observational data in an experimental spirit. Both natural experiments and quasi-experiments involve the subject individuals being exposed to an "experimental" condition outside the control of the actual investigator, e.g. a policy intervention or a natural shock, so that the changes in the outcomes of these individuals could be plausibly attributed to the exposure (DiNardo, 2008). Although it is not always easy to find a convincing natural experiment, if it were found, then the comparison of conditions would allow us to establish causal inference. One notable work among the immigration literature is done by Card in his 2001 paper, examining the impact of the Mariel Boatlift on the wage and employment level of local U.S. citizens in major gateway cities. Mariel Boatlift is an event of mass emigration of Cubans into the U.S. in 1980s led by a sharp downturn in the Cuban economy. The large immigrant inflow has instantaneously raised the fraction of low skilled workers in the labour force, but previous research had not found large and significant change in wage level by using simple before and after comparison. The new identification strategy used in his 2001 paper is an instrumental variable one which provided some robust evidence for wage competition and depression.

I believe all perspectives have advantages but also come with challenges. The experimental perspective does provide us a benchmark for establishing causal inference, however, as mentioned previously, randomised control trials are not always practical, natural experiments are not easy to find, and the methodologies designed for example the instrumental variable approach (IV) could come with a number limitation. There is also external validity issue, could the results be generalised to everyone? Possibly not, one would perhaps always consider this type of research to provide some kind of

"average" effect, not of a particular person or a small group of people. It helps us establish causal relationships in a more robust ("scientific") way, which are perhaps meaningless if they were focused on single individual since we are unlikely (and we wouldn't wish) to behave in an exactly deterministic way in our everyday lives. However, in a more macro level, these types of relationships are useful for "making predictions about the consequences of changing circumstances or policies; it tells us what would happen in alternative worlds." (Angrist & Pischke, 2008, p3)

With that being said, other methodological approaches particularly qualitative would achieve similar results depending on the way you look at the problem. Surveys and interviews designed to examine local attitudes towards foreign immigrants are good examples of qualitative studies. In my opinion, it would be considered a good approach as far as it could be used to discover the underlying structure and mechanisms of events and experiences (Barry & Hansen, 2008, p70), so that the explanation is "final", i.e. it does not arouse further questions in our minds (Boudon, 2003). For instance, simply knowing that "immigration reduces house prices" would not stop us questioning further about why immigration reduces house prices. If further intermediate steps are added to facilitate explanation such as immigration lower housing quality and etc., then the explanation could be treated as completed. Whether you look at large number of cases and design statistical methods around the data to test these hypotheses, or you set up a participant observation project to observe the day to day behaviours of immigrants, they all serve the purposes to complete this whole explanation.

2.6 Categorisation of Immigrants

In quantitative analysis, it is unlikely that we could avoid categorisation of certain concepts and ideas. Some are found to be straightforward to turn into a variable such as gender and age, while others are potentially harder to categorise, especially for those which involve feelings and emotions. On the scale of difficulty, the classification of immigrants would perhaps settle in the middle. It can be said to be both easy and hard to define. When we say easy, it is because immigrants do possess certain binding characteristics such as they or their parents/grandparents all came from somewhere outside to settle in the UK, maybe at some point recently; but it could also be hard when we incorporate the elements of attachment and national identity into the definition.

Although the consensus on the single definition of immigrants is not yet reached, various data sources have attempted to capture partially this concept by using several different variables. Questions on the country of birth, the nationality, the national identity, the ethnicity, the length of stay and so on have all been recorded in major surveys such as the Labour Force Survey and the Census so that analysis could be done based on this information.

Ultimately, the question of "who counts as immigrants" (Migration Observatory, "Who counts as Migrants",2017) is of crucial importance to individual piece of research. It is worth noting

that no single variable is sufficient to define immigrants that satisfy everyone. In general, being born outside the country could serve as a good proxy for your immigrant status. It attracts relatively less contention when compared to ethnicity due to its clear-cut definition. However, life experiences can get as complicated as one wants to! It is perfectly reasonable that some UK-borns do not wish to be treated as locals if they spent most of their lives outside the UK. Other issues also exist: should we treat those foreign-borns who tend to settle permanently in the UK as immigrants, while keep the rest of the foreign-borns with temporary stay as merely "visitors", or should we consider them all as immigrants? Perhaps, there is no single satisfactory answer to this; however, the definition of immigrants may need best be chosen to fit the purpose of the research topic at hand.

With respect to ethnicity, it is also very difficult to capture all the dimensions including the culture, customs, geographies, race, language, religion and politics into a single variable that categorise the whole population into distinct and exactly non-overlapping social groups. For example, a Catholic person born in Northern Ireland may find himself in a dilemma that whether he should identify himself as an Irish or a British; similarly, the second-generation immigrants born in the UK may find their own ethnic identities to be confusing, therefore feeling difficult to arrive at a unique answer on the census form, let alone those whose ancestries consist of multiple ethnicities but no single dominant one. However, despite of its limitations, the thesis uses census classification which is also adopted in the Quarterly Labour Force Survey to define immigrants. Specifically, two variables were used, namely, country of birth and ethnicity. While the country of birth definition is less controversial, which is defined as those born in the UK or born outside the UK, the ethnic group categories are more subjective therefore are more prone to stability issues (Simpson et al., 2016), i.e. individuals may not identify their ethnicity consistently over time; it could also mean different things for different people. However, for research purpose, the corresponding variable remains to be treated as an 'objective measure of social groups with clear boundaries' (Simpson et al., 2016, p1025). One justification for using these two definitions is that if an individual identifies themselves as non-British or non-White British, there is certainly an element of "foreignness" in their perception about themselves. It is this lack of feeling "local" or "indigenous" which distinguishes them from native people. And this is sufficient when we examine the social cohesion and the subsequent economic impact of these groups of people. The research method relies substantially on co-ethnic ties, networks and the sentiments that unite the group especially for chapter 5. Therefore, they are chosen as ways of classification of immigrants.

In particular, for the PhD thesis, chapter 3 and chapter 4 adopt country of birth to define immigrants. In other words, those born in the UK are treated as natives and those born outside the UK are treated as immigrants. The terms - immigrants, foreign borns or non-UK borns are used interchangeably. For chapter 5, to analyse the housing experiences of immigrant subgroups with respect to ethnicity, the population is divided into different ethnic groups. Unlike country of birth, ethnicity is often

considered the cultural identity of a group, usually based on language and tradition. However, by using ethnicity in this chapter, the extent of cultural homogeneity within each group is greatly improved, especially those with respect to housing and residential living behaviours, which serves the research purpose of the chapter. Because of its multiple dimensions within its single definition, different individuals would potentially hold different views towards their own ethnic identity, with some focusing more on "places of descents", while others have more emphasis on "places where they have the most cultural experience or where they share the common language", although they do not have to be mutually exclusive of each other. Furthermore, at least in Britain, understanding towards the various ethnic identities is not something that is fixed over time. The "emergence of new or mixed identities, as well as the shifting significance of language and religion" would constantly challenge the group boundary and cause changes within the group (CoDE, 2012; ONS, 2015).

The ethnicity question from the 2001 Census contains a total of 16 categories which are White British, White Irish, White Other, White and Black African, White and Black Caribbean, White and Other Asian, Other Mixed, Indian, Pakistani, Bangladeshi, Chinese, Other Asian, Black African, Black Caribbean, Other Black and Other Ethnic Groups. The 2011 Census has ethnicity question that is broadly consistent with this categorisation. For the purpose of research in Chapter 5 which mainly pertains to overcrowding issues, 10 ethnic categories are re-grouped for analysis. This includes White British, White Irish (combining both Irish and Gypsy), White Other, Indian, Pakistani, Bangladeshi, Chinese, Other Asian, Black African (combining both Africans and Other Blacks), and lastly Black Caribbean. The special licence access version of Quarterly Labour Force Survey used in this research project also introduces the ethnic origin question in line with the recommended output classification of ethnic groups for National Statistics data. The question contains 15 categories excluding the "Irish" ethnicity which is present in the 2001 Census. This is because Northern Irish residents were not asked the corresponding ethnic group question and hence were coded as missing. The categorisation is relatively stable across the analysis period between 2001 and 2011 which allows a great degree of convenience for carrying out the research and analysis for Chapter 5.

Just as pointed out by Finney and Simpson in their book "Sleep walking to segregation", ethnicity [as such] is not measurable as a single variable, and the ethnicity question from the censuses does not allow multiple affiliations while many cannot identify themselves in just a single ethnic group; but one is able to sympathise the impossibility of the statistics to satisfy conceptually a variety of motivations (Finney & Simpson, p37) and also to recognise that "categories of separate ethnic identities" could help us "understand and accommodate differences" (Finney & Simpson, p30). The data gathered by these questions still provide us a rich source to examine economic/social conditions and social changes, which otherwise we could not.

Chapter 3

Immigration Effect on the Housing Market in England and Wales – the Role of Ethnic Heterogeneity and Area Level Labour Market Structure

3.1 Introduction

How does immigration impact the housing market? Ostensibly, one might expect immigration to increase demand for housing, leading to price rises particularly in an economy with inelastic housing supply (Pryce, 1999; Barker, 2004; Bramley, 2008; Ball, Meen & Nygaard, 2010). While a positive house price effect might be expected at the macro level (Saiz, 2007; Sá, 2014), there are factors working at the local level which might mitigate these impacts. The extensive literature on "white flight" (Saiz & Wachter, 2011; Sá, 2014), for example, suggests that the influx of an outside group into a neighbourhood can cause outflows of indigenous residents. Given that buyers may place a high value on neighbourhood stability (as it reduces uncertainty about the long-term characteristics of the neighbourhood); this increased churn may itself reduce the value of properties.

Concerns about the negative impacts of immigration (particularly house prices, crime, competition for jobs, and educational and welfare resources) have become particularly acute during periods of increased migration flows. At the time of writing, the Syrian refugee crisis and instability in the surrounding regions, has dramatically increased the number of refugees and immigrants seeking entry to affluent EU countries, heightening political pressures and priorities in countries such as the UK. As such, there is a pressing need for robust evidence to help inform and foster rational discussion in an increasingly emotive debate.

So far, robust econometric estimation of the impact of immigration has mainly focused on labour market outcomes; notable works include Card (2001) for the U.S., and Dustmann et al. (2013) for the UK. Both are with a focus on spatial correlation approach. Immigration was usually found to displace native workers at the lower end of the wage distribution, but with a positive effect on wages of the better-off. This, to a large extent, depends on the degree of complementarity and substitutability between immigrant and native workers (Dustmann 2005, 2014; Manacorda 2012). These findings have encouraged policies of attracting highly skilled immigrants (such as the UK's Highly Skilled Migrant Programme (HSMP) launched in 2002, and the "Exceptional Talent Scheme" started in 2011) and attempts to protect the local working-class families and ethnic minorities inside the country (such

as the recent UK reform on family visas and cuts in number of student visas (May, 2012)). However, beyond its effect on the labour market, immigration potentially influences the economic life of natives in a variety of ways, including the availability and cost of housing, transport, welfare, health services and competition for school places. While these areas are clearly inter-related, relatively little robust quantitative work has been conducted that investigates them separately or jointly.

It is only in the last decade, one has seen robust empirical estimation of the impact on the housing market (Saiz, 2007; Akbari & Aydede, 2012; Gonzalez & Ortega, 2013). Housing is an important sector in its own right, generating significant employment and trade through construction (Akbari and Aydede, 2012) and transactions-related industries (estate agency, surveying, conveyancing, and mortgage finance). So, the impact of immigration on housing demand is potentially an important component of the overall economic contribution of the immigrant population. However, fluctuations in the inflow of migrants have raised concerns about increased volatility of demand for residential housing, particularly in small economies (Stillman and Mar***é*** 2008). There are also concerns arising from the fact that particular migrant groups tend to spatially cluster (Meen et al. 2016; Saiz 2007; Munshi 2003). So, even in large economies, migrant inflows could potentially have large collective influence on housing submarkets in particular regions (Saiz, 2007, p5). In the UK, the majority of immigrants concentrate in London boroughs: for example, Westminster has over a 60% share of foreign-borns; outside London, local authorities such as Leicester, Newcastle and Coventry also have an over 20 % share of immigrants (Sá, 2014). Overall, immigration in the UK as a fraction of the working population has risen from 8% in the mid-1990s to 16% in 2015, while seasonally adjusted average house prices have increased from £60,000 in 1995 to £210,000 in 2015 (Source: Quarterly Labour Force Survey, 2015), raising concerns about the impact of immigration on housing affordability, such as the claim by former Home Secretary that "without the demand caused by mass immigration, house prices could be ten per cent lower over a twenty-year period" (May 2012). However, even if this claim could be substantiated at the macro level, it would bely a complex geography of varying house price effects at the local level due to spatial concentrations of migration and different rates of spatial clustering across different migrant groups (Meen et al. 2016), different socio-economic impacts of different groups, and the different characteristics and dynamics of local economies.

It is these effects that the existing literature has tended to overlook and which the current chapter seeks to address. In Section 2.2 I summarise the main hypotheses for how immigration affects local house prices. In Section 2.3, I set out the methodological challenges and our strategies for dealing with them. In Section 2.4 I describe the data and provide summary statistics. I then present the results of the baseline models adopted from Sá (2014) and extensions in Section 2.5. I conclude in Section 2.6 with a brief summary of the findings and their implications.

3.2 Mechanisms for Local House Price Impact

Several hypotheses have been proposed as to why one might expect local house price impacts to differ from the macro consequences of immigration:

1. *Native flight:* In response to immigrant inflows into a neighbourhood, native households could choose to move out of their areas (Borjas, Freeman and Katz 1997; Card 2001; Borjas, 2003; Saiz, 2007; Accetturo *et al.* 2014). The underlying psychological processes that drive the out-migration behaviours could be due to homophily (the tendency to be drawn to those like ourselves, either based on ethnic identity or country of birth), Heterophobia (fear or aversion to those different to ourselves), or metathesiophobia (fear of change). Crucially, native outflow may shift the income distribution of the neighbourhood to the left, thereby affecting house prices. For example, if the number of natives who leave the area are greater than the number of migrants moving in, total income would fall, leading to a reduction in housing demand and house prices through an income effect. Even if the number of natives moving out are exactly displaced by incoming immigrants, or the number of natives moving out are greater than the number of immigrants moving in, if the new households tend to have lower income, there could still be a reduction in the overall income in the area, leading to a fall in both housing demand and house prices.

2. *Higher crime:* There may be a perception that immigrants generate more crime (Saiz, 2007) either directly by perpetrating crime, or indirectly by undermining social cohesiveness and the informal means of social control. Immigrants may also be more likely to be victims of crime, and offenses may rise as a result of social tension between established residents and new comers due to cultural and religious differences, perceived threat or perceived competition for employment, houses and public services. In this case, if local residents generally perceive immigrants as a source of crime, they would avoid neighbourhoods with a high level of immigration. Therefore, these places are less appealing to house buyers, and their housing demand would be reduced leading to a drop in house prices.

3. *Higher population density*: How can low income migrants displace high income native homeowners in high house price areas such as London? One mechanism for this is through increased population density (Johnson et al., 2016). A dwelling occupied by a small indigenous household might be occupied by larger or multiple families of migrants. While higher occupancy rates entail a more efficient use of resources, it may also lead to reduced house prices if the market places a higher value on low density neighbourhoods. Overcrowding may adversely affect the desirability and physical appearance of a neighbourhood, and affect the demands on local schools, public services and amenities.

4. *Neighbourhood stability:* for risk-neutral and risk-averse house buyers, neighbourhood stability may itself be a desirable attribute, particularly for those seeking to establish stable social networks. High levels of inflows from migrants or indigenous households may lead to higher population churn (particularly if there is a transition from homeownership to private renting) eroding the "stability premium" of the neighbourhood.

5. *Tenure*: A shift to higher density population with per capita lower income may attract and/or be caused by landlords' re-arrangement of housing spaces, entailing a transfer of dwellings from home ownership to private renting, and also in some cases, allowing free renting of new arrivals of co-ethnic members. With these transitions, housing values could be pushed down through both the demand and supply sides of the mechanisms. Firstly, it would lead to a reduced level of involvement in transactions related housing market activities for household members, especially for households that accommodate free renters, since lower per capita income within a household would decrease members' financial capabilities and desire to participate in more sophisticated housing transactions such as private rentals, mortgage finance, buy-to-let schemes and so on. This directly suppresses housing demand in an area. Secondly, as the occupational density of a dwelling unit goes up, it leads to less incentives for inhabitants to maintain the physical appearance of the neighbourhood, gardens and property exteriors. Landlords may also be less inclined to maintain and invest in the physical fabric of the housing stocks than owner-occupiers, adversely affecting the physical appearance of the neighbourhood. Local housing values drop as a result of a reduction in the attractiveness of the neighbourhood. Thirdly, an increase in the units of housing stocks from existing stocks to accommodate immigrants would directly increase the supply of housing, which would also depreciate the average housing value of the area.

The size of the "native flight" effect in the UK context very much depends on the spatial scale and the period span used in an analysis. Hatton and Tani (2005) conducted a study examining the displacement effect of immigration in the UK at the government office region level. They found that a net inflow of 10 immigrants in a region would generate a net population outflow to other regions of around 3.5. Sá (2014) examined this by regressing immigrant population change on native population change, at the local authority level, and found almost a one-for-one displacement. Another closely related article by Braakmann (2016) discovered there is native displacement at local authority level in the most recent census decade 2001-2011; the magnitude is much smaller around 34 natives being displaced by every 100 immigrants.

With regards to the immigration-crime link, there is almost non-existent empirical evidence in recent studies. Jaitman and Machin (2013) found no statistically significant relationship between immigration and crime. On the other hand, Bell (2013) looked at two waves of immigration inflow separately – the asylum seekers in 1999 and the economic migrants from accession countries in 2004. He only found the former group to be associated with a surge in property crimes, but neither group has any effect on violent crimes.

Densification of an area driven by immigrant inflows in general is perceived as a response of high house prices. In order to cope with expensive housing in London, for example, migrants tend to form larger households overcrowding the properties (Johnson et al., 2016). This behaviour could in turn depress house prices: the lack of space and the increased pressure on public amenities as a result of densification may reduce the attractiveness of the neighbourhood, inducing further sorting between the low/high income groups, as well as deterring future affluent households to move in, subsequently the overall demand in the area drops. Although there is limited literature on immigration adding pressure on public amenities, Braakmann (2016) provided some evidence on overcrowding: the immigrant dense regions show an increase in number of available properties but a decrease in number of property transactions. This is consistent with the suggestion that per capita, immigrants tend to demand less housing consumption and share properties with other households.

Neighbourhood stability, if considered a desirable trait in an area by local people, would positively contribute to the price "premium" of its corresponding local housing market. So far, there is not yet a direct measure found in the literature to capture this preference of local people. Most of the native preference towards stable social networks/solid social capital is often inferred through their mobility response to immigration, which is usually tested through area level population changes.

Evidence on any structural decline in housing quality in response to immigration has also been examined by Sá (2014). However, she did not find any statistically significant relationship suggesting no evidence on the deterioration of the housing stock at least at the local authority level. However, there is a change in tenure composition in areas of high immigration areas as examined by Braakmann (2016): there is an increased share of rental properties but a decreased share of owner-occupied properties in immigrant dense areas. This suggests owners in these places tend to split up larger properties into smaller units in order to accommodate the newly arrived immigrants. I offer some additional evidence of tenure transition in the Extension Section 2.

Overall, native flight and stability issues seem to mark the inevitable conflict when natives interact with immigrants. Specific housing market discriminatory practices would further widen the income inequality and segregate the communities in the long term (Meen et al., 2005). Because, if an immigrant household faces discriminatory practices in the housing market, they either meet their housing demand at a substandard or move to alternative locations if there is no adequate housing

resources. Immigrants rarely have collective bargaining power to negotiate better housing condition especially for new arrivals due to a range of constraints (time, income, length of stay, knowledge of the housing market). Compromises are likely to be made therefore one is likely to observe immigrants having substantial proportion residing in low quality and high density housing (Whitehead et al., 2011; De Noronha, 2015). The process of native flight is likely to exacerbate due to greater housing and income inequality observed in the neighbourhood, lower status of immigrants perceived through the type of housing they live in etc.. In this case, more affluent natives are likely to move out reducing housing wealth of the area while new arrivals do not make up the short fall as their demand for housing and housing related services are typically small.

To conclude, the channels through which immigration may affect house prices are summarised in Figure 1:

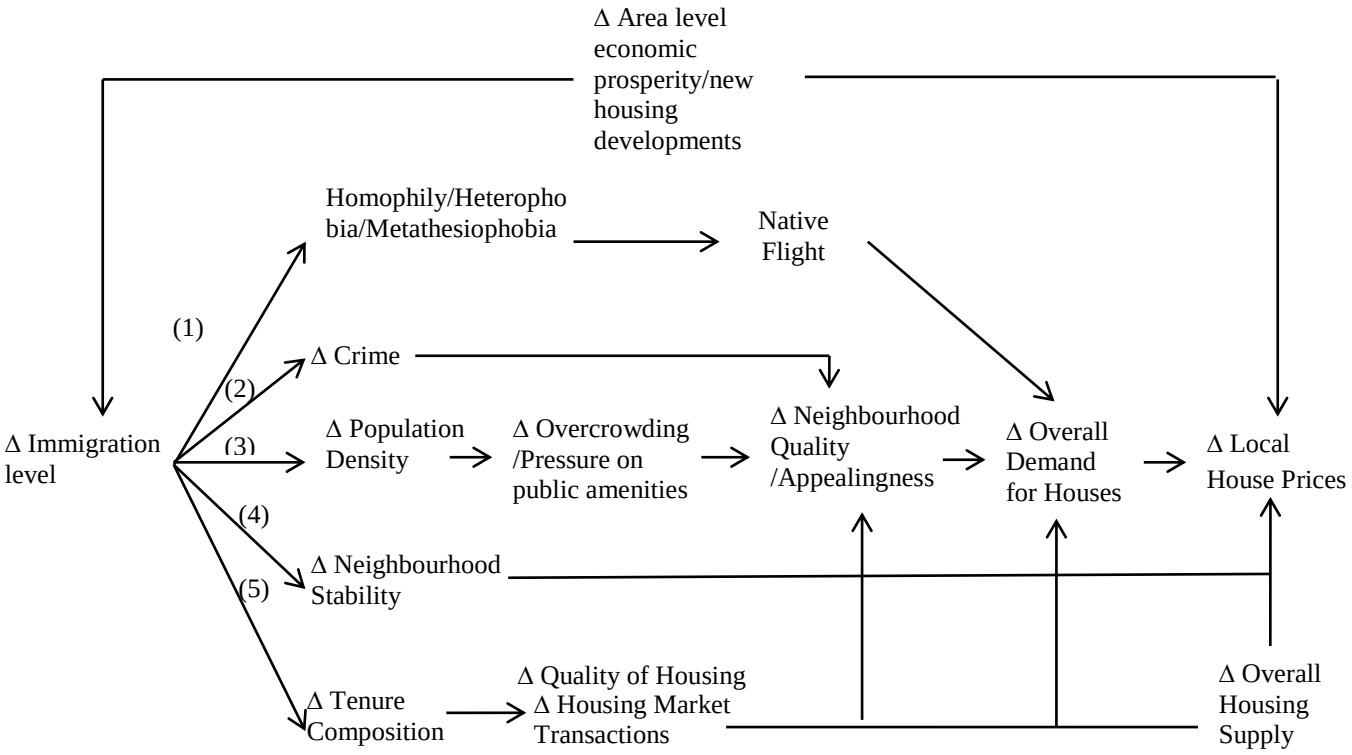


Fig 1. Channels through which Immigration could Impact on House Prices

3.3 Methods

In order to examine the impact of immigration on house prices, this chapter investigates the correlation between changes in immigrant stocks and changes in house prices in different geographic areas. Any attempt to make causal statements about these empirical relationships must address a number of important endogeneity issues. Common fixed characteristics of different areas tend to act

as a confounder for us to observe the true relationship between the two. For example, areas which enjoy higher level of economic prosperity or are currently experiencing large housing developments, tend to see faster house price growth, and at the same time, they are more likely to attract migrants to work and settle there. Additionally, the reverse causality problem manifests itself through the fact that immigrants may also prefer to choose to locate in areas where house prices are growing more slowly so that they are within their affordability.

3.3.1 Spatial Panel Instrumental Variable Approach Review

One common approach used to examine the causal effects of immigration on house prices is a spatial panel data model with the use of an *instrumental variable*. The method was initially developed in the literature investigating the labour market effects of immigration by Card (2001), then it has become more widely used in the context of housing markets: see, for example, Saiz (2007), Ottaviano and Peri (2007), Stillman and Mar*é* (2008), Degen and Fischer (2010), and Sá (2014). The main idea is to use spatial variation in the stock of immigrants to explain the spatial variation of house prices through an instrumental variable (IV). IV estimation is needed because regressing the change in the stock of immigrants on the change in house prices directly would incur an endogeneity problem, and the direction of bias is difficult to predict *ex ante*. For example, consider an area, which is going through an economic boom; as a result, the demand for housing rises in that area, which in turn leads to an increase in house price. At the same time, the economic boom also attracts more individuals into the area, including both natives and immigrants. The conflation of economic buoyancy and immigration effects would induce a positive bias in the OLS coefficient. However, the bias could also run in the opposite direction, since rapid increases in house prices might deter migrants who may choose to settle in places where house prices rise more slowly, when controlling for other economic conditions in that area.

The most often used IV is constructed based on the historical settlement pattern of previous immigrants. The seminal work by Saiz (2007) explored the effect of immigrant inflows on housing rents and prices at the U.S. Metropolitan Statistical Area (MSA) level. His IV strategy was based on the fact that immigrants tend to move to areas where other immigrants of the same nationality had settled previously (Altonji and Card, 1991). In his model specification, he instrumented the actual change in stock of immigrants by the predicted change. And this prediction is independent of city and time-specific shocks. It is calculated by multiplying a base year share of immigrants in each city the total number of immigrants coming into the U.S. each year. The base year share serves as a measure of immigrant level in each city in the past. If immigrants tend to spatially cluster, this provides a good prediction of the current level of immigration in that city.

Note, however, that the construction of this IV is based on two identification assumptions. Firstly, it is assumed that immigrant inflows in base year are not driven by omitted variables that will

affect the rents in the future. Secondly, annual change in national immigration inflows is assumed to be exogenous to the economic conditions of immigrant cities. The second assumption in particular may not hold in reality. Consider the case of United States, around 68% of immigrants concentrate in 6 major states such as California, New York, and Florida. Some years of better economic conditions in these cities would certainly influence the overall change of national immigration inflows substantially.

To relax the second assumption, Saiz developed an alternative instrument which aims to estimate annual immigration inflows by country and year. Since the immigrants' countries of origin are exogenous to changes in city-specific amenities, disaggregating the annual change in stock of immigrants by their country of origin would help construct a variable that exogenously explains the actual area level change of immigrant inflow.

Following Saiz's model, Sá conducted similar work in the context of UK. The IV used in her paper is also based on the fact that immigrants tend to settle in places where earlier immigrants already settled. According to Munshi (2003), these local networks are very important for those immigrants who just arrived in the destination country because they help them find jobs more quickly and facilitate them to mingle within the local community more easily. Based on past immigrant settlement pattern, the predicted annual change in the stock of immigrants in each local authority is constructed to replace the endogenous regressor: the actual change in the immigrant inflow.

In addition to the classic country of origin network instrument, the 'gateway' IV was also used in investigating the immigration impact. In some situations, certain ethnic groups who arrive at their destination country are fairly new so may not yet establish extensive networks locally. In Gonzalez and Ort*é*ga (2013) where the authors analysed the impact of immigration on Spanish housing market, the instrument is constructed based on "accessibility of each Spanish province from the point of view of each immigrant's country of origin." According to the specific geographic characteristics of Spain, immigrants enter the country either by land, sea or air, and the most common mode of transportation varies by country of origin. For instance, immigrants from Morocco are most likely to access Spain through the provinces with ports along the Mediterranean coast. In this way, the accessibility to each province by each immigrant group can be established to construct the predicted number of immigrants in each province by summing across all groups. However, it is worth noting that for this IV to be valid, one needs to assume immigrants who enter the country through the province are highly likely to settle in that province. This is reasonable to some degree as the geographical unit used here (i.e. province) has a fairly large area size, and unless there are some specific reasons, newly arriving immigrants without any other previous local networks may not be likely to think of moving to somewhere else.

Other variations include the spatial diffusion instruments. Also developed by Saiz, the IV captures the fact that neighbourhoods that are geographically close to existing immigrant enclaves have a higher probability of becoming immigrant areas in the future. The spatial clustering nature of immigrants is widely documented in both sociology and economics literature (Borjas 1995; Mobius 2002). A gravity pull variable can then be defined to estimate the appeal of a neighbourhood to immigrants. Being closer to immigrant enclaves serves as a stronger predictor of subsequent immigrant arrivals in metro areas as immigrants can take advantage of being close to others in the same national, ethnic, linguistic, or socioeconomic group. The basic idea was to use spatial diffusion to model assignment to treatment (i.e. immigration shocks). To see the specific set up and further improvements of IV, one could find it in section II.B from Saiz and Wachter (2011).

Similar IVs used to investigate immigration impact on house prices have also been found in Degen and Fischer (2010) for Switzerland, Stillman and Mar*é* (2008) for New Zealand.

One advantage for the use of the above methodology is that it allows us to compare immigration impact on housing values across various countries. What's more, the findings in general differ depending on the level of disaggregation of geographic unit and period span of the data used.

Usually, using broader regions within a country one tends to find a positive effect between house prices and immigrant inflows. For example, in Saiz (2007), the author examined the impact of immigration inflows on housing rents at the level of Metropolitan Statistical Area (MSA). High concentration of immigrants in the U.S. is one of the main reasons to investigate its collective effect on rents and house prices. What's been found is that, an immigration inflow that amounts to 1% of the initial metropolitan area population is associated with, roughly, a 1% increase in rents and housing values. "Homeowners, [therefore], on average, do benefit from higher housing prices, pointing out a small distributive impact in the short and medium run" (Saiz, 2007, p23).

Positive effect has also been found in the Spanish housing market. Between 2000 and 2010, Gonzalez and Ort*é*ga (2013) conducted related research using similar techniques. The study focused on the immigration impact on house prices and construction activity at provincial level (50 provinces in total). It was found that during the period investigated, "immigration led to an average 1.5 % annual increase in the working-age population, and this is responsible for annual increase of house prices of about 2%, and for 1.2-1.5 % increase in housing units." The relationship appears causal as established by its statistically significant IV estimates. The reason suggested is that there is a large increase in the working age, foreign-born population in Spain which boosted housing demand. According to the National Immigrant Survey, a significant share of immigrants (40%) was homeowners in 2007. This would have direct impact on house prices. In addition, the demand for housing rentals went up which in turn stimulated the demand for investment purchases for new housing units in the buy-to-let market.

Similarly, Degen and Fischer (2010) investigated the immigration-house price relationship in Switzerland. 6 years of panel data were used to analyse the behaviour of house prices across 85 districts between 2001 and 2006. Its housing market is characterised by a low rate of homeownership and a nationwide rent control. As a result, during 2001-2006, the population-weighted average price change for single family homes grew annually by 1.5% while the immigration inflow to Switzerland was 0.3% of the local population. From these market features, one would expect demand pressures led by immigration to be weaker in an environment of low house price inflation. However, the findings suggest otherwise. An immigration inflow equal to 1% of a district's population is coincident with an increase in prices for single-family homes of about 2.7%, which is even higher than the ones found in studies from other countries. One explanation given is that Switzerland has a very tight housing market characterised by low vacancy rate and low turnover rate. The strong rental sales market may lead to an owner-occupied property market that is fairly susceptible to local shocks, for example unexpected immigration inflows. In this case, house prices can show greater fluctuations despite of its slow growth. However, this was not tested empirically.

IV strategy is also used in Stillman and Mar*é* (2008) for studying the local immigration impact on housing prices and rents in New Zealand. Unlike the U.S., New Zealand has very large and volatile migration flows which coincides with large increases in house prices during the last twenty years. A significant proportion of them include returning New Zealanders. The fact that these immigrants and returning New Zealanders have higher education and average income than the general population possibly explains why they may have a higher level of housing demand hence have a broader impact on the housing market. When dividing international migration further into two components, namely foreign-born immigrants and returning New Zealanders (kiwis) previously living abroad, there was no statistically significant relationship found between the former and local house prices, but a strong positive relationship between the latter and local house prices, with 1% increase in population resulting from higher inflows of returning Kiwis associated with a 6-9% increase in house prices. However, the results are not robust across different time periods, suggesting population growth is not the dominant determinant of house price changes throughout the time.

It was also Saiz who discovered first that at local level, immigration tends to have a slightly negative effect on house prices. In his 2011 paper, census tracts were used as the geographic unit of analysis instead of Metropolitan Statistical Area (MSA). This is used as a geographic measure of neighbourhoods. When looking at the spatial variation of housing values led by immigration at this level, it's been found that the growth of a neighbourhood's immigrant share is associated with relatively lower housing value appreciation. IV estimates did not give much different results from the OLS. It was further found that white flight is the main reason for the reduction of home values and the key driver for white flight is the preference for residing with natives from the same ethnic group and socioeconomic status.

Sá's findings on immigration impact in house prices in the UK at local authority level are also consistent with past research. In particular, an immigrant inflow equal to 1% of the local initial population leads to around 1.7% reduction in average house prices in an area. The channels through which immigration may affect local house prices are broadly consistent with what's been found in Saiz and Wachter (2011).

Overall, researchers have performed similar spatial studies in various countries and their details are summarised in Table 1:

Table 1: Summary of related IV studies across Countries

Source	Country	Geographic Disaggregation	Period of Analysis	% change in house prices led by immigration inflow equal to 1% of local population
Saiz (2007)	U.S.	Metropolitan Statistical Area (MSA level)	1983-1987 (annual data)	+1%
Gonzalez and Ortéga (2013)	Spain	Spanish Province	2000-2010 (annual data)	+2%
Degen and Fischer (2010)	Switzerland	Swiss districts	2001-2006 (annual data)	+2.7%
Stillman and Maré (2008)	New Zealand	Labour Market Areas (derived from Travel to Work areas from NZ Census)	1986-2006 (every five years, based on NZ census)	Very small effect
Akbari and Aydede (2012)	Canada	Census division	1996 -2006 (every 5 years, based on Canadian census)	Very small effect
Saiz (2011)	U.S.	Census tract	1980-2010 (every decade, based on U.S. census)	-0.2%
Sá (2014)	U.K.	Local authority	2003-2010 (annual data)	-1.7%

3.3.2 Modelling Strategy

I focus on a spatial panel approach to examine the impact of immigration on house prices. It is a dominant methodology employed to investigate the effects of immigration on various local economic outcomes (Dustmann, Frattini and Glitz, 2008). Analyses are originally focused on the labour market outcomes of the local regions; for example, Card (2001) evaluated the impact of the Mariel Boatlift on the wages and the unemployment rates of the less-skilled workers. With respect to housing, Saiz (2007) used a similar spatial approach to Card (2001) and looked at the impact of immigration on rental prices in Miami.

Ideally, if all regions are identical and immigrants are randomly allocated across regions, then one can safely accrue any house price differentials to the differences in the level of immigrants; that is, if one observes a higher level of immigrants in one area and a higher level of house prices at the same time, under the conditions set out before, one can reasonably conclude that it was the higher level of immigrant population which "caused" the house price to increase and vice versa. However, these two conditions are unlikely to be satisfied in reality. First of all, areas are not identical in terms of various economic characteristics; one can view this area level difference in two ways: one is a permanent local area fixed effect which is constant over all periods. These could be local physical geographies, the level of economic prosperity and so on. The other is less persistent which can change over time due to for example, an economic shock, since each area is not a closed entity without outside influences.

Secondly, immigrants are not randomly assigned to different areas. Their settlement choice is itself an outcome of their economic decisions. Most often, immigrants may choose to settle in places where the economic conditions are better, while these areas tend to see faster house price growths; it is also possible that, controlling for other economic conditions, immigrants would prefer residing in places where house price growth is slower. However, either way, one cannot say that it is the immigrants who lead to a house price increase or decrease, it is this unobserved common fixed influence which are at work, masking out the true effect of immigration on house prices. In the past literature, several models have been developed to solve these endogeneity problems. Under the existing panel data framework, these models are applied and, by comparing them, their relative merits and pitfalls have been discussed in detail in the results section.

Classical OLS

Since no area would be the same, a set of socioeconomic controls are included in the model to start with. This would in principle reduce the severity of the endogeneity problem but does not solve it completely, for the reason that one cannot collect all the variables which could potentially influence

local house prices. Once these controls are in place, the model assumes mean-zero homoscedastic errors, i.e. errors are uncorrelated over time within each local authority.

The model specification follows closely the one in Sá (2014):

$$\ln(P_{it}) = \beta \frac{Imm_{it}}{Pop_{it-1}} + \gamma X_{it-1} + \phi_t + \mu_{it} \qquad (1)$$

where ln (P_{it}) is the log of the house price index in local authority *i* between years *t-1* and *t*. The main independent variable is the stock of immigrants divided by the previous year population in local authority *i*. The estimate β represents the percentage change in the log house price index as the stock of immigrants rises by 1% of the initial local population.

The socio-economic controls follow Sá's model closely (Sá, 2014) and are represented in the *Xs*. These include: the local unemployment rate, to control for local macroeconomic conditions; the share of the local population claiming state benefits, the crime rate which may affect housing demand; the number of dwellings divided by local population, this is to capture the level of local housing supply and an index capturing the average quality of housing in each local authority. The controls are lagged by a year to reduce the potential endogeneity between the controls and the immigration. For example, the incoming immigrants this year may alter the current level of unemployment rate if some of these immigrants are unemployed.

The model also includes time effects (ϕ_t) to capture the national trends in inflation and other economic variables.

Pooled OLS

The specification is similar to the classical OLS model, except for the fact that it considers the over-time correlation within each local authority, i.e. the standard errors are clustered by local authorities.

Random Effects (RE)

While still assuming that the local authorities (LA) are independent for each other, the within LA over-time correlation is modelled by local authority level fixed effects (ρ_i). It is to represent the time constant local authority level characteristics. Therefore, the specification becomes:

$$\ln(P_{it}) = \beta \frac{Imm_{it}}{Pop_{it-1}} + \gamma X_{it-1} + \phi_t + \mu_{it}, where\ \mu_{it} = \rho_i + \varepsilon_{it} \qquad (2)$$

The random effects framework further assumes that the time constant part of the error (i.e. local authority fixed effects) is not correlated with any other regressors in the model:

$$E(\rho_i) = 0; E\left(\rho_i \middle| X_{it-1}, \frac{Imm_{it}}{Pop_{it-1}}\right) = 0 \qquad (3)$$

That is to say, the unobserved local authority level heterogeneity, e.g. relatively permanent economic conditions of the area are not correlated with the immigrant inflow, the unemployment rate, the benefit rate and so on. If the assumption is valid, then the resulting estimate β is unbiased. To estimate β efficiently, standard errors are adjusted by re-estimating the variance-covariance matrix.

Fixed Effects (FE)

Perhaps a more realistic case is to assume that the local authority fixed effect **is** correlated with the regressors in the model:

$$E(\rho_i) = 0; E\left(\rho_i \middle| X_{it-1}, \frac{Imm_{it}}{Pop_{it-1}}\right) \neq 0 \qquad (4)$$

Since these common fixed influences act as a confounder in our investigation of the immigration impact on house prices, the approach adopted in the fixed effects model is to de-mean[1] all variables so that local authority permanent characteristics (ρ_i) are removed from the equation. More specifically, the model is laid out as follows:

$$\ln(P_{it}) - \overline{\ln(P_{i}.)} = \beta\left(\frac{Imm_{it}}{Pop_{it-1}} - \overline{\frac{Imm_{i.}}{Pop_{i.}}}\right) + \gamma(X_{it-1} - \bar{X}_{i}.) + (\phi_t - \bar{\phi}) + (\varepsilon_{it} - \bar{\varepsilon}_{i.}) \qquad (5)$$

In this way, the time-invariant effects of each local authority are removed from the model for all periods concerned.

First Difference (FD)

The method serves the same purpose of removing the time-invariant local authority fixed effects and attempts to do so by using first differences. Essentially, I now examine the effect of an annual change in immigrant inflow on the annual change in the log of house price index. In particular,

$$\Delta \ln(P_{it}) = \beta\left(\frac{\Delta Imm_{it}}{Pop_{it-1}}\right) + \gamma X_{it-1} + \Delta\phi_t + \Delta\varepsilon_{it} \qquad (6)$$

Again, ρ_i is removed from the model. In addition, lagged controls are used, as the changes in the socioeconomic characteristics of the local authorities are endogenous to immigration. In theory, the model would produce consistent estimates if the unobserved individual heterogeneity is the only

[1] De-meaning a variable means to take the average of the variable for each local authority *i* over time and subtract it from the original variable.

reason for endogeneity to occur. But the direction of causality is still not clear-cut even if I remove the time-invariant fixed effects. This is because immigrants could be attracted to those areas where they are enjoying a current economic success. That is, the immigrant variable is correlated with ε_{it} or ε_{it-1} (the current economic shock or the past year economic shock). Since one cannot guarantee that positive shocks and negative shocks can cancel each other out exactly, estimates are likely to be inflated if there is an overall positive shock to certain regions and vice versa. In addition, it is worth noting, in Sá (2014), local authority level fixed effects are included in the first differenced model to pick up additional area level trends.

First Difference with IV

In order to mitigate endogeneity further, one solution is to use an instrumental variable (IV). Within the first differenced model framework, the idea behind using an IV is to find a variable correlated with the main independent variable of interest and at the same time uncorrelated with the error (hence omitted variables and reverse causality problems are solved). By using the variation within the instrument, one can estimate the effects of the independent variable on the dependent variable consistently subject to a number of identifying assumptions.

The main regression model used to examine the effect of immigration on house prices is still the first differenced model but with local authority fixed effects included. This is an essentially a fixed effects model with the first differenced dependent variable and the main independent variable:

$$\Delta \ln(P_{it}) = \beta \frac{\Delta Imm_{it}}{Pop_{it-1}} + \gamma X_{it-1} + \phi_t + (\rho_i) + \Delta\varepsilon_{it} \qquad (7)$$

However, instead of using the actual annual change in the stocks of immigrants, the expected change in the stock of immigrants is constructed to instrument the former. I use two ways to construct the instrument: one based on the historical settlement pattern and the other based on the proximity of the local authority to existing immigrant enclaves. The former follows the methodology in Sá (2014) closely and the latter follows that in Saiz and Wachter (2011). To see the specific setup and discussion of these two IV constructions, please refer to Section 6: Appendix A1.

3.4 Data and Descriptive Statistics

The resulted data for analysis come from a merge of several datasets. The main idea is to look at the spatial variation of immigration stock and how this correlates with the spatial variation of house prices. The unit of observation is local authority in England and Wales and after combining all the

datasets, I am left with 170 local authorities and 13 years between 2003 and 2015. Below, I describe each dataset more fully:

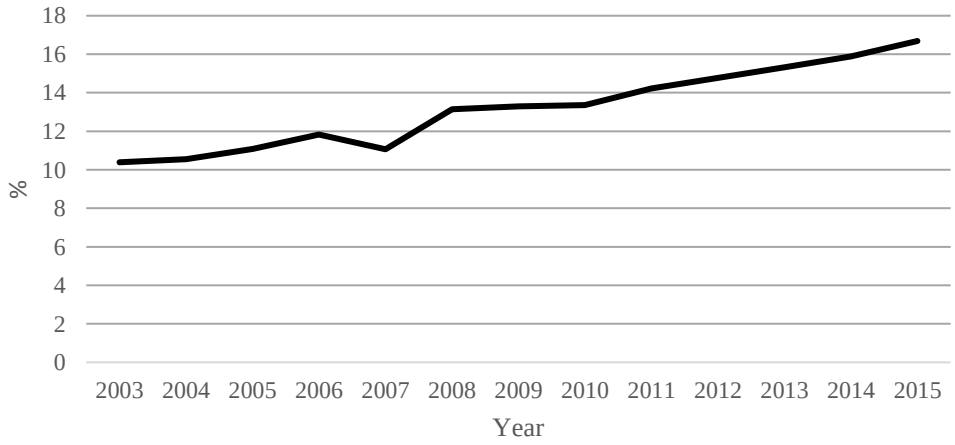
Immigrant information

The information on immigrants is gathered from the UK Quarterly Labour Force Survey (QLFS). The QLFS is a household survey which provides a unique source of information on employment, unemployment, occupation, training and other personal characteristics. Since 1992, it has been carried out as a rotating quarterly panel. Each household in the survey is interviewed for five consecutive quarters and for every quarter, 20% of the sample will be replaced by new households. The analysis looks only at yearly variation therefore all quarters of each year are pooled together. In order to examine the effect at the local authority level, an agreement is also reached with the ONS to access the special licence version of the QLFS which the data contain local authority identifiers. The data for analysis will start from the first quarter of 2003.

In addition, the classification of immigrants is based on each person's country of birth. This is possible as the QLFS has self-reported country of birth questions for each individual. Anyone who claims themselves to be born in England/Wales/Scotland/Northern Ireland/Other Parts of Britain not otherwise specified is classified as a native; otherwise he/she will be classified as an immigrant. The design of the country of birth question in QLFS is in line with the recommended output classification of ethnic groups for National Statistics data sources so that it is consistent with the one on the Census form.

Over the years, the percentage share of immigrants in England and Wales has been on the rise. It was around 10% of the total population in 2003 but has risen to just below 16% in 2015.

Fig 2. % Share of Immigrants (Foreign Borns) in England and Wales



Source: Labour Force Survey

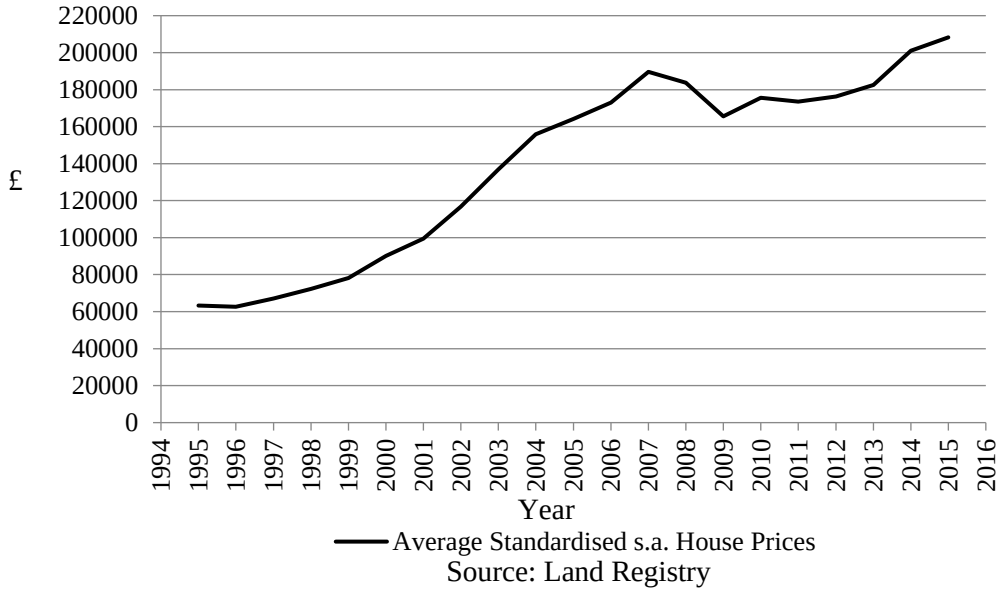
House Prices

House price data at local authority level are from the Land Registry. The data include information on all residential property sales in England and Wales that are sold for full market value since January 1995, whether with cash or with mortgage. Throughout the sample period, i.e. from 1995 to the present day, there are already over 18.5 million sales recorded. From these sales data, an index is constructed using repeated sales regression. This index is seasonally adjusted and also corrects for changes in the quality of housing. In this chapter, it runs from the first quarter of 2003 to the last quarter of 2015. Details of the construction methodology could be found in Lim and Pavlou (2007) and the paper also discusses its limitation.

Seasonally adjusted standardised (corrected for quality) average house prices can also be constructed across local authorities from the index. It's calculated by taking the geometric mean price for each area in April 2000 and using the seasonally adjusted price index to compute average prices back to 1995 and forward to the present day.

One can see from the plot below that house prices in England and Wales exhibit strong upward trends over the years. It was around £60,000 in 1995 and moved steadily up to £19,000 in 2007 until the financial crisis hit. Afterwards it was slowly recovering to its previous peak level around 2015.

Fig. 3 House Prices in England and Wales



Source: Land Registry

Overall, for the regression analysis in this chapter, the linked panel dataset (QLFS and Land Registry) covers the sample period from 2003 to 2015. It includes an extended period analysis for

Sá's work first and two extensions which are built on top of her existing work. It comes up with 170 local authorities in England and Wales after the aggregation of the Quarterly Labour Force Survey data. The sample population only covers those of working age group, i.e. 16-64.

Socioeconomic Controls

The socio-economic controls (X_{it-1}) are placed in the equation to control for neighbourhood characteristics and they are lagged by a year to avoid endogeneity (potential correlation with immigration). Details of each individual control variable are explained in each subsection.

- *Unemployment Rate*

The unemployment rate controls the local macroeconomic condition and it is derived from the Quarterly Labour Force Survey. The unemployment rate is the share of the unemployed (using the ILO definition) as a percentage of the total working age population that are economically active.

- *Benefit Rate*

The benefit rate is the share of the local population claiming state benefits. The data come from NOMIS – service run by the ONS, providing official labour market statistics. The benefit rate is derived by dividing the number of claimants receiving any type of state benefits by the resident population aged 16-64 in each local authority. The state benefits include: carers allowance, disability living allowance, incapacity benefit, income support, pension credit, job seekers allowance, severe disablement allowance and widows benefits. The variable is derived from figures in May of each year.

- *Crime Rate*

The crime rate is the total number of offences normalised by the previous year working age population; this variable is used as a control because it may affect the local housing demand. The crime data come from the Home Office and the population data come from the ONS. The figures are reported based on the financial year hence for example, year 2003 means the 12 months ending in 31st March 2003. There is no further disaggregation based on the offence type.

- *Dwelling Stock / Population*

The dwelling stock over population is used to capture the local housing supply. The data for dwelling stock in England are provided by the Department for Communities and Local Government. The dwelling stock estimates for Welsh local authorities are provided by StatsWales.

- *Index of Housing Quality*

The index ranges from 0 (indicating the lowest quality) to 9 (indicating the highest quality). It is constructed by adding up 9 indicator variables for housing quality attributes, including shortage of space, street noise, noise from neighbours, light, heating, dampness, condensation, leaky roofs as well as rot in windows/floors/doors. These variables come from the British Household Panel Survey (BHPS) which runs from 1991 to 2009. However, it does not cover the whole range of period in the analysis therefore it is dropped, although it appears in the original model of Sá (2014).

The summary statistics is laid out in Table 2:

Table 2: Descriptive Statistics

Variable	*Observations*	*Mean*	*S.D.*	*Min.*	*Max.*
$\Delta Imm_{it}/Pop_{it-1}$	2040	0.003	0.039	-0.257	0.414
Imm_{it}/Pop_{it-1}	2040	0.150	0.148	0.000	1.085
$\Delta N_{it}/Pop_{it-1}$	2040	0.681	0.298	-0.396	1.375
N_{it}/Pop_{it-1}	2040	0.829	0.162	0.251	1.456
ΔLog House Price Index	2040	-0.055	0.301	-1.957	0.338
Lagged Unemployment Rate	2040	0.067	0.029	0.000	0.216
Lagged Benefit Rate	2040	0.148	0.047	0.049	0.308
Lagged Crime Rate	2040	0.140	0.054	0.018	0.542
Lagged Share of Dwelling Stocks	2040	0.671	0.058	0.469	0.853

3.5 Results

3.5.1 The Impact of Immigration on local House Prices

Table 3 summarises the list of assumptions for each model specification and only the first differenced models with IV are expected to yield consistent estimates. Under the panel data framework, the classical OLS, the pooled OLS, the random effects, the fixed effects and the first difference models were run in turn and the results are presented in Table 4. The classical OLS does not consider the correlation over time within each local authority. It shows around a 1.30% increase in log of the house price index due to a 1% rise in the annual stocks of immigrants. The pooled OLS clusters the standard errors by local authorities while using the same specification. The estimate remains the same; however, the standard errors become larger from 0.037 to 0.098 for the immigrant variable. Residuals derived from the regression show strong correlation over time, and they are persistent: residuals show a correlation of 0.654 with residuals lagged by one year (p-value= 0.000), residuals show a correlation of 0.634 with residuals lagged by two years (p-value: 0.000). This indicates strong potential local authority level heterogeneity.

The random effects model further depresses the effect of immigrant inflows to 0.57%. That is, a 1% increase in the stocks of immigrants is positively associated with 0.57% increase in log of house price index. However, the fixed effects model reduces the estimate further: a 1% increase in the stocks of immigrants is now associated with a 0.20% increase in log of the house price index – now a much smaller effect. This may infer that the local authority level heterogeneity is likely to be positively correlated with the share of immigrants in each area. If one thinks of the economic prosperity of the area to be one of the unobservable factors, while the area being economically successful could generally see a faster house price growth, it is more likely to attract a larger number of immigrants coming in to pursue economic opportunities. This would lead to a positive bias in the OLS estimates and the random effects estimate.

The Hausman Test[2] statistics is found to be 131.18, strongly rejecting the null that the unobserved local authority fixed effect is uncorrelated with the regressors. This favours the fixed effect model rather than the random effects model.

Models B5-B8 look at changes in the annual stocks of immigrants on changes in the log house price index. For the settlement pattern IV model, the test for presence of endogeneity of the immigrant variable shows a coefficient of 1.312 (p-value: 0.015) strongly rejecting the null that the annual change in the immigrant stocks is exogenous in the model set up. The instrument predicts well the actual change in the local immigrant level. Its coefficient is 0.934 in the first stage regression which is significant at 5% critical level. In addition, the first stage regression gives an F-statistics of about 11.46 which pass the Stock-Yogo Test. With regards to the findings, the estimate of the negative effect on house prices are negligibly small and insignificant in both the OLS and IV specifications. Specifically, a 1% increase in the annual stocks of immigrants would lead to around 0.08%-0.14% reduction in local house prices; in Sá (2014), there is a house price effect of -1.7%, therefore, I conclude that the negative immigration impact on local housing values at the local authority level is not robust over an extended period.

The lagged dwelling stock over population, which is used to capture the level of housing supply in each local authority from previous year, has shown a less and less positive effect across the different models. It was originally associated with a 0.90% increase in log house price index in the OLS models, but it was associated with a 0.07% decrease in the RE model, a 0.04% decrease in the FE model, and a 0.45% increase in the FD and IV models. One can interpret the estimate as follows: a higher degree of presence of dwelling stocks in area sees a larger rise in house prices subsequently,

[2] When conducting the Hausman Test, both FD and IV models are run without clustering the standard errors at local authority level

reflecting positive price elasticity of housing supply. For both FD and IV models, positive effect of house prices has also been found for unemployment rate and benefit rate which may indicate the general level of deprivation in an area. Clearly, one can also see the positive bias in OLS estimates has been reduced when using FD and IV models. Sign change has taken place in reverse for both unemployment rate and benefit rate: after controlling for local area long-term fixed characteristics, changes in unemployment rates and benefits of the area are not main determinants of house price reductions; in fact, they lead a rise in its value. The two indicators might suggest an increased rigour in economic activity rather than increased deprivation, which lead to house prices to rise. However, potentially intermediate links are not tested in this chapter. Crime effect has disappeared using FD and IV models.

Table 3: Model Summary Assumptions and Description of their Validity

	Identification Assumptions for consistent estimation	*Comments*
Classical OLS Pooled OLS	(1) The dependent variable is a linear function of a set of independent variables and a random error component (2) The expected value of the error term is zero (3) Homoscedasticity of the errors (4) Errors are i.i.d such that there is no over-time correlation within a local authority or spatial correlation across local authorities (5) All independent variables should be uncorrelated with the error term	(1) Reasonable assumption, as house price index (HPI) is in its logarithmic form (2) Empirically, this never holds as one cannot collect all variables which potentially affect house prices (3) Not reasonable, as variance of the error term for each local authority is unlikely to be a constant (4) Not reasonable, as there will be strong time series correlation within each local authority, but for pooled OLS, I consider the time series correlation within each LA but still assume all the LAs are independent of each other (5) Not reasonable, there is endogeneity for the immigrant variable, while all other socioeconomic controls are in the form of one-year lag therefore are exogenous in the model.
Random Effects (RE)	(1) All above (2) Local authority fixed effects uncorrelated with other regressors	(1) The validity of assumptions same as that of pooled OLS (2) Not reasonable, e.g. area level economic condition can affect change in immigrant flows
Fixed Effects (FE)	(1) All above (2) Local authority fixed effects correlated with other regressors (3) $E\left(\varepsilon_{it} - \bar{\varepsilon_{i.}} \middle\| X_{it-1}, \frac{Imm_{it}}{Pop_{it-1}}\right) = 0$ (strict exogeneity)	(1) The validity of assumptions same as that of pooled OLS (2) Reasonable assumption, but ρ_i removed from de-mean process (3) Not reasonable, as temporary shocks could still affect other regressors
First Difference (FD)	(1) All above (2) Local authority fixed effects correlated with other regressors	(1) The validity of assumptions same as that of pooled OLS (2) Reasonable assumption, but ρ_i removed from first difference process

	(3) $E\left(\Delta\varepsilon_{it}\middle\vert X_{it-1}, \frac{\Delta Imm_{it}}{Pop_{it-1}}\right) = 0$ (weak exogeneity)	(3) Not reasonable, as temporary shocks could still affect other regressors
First Difference with IV (IV)	Additional assumptions include: (1) IV not correlated with the errors (2) Exclusion restriction (3) Strong correlation with the endogenous variable	(1) Reasonable, as historical settlement pattern in the base year unlikely to be with any economic shocks (2) Reasonable, although not directly testable (3) Testable using Stock-Yogo test

Models B1-B3 examine immigration impact on house prices at levels; B4 is a fixed effect model with de-meaned variables and B4-B8 examine the change in immigration stock on the change in house price, B9-B10 examine the lagged effect of immigration. Standard errors are included in parentheses. Year effects are included in all models; B5-B6 include local authority fixed effects whereas B7-B8 include government office region fixed effects. Apart from B1, B2-B6 cluster standard errors at local authority level, and B7-B8 cluster standard errors at the government office regions. Statistical significance is shown by the star symbols where * indicates *significance at 10%*, ** indicates *significance at 5%*, *** indicates *significance at 1%*; Δ indicates first difference. The definition of immigrants is based on the country of birth of the person in the Quarterly Labour Force Survey data.

Table 4: The Impact of Immigration on local House Prices 2003-2015 – Baseline Models

Dependent Var.	$\ln(P_{it})$			$\ln(\widetilde{P_{it}})$	$\Delta\ln(P_{it})$				$\Delta\ln(P_{it})$	$\ln(P_{it}) - \ln(P_{it-3})$
	(B1) Classical OLS	(B2) Pooled OLS	(B3) RE	(B4) FE	(B5) FD	(B6) Settlement Pattern IV	(B7) Proximity IV – Pull Only	(B8) Proximity IV – Pull + Interaction	(B9) Lagged Effect OLS	(B10) Lagged Effect Long Difference (IV)
Imm_{it}/Pop_{it-1}	**1.291***** (0.037)	**1.291***** (0.098)	**0.572***** (0. 054)	**0.201***** (0.065)						
$\Delta Imm_{it}/Pop_{it-1}$ (β)					**-0.076** (0.029)	**-0.137** (0.036)	**1.674** (1.322)	**1.758***** (0.423)	**0.128** **(0.126)**	
Imm_{it-1}/Pop_{it-1} (β_2)									**0.050** **(0.118)**	
$(Imm_{it} - Imm_{it-3})/Pop_{it-3}$										**0.174** **(0.205)**
Lagged Unemployment Rate	-0.975*** (0.200)	-0.975*** (0.341)	-0.583*** (0.149)	-0.603*** (0.147)	0.406* (0.234)	0.399*** (0.227)	0.492** (0.202)	0.493** (0.199)	0.374 (0.239)	0.184 (0.246)
Lagged Crime Rate	-0.383*** (0.094)	-0.383* (0.230)	0.451*** (0.125)	0.441*** (0.109)	-0.014 (0.160)	0.003 (0.156)	-0.041 (0.062)	-0.043 (0.047)	1.465*** (0.349)	5.122*** (0.391)
Lagged Benefit Rate	-1.642*** (0.111)	-1.642*** (0.236)	-2.219*** (0.186)	-2.108*** (0.340)	1.592*** (0.339)	1.570*** (0.317)	0.029 (0.096)	0.029 (0.098)	-0.018 (0.156)	-0.718*** (0.248)
Lagged Dwelling Stock/Population	0.898*** (0.086)	0.898*** (0.195)	0.073 (0.136)	-0.036 (0.182)	0.467* (0.110)	0.448* (0.244)	0.191*** (0.071)	0.194*** (0.054)	0.670** (0.328)	-0.457 (0.382)
Joint Significance Test ($\beta_1 + \beta_2 = 0$)									0.06	
Observations	2040	2040	2040	2040	2040	2040	1870	1870	2039	1699
R^2	0.805	0.805	-	0.881	0.870	0.869	0.823	0.819	0.870	0.875

Notes. To examine the lagged effect of immigration on house prices, the equation is further modified to include lagged term for the main independent variable by 1 year which results in: $\Delta\ln(P_{it}) = \beta\frac{\Delta Imm_{it}}{Pop_{it-1}} + \beta_2\frac{Imm_{it-1}}{Pop_{it-1}} + \gamma X_{it-1} + \phi_t + (\rho_i) + \Delta\varepsilon_{it}$; I also used long differences looking at three-year differences: $\Delta_3\ln(P_{it}) = \beta\frac{\Delta_3 Imm_{it}}{Pop_{it-1}} + \gamma X_{it-3} + \phi_t + (\rho_i) + \Delta\varepsilon_{it-3}$.

Table 5. First Stage Results for Selected Baseline IV Models

First Stage Results for:	(B6)	(B7)	(B8)
First Stage Coefficient:			
Settlement Pattern IV	0.934***		
	(0.100)		
"Proximity" IV		-0.0005	0.001**
		(0.0006)	(0.001)
"Proximity" IV + Interaction			-0.004***
			(0.002)
First Stage F-Statistics	11.46	3.70	4.02

Models B7-B8 use the spatial diffusion ("proximity") instrument to predict the future immigrant net inflows into a local authority and examine the effect of immigration on house prices. For model B7, the effect is positive but insignificant and for model B8, the effect is statistically significantly positive. The results are in contrast with that found in model B6 predicted by the settlement pattern instrument. It shows a statistically insignificant negative effect. Turning to the first stage results, the proximity IV model B8 fails the Stock Yogo test even though the first stage coefficients are statistically significant and have expected signs. This deems the instrument invalid therefore the corresponding models are not credible. One reason for this to happen could be due to that the spatial diffusion model does not fit well at local authority level. The idea behind the construction of the instrument is that immigrants tend to reside close to each other geographically therefore immigrant densities in surrounding neighbourhoods would serve as a good prediction of future inflows of immigrant streams of the current neighborhood. However, unlike that initially developed in Saiz and Wachter (2011), the size of a local authority is typically much larger than a neighborhood or community in which spatial diffusion process works better such that the immigration level in nearby local authorities cannot be used to predict that of the local authority under investigation. That is, spatial diffusion may not take place at local authority level; one could alternatively look at smaller spatial scale for example at the census ward level that perhaps better capture the concept of a local neighborhood. Due to a weak first stage for the spatial diffusion model, I give more credits to the results of the settlement pattern model in this chapter.

One concern about a non-house price response towards immigration is that the housing market might need to take time to adjust to the changes brought by immigrant inflows. Therefore, while a contemporaneous effect might not be found but immigration flows a few years back might have a substantial effect on the local house prices. I follow Sá (2014) again by examining the lagged effects; model B9 includes the lagged immigration variable by 1 year: the change in immigrant stocks between year *t-2* and *t-1* as a percentage of total population in t-2 and model B10 uses long differences looking at changes of variables between year t and t-3. The corresponding instrument and socioeconomic controls are reconstructed to accommodate this long period effect. However, from both models, statistically significantly negative effect on house prices were not found.

2. Please see Appendix A1. for detailed setup.

3.5.2 The Impact of Immigration on Native Displacement

The specification used to examine native displacement led by immigration is as follows:

$$\frac{\Delta N_{it}}{Pop_{it-1}} = \alpha + \beta \frac{\Delta Imm_{it}}{Pop_{it-1}} + \gamma N_{it-1} + \phi_t + \rho_i + \varepsilon_{it}, \qquad j = 1, \dots, 9 \qquad (8)$$

The model is in line with Sá (2014) and Card (2007). The dependent variable is the annual change in the number of native workers as a share of initial local population in local authority *i* and in year *t*. The main independent variable is the annual change in the immigrant level as a share of initial local population in local authority *i* in year *t*. Time dummies and local authority dummies are included to control for time trends and regional time-invariant characteristics. I also included the lagged native population as an additional control.

However, this specification also suffers from the same endogeneity problem, i.e. variables uncontrolled for in the error term could affect both immigrants' and natives' locational choices. The bias is predicted to be positive as factors that attract immigrants into an area would also attract natives, and similarly, factors that repel immigrants would in general also repel natives. The solution for solving this problem again is to use the IV based on the settlement pattern of each country of origin group in 2001.

Following Sá (2014) to study the native population response to inflows of immigrants, I also look at the in-migration and out-migration rates. The LFS provides data not just on the current local authority (LA) in which each individual resides, but also on the place of residence they lived a year ago. This information would help us compute the in-migration rate, the out-migration rate and the net out-migration rate of native people. A native is defined to be migrated out of local authority *i* if he lived in local authority *i* in year *t-1* and lives in a different local authority in year *t*; hence the out-migration rate in each is calculated as the total number of natives who moved out of local authority *i* between years *t-1* and *t* divided by the native population of local authority *i* in year *t-1*. On the other hand, a native is defined to be migrated in to local authority *i* if he lives there currently but was in a different local authority in year *t-1*. The in-migration rate is therefore obtained by dividing the total number of natives who moved in to local authority *i* between years *t-1* and *t* by the native population of local authority *i* in year *t-1*. Lastly, the net out-migration is the difference between the out-migration rate and the in-migration rate.

The specification is similar to that of the native population change; it is laid out as follows:

$$y_{it} = \beta \frac{\Delta Imm_{it}}{Pop_{it}} + \gamma N_{it-1} + \phi_t + \rho_i + \varepsilon_{it} \qquad (9)$$

y_{it} is the out-migration rate, the in-migration rate or the net-out migration rate. The coefficient β has an interpretation of an annual change in the mobility rates led by an increase in the stock of immigrants equal to 1% of the initial local population. To account for the endogeneity problem, the same IV is used based on the historical settlement pattern of immigrants in 2001.

From Table 6, the IV estimates are overall not so much different from the FD estimates. Specifically, as an additional 10 immigrants move into a local authority; around 3.4 native residents are displaced, but the result is significant. Looking into the in- and out-migration rates, an increase in the immigrant stocks equal to 1% of the initial local population would lead to 0.11% increase in native out-migration rate and a 0.05% increase in native in-migration rate. The overall impact of immigration on native net out-migration rate is therefore significantly positive but very small, around 0.05%. Therefore, I conclude that there is weak evidence on native displacement for the period concerned.

Table 6: Immigrant Inflows and Native Population Movements 2003-2015

	Independent Variable: $\Delta Imm_{it}/Pop_{it-1}$	
	(M1) FD	(M2) IV
$\Delta N_{it}/Pop_{it-1}$	-0.092	-0.335*
	(0.161)	(0.178)
R^2	0.877	0.874
Native Out-Migration Rate	0.092***	0.105***
	(0.014)	(0.014)
R^2	0.693	0.690
Native In-Migration Rate	0.057***	0.052***
	(0.014)	(0.013)
R^2	0.605	0.605
Native Net-Out Migration Rate	0.035**	0.053***
	(0.017)	(0.019)
R^2	0.365	0.359
Observations	2040	2040
First Stage Coefficient		0.714***
		(0.108)
First Stage F-Statistics		114.13

Standard errors in parentheses * *significant at 10%*, ** *significant at 5%*, *** *significant at 1%*; Δ indicates first difference. Both local authority and year fixed effects are included in the models. Robust standard errors are clustered at local authority level. Δ indicates first difference. The model for native population change used data from all quarters of each year, with all duplicate cases removed within each same year. On the other hand, the models for migration rates used only data of quarter 2 in each year as individuals' prior LA of residence is only available for that quarter.

3.5.3 Immigration impact on local wage distribution

As immigrants move into an area, their interaction with the locals would lead to a significant degree of out-mobility responses for natives. What would be the implication on the local income distribution due to the change in the population composition? The section examines this question over the analysis period between 2003 and 2015.

The methodology utilised to examine shifting income distribution is broadly similar to the one used in Sá (2014). I divide the wage distribution of the total population in each year into four quartiles.

Following Sá (2014), several fractions are defined:

$\pi_{iqt}, q = 1,2,3,4$; is the fraction of all residents (natives and immigrant) in local authority *i* that have wages in each quartile of the wage distribution in year *t*.

$p_{qt}^{UK}, q = 1,2,3,4$; is the fraction of all natives in the UK that have wages in each quartile of the wage distribution in year *t*. Since most of the population is of British descent, the fraction should be close to a quarter.

$p_{iqt}, q = 1,2,3,4$; is the fraction of native residents in local authority *i* that have wages in each quartile of the wage distribution in year *t*

$q_{qt}^{UK}, q = 1,2,3,4$; is the fraction of immigrant residents in the UK as a whole that have wages in each quartile of the wage distribution in year *t*.

$q_{iqt}, q = 1,2,3,4$; is the fraction of immigrant residents in local authority *i* that have wages in each quartile of the wage distribution in year *t*.

The following identity equation is used to explain the source of impacts on the excess fraction of population in each wage group:

$$\pi_{iqt} - p_{qt}^{UK} = f_{it}\left(q_{qt}^{UK} - p_{qt}^{UK}\right) + f_{it}\left(q_{iqt} - q_{qt}^{UK}\right) + (1 - f_{it})\left(p_{iqt} - p_{qt}^{UK}\right) \qquad (10)$$

Denote f_{it} to be the share of immigrants in the population of local authority *i* in year *t*. In addition, the dependent variable measures the excess fraction in each wage group, since if there is no immigration and sorting as a result of immigration, the local authority level fraction of residents in each wage group (π_{iqt}) should be close to the national level fraction (p_{qt}^{UK}). The term is further decomposed into three terms. The first is the composition effect: if at national level, the overall fraction of immigrants in wage group *q* (q_{qt}^{UK}) is higher than the overall fraction of natives in the same wage group (p_{qt}^{UK}), this could pull up the regional level of fraction of immigrants (π_{iqt}) so that it deviates more positively from the counterfactual scenario where only natives are present in the whole population in the wage group (p_{qt}^{UK}). The reverse story is similar. The second term reflects the local selectivity of immigrant population. If local authority *i* has more immigrants in wage group *q* than the national average, the fraction of total population in region wage group *q* in local authority *i* would also be higher. Similarly, the third term captures the local selectivity of natives.

In order to examine how immigrant inflows would affect the local income distribution, each of the three decomposed term is regressed on f_{it} and a set of local authority and year fixed effects. This is done separately to each wage group.

Table 7: Immigration and Wage Distribution of the Local Population

	Excess fraction in wage group (W1)	Composition Effect (W2)	Selectivity of immigrants (W3)	Selectivity of natives (W4)
Quartile 1	0.195***	0.064***	0.035*	0.096***
	(0.033)	(0.005)	(0.021)	(0.031)
Observations	2210	2210	2210	2210
R^2	0.776	0.771	0.584	0.743
Quartile 2	0.009	-0.011***	-0.018*	0.038
	(0.030)	(0.001)	(0.011)	(0.029)
Observations	2210	2210	2210	2210
R^2	0.619	0.816	0.353	0.568
Quartile 3	-0.113***	-0.043***	0.001	-0.071**
	(0.029)	(0.002)	(0.012)	(0.028)
Observations	2210	2210	2210	2210
R^2	0.312	0.832	0.233	0.287
Quartile 4	-0.091***	-0.010***	-0.018	-0.063*
	(0.033)	(0.003)	(0.020)	(0.037)
Observations	2210	2210	2210	2210
R^2	0.888	0.531	0.723	0.863

Coefficients reported are from regressions of the variable indicated in the column heading for each quartile of the wage distribution on the share of immigrants in the local population. Robust standard errors clustered by local authority in parentheses. Regressions include year and local authority fixed effects. Standard errors in parentheses * *significant at 10%,* ** *significant at 5%,* *** *significant at 1%.*

The argument put forward in Sá (2014) is that, "if immigrants have lower income than natives, an increase in the immigrant population and a reduction in native population would depress income in the local area and should lead to a reduction in demand for housing and house prices" (Sá, 2014, p21). The result in Table 7 is consistent with that presented in her work over the extended period of analysis. Specifically, a 10% increase in the local fraction of immigrants is associated with a 2% increase in the fraction of the population in wage quartile 1 (the lowest wage group), of which 0.6% is attributable to the composition effect, 0.4% is attributable to the fact that immigrants tend to have smaller wages in high immigration cities and 1% is attributable to the fact that natives tend to have smaller wages in high immigration cities. For high wage quartiles (3&4), the effects are opposite. I tend to see the fraction of high wage population to decrease in high immigration cities. In particular, a 10% increase in the fraction of immigrants is negatively associated with a 1% decrease in the excess fraction of population in high wage quartile 3&4. This mainly attributes to a decrease in the fraction of high wage natives about 0.6%-0.7% in high immigration cities. This provides evidence of the tendency for natives at the top of the income distribution to move out of the area as a result of residential sorting.

3.6 Extensions

3.6.1 Impact of Immigration on Local House Prices disaggregated by Region of Origins

The results are further extended to look at the impact of inflow from each individual region group on local house prices. The classification of these groups is also based on each person's country of birth. Specifically, 8 groups are identified including: the A8 Accession countries from which citizens are allowed to enter the UK and to participate the UK labour market freely since 2004; the remainder of European countries, Antarctica and Oceania, India, the Indian Subcontinent and Middle Eastern countries, the remainder of Asia, Africa, and Americas and Caribbean. The motivation of looking at housing impacts of population across country of origin groups arises from the concern that due to different cultural and socioeconomic backgrounds, certain groups may have substantially collective influence in some areas and their interaction with the locals are likely to be different as well.

Table 8: Cross Sectional Profile for Various Region Groups in 2015

	% Population in Managerial Position	% Population in Routine Position	Unemployment Rate (%)
Native Overall	35.9	38.8	5.1
Immigrant Overall	30.2	46.2	4.9
Antarctica and Oceania	61.3	19.0	8.6
Europe			
EU15	44.5	33.6	5.2
A8 Accession Countries	13.5	58.2	4.0
Rest of Europe	28.0	43.3	6.7
Asia			
India	36.1	43.6	5.4
Indian Sub-Continent and other Middle East	18.4	57.6	7.8
Rest of Asia	28.5	46.9	5.9
Americas and Caribbean			
North America	43.7	35.1	6.7
Rest of America	40.7	41.0	5.9
Africa	32.8	45.5	8.6

Source: Quarterly Labour Force Survey

Table 8 displays the socioeconomic profile for each region group in 2015. In particular, countries from the region of Antarctica and Oceania have the highest share in managerial positions and the lowest share in routine positions. For the European countries, the highest share within the managerial professions comes from the EU15 member countries prior 2001, the lowest comes from the A8 and the rest of Europe is on par with the immigrant average. A8 has the highest percentage in routine jobs. For Asian countries, India has the highest share in both managerial and routine

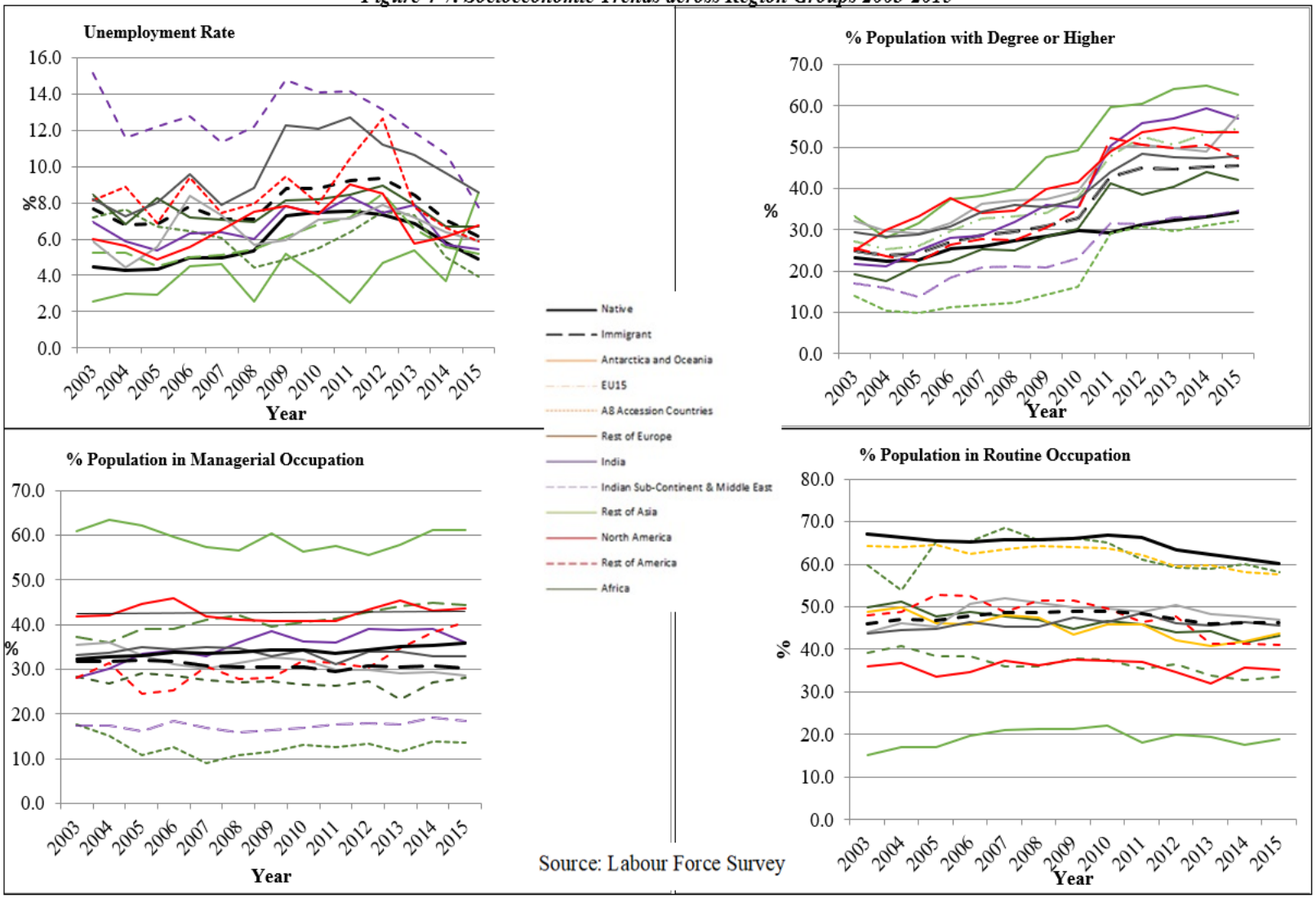
occupations whereas countries from Indian Sub-Continent and Other Middle East have the lowest share in managerial positions. While there is not much of a divide between north and south part of the American continent, North America has a slightly higher share in managerial professions when compared to the rest of America. Africa is broadly on par with the immigrant average apart from its almost 4%-point higher unemployment rate. Also, countries from Indian Sub-Continent and Other Middle East have the second highest level of unemployment rate.

Figures 4-7 give some trends of each country group's socioeconomic characteristics between 2003 and 2015. For the unemployment rate, the Indian Sub-continent and the Middle Eastern countries, as well as the African population over the period has had higher level of unemployment rate above the immigrant average, and the former has had the highest rate when compared to other country groups, despite its decreasing trend since 2011. On the other hand, population from the region of Antarctica and Oceania had the lowest level of unemployment rate throughout the period. One can see that unemployment rate is more cyclical, with distinct ups and downs throughout the period of analysis for all groups.

With regards to the share of first degrees obtained by each country group, the overall picture appears optimistic as all groups show an upward trend in the percentage population holding a degree or higher over time. Interestingly, the immigrants tend to have higher share of population with at least a degree and this gap has been widened since 2010. While people coming from the remainder of Europe tend to have an above the immigrant average higher education rate, but those from the A8 accession countries tend to have a much lower share. Overall, the Asians, the Americans and the Indians follow similar trends around the immigrant average but countries from the Indian Sub-Continent and the Middle East has a below average share.

For socioeconomic status of each country group, the trends are more stable over the years. The immigrant population in managerial positions was lower than the native population but the difference is not large. The opposite took place for the routine positions. While the Antarctica and Oceania region had the highest share of managerial professionals, Region breakdowns depict a similar story to that of the cross-section.

Figure 4-7. Socioeconomic Trends across Region Groups 2003-2015



For the house prices, previous estimation strategy is used in which I include both FD and IV specifications. The instrumental variable is still based on the historical settlement pattern of each country of origin group.

The results of country of origin house price model (C1) to (C10) are presented in Table 8. I look at the first stage results first; it seems that the settlement pattern IV specification works less well when immigrants are disaggregated by different country groups. The IV is constructed based on the residential clustering of ethnic groups, but due to low cell counts after country of origin disaggregation, one cannot tell whether it is because the past settlement pattern does not predict well the settlement of new immigrant arrivals for some ethnic groups or the limitation of the data. However, for those that have a valid first stage, the correlation between the Indian group and the IV is 0.579, 1.147 for Indian Sub-continent and Middle East, 1.221 for the group of rest of Asia, 1.006 for the A8 group, 0.634 for the rest of American group and 0.936 for the African groups. The F-statistics are below 10 for all ethnic groups which suggest that interpretation needs to be taken with caution.

Examining the house price effects of different region groups from Table 9, over the period of analysis, household or individuals from Indian, Indian Sub-Continent and Middle East and A8 Accession countries tend to contribute positively to local house prices: an increase in Indian immigrant stocks equal to 1% of previous year population leads to 4.9% increase in house prices while an increase in South Asian and Middle Eastern immigrant stocks is associated with 8.5% increase in house prices. For A8 immigrants, this is 4.3%. Three regions show significant negative effects: immigrants from the Rest of Asia (including the Far East and South East Asian) reduce house prices by about 2.8%, while migrants from Central and South America decrease house prices by 40.6% and migrants from Africa by about 1.0%. EU15 immigrants show negative contribution although the first stage results deem the IV specification invalid. No statistical evidence is found for the rest of the region groups. However, one should interpret the IV results with caution since no evidence is found from OLS estimations.

Overall, there is no evidence on native out-mobility response towards any of the region of origin groups separately, from both the OLS and IV specifications tabulated in Table 10. Therefore, drops in house prices led by the Far East and South East Asians, Central and South Americans and Caribbeans, as well as African immigrants cannot be explained by the native out-migration process. The positive estimates obtained from the OLS model merely reflects the upward bias, however, there is no statistically significant evidence that indicates any specific country of origin group would drive out indigenous households. While the rise in local house prices driven by some groups can be explained through a rise in housing demand, one needs to seek alternative explanations for house price decreases for those country groups.

The section originally aimed to discover phenomenon of residential sorting or segregation down to each region of origin group level, potentially reflected in local house price changes. This is because, apart from labour market displacement, groups from different region of origins tend to practise different traditions which is also an important factor for segregation. When interacting with native households, those groups which are culturally more similar might induce lower rate of native flight while those which are culturally less similar or geographically more distant to the UK might induce a higher rate of native flight, while other factors are kept constant. From the results, while different country of origin groups tends to influence house prices differently, but it is considered not through the interaction with the native households in a neighbourhood, as was typically found in the U.S. literature. However, caution needs to be taken again when interpreting these results: the population cell counts for each local authority is small when disaggregated by ethnicity, the first stage F-statistics is low with some not passing the Stock-Yogo test. It is worth seeking alternative datasets or using other methodologies to contribute more robust evidence towards these findings.

Perhaps, future research could be directed to look at the unique interaction among different country of origin groups (or ethnicities) where the interaction could result in a larger collective effect over certain economic outcomes. The importance of individual country of origin level of research should be emphasised since the immigrant population is not a homogenous group of foreigners, but also, they carry their cultures, customs as well as their skills to the UK. The section only serves as a starting point to motivate this type of quantitative research.

Table 9: Impact of Immigration on local House Prices disaggregated by Region of Origin, 2003-2015

Dep Var: $\Delta\ln(HP_{it})$	Oceania	Asia			Europe			America and Caribbean		Africa
	(C1)	(C2) India	(C3) Indian Sub-Continent and Other Middle East	(C4) Rest of Asia	(C5) EU15	(C6) A8	(C7) Rest of Europe	(C8) North America	(C9) Rest of America	(C10)
OLS	0.775	-0.273	0.380*	0.281	0.257	-0.062	0.334	0.299	-0.265	-0.193
	(0.722)	(0.308)	(0.197)	(0.406)	(0.557)	(0.324)	(0.451)	(0.792)	(0.574)	(0.297)
Observations	2040	2040	2040	2040	2040	2040	2040	2040	2040	2040
R^2	0.870	0.870	0.870	0.870	0.870	0.870	0.870	0.870	0.870	0.870
IV	73.199	4.866**	8.482***	-2.755***	-14.292**	4.328***	-26.026	80.873	-40.576***	-0.938***
	(218.652)	(2.211)	(2.525)	(1.052)	(6.505)	(1.283)	(20.530)	(57.982)	(14.600)	(0.268)
Observations	2040	2040	2040	2040	2040	2040	2040	2040	2040	2040
R^2	-	0.842	0.734	0.859	0.541	0.846	0.253	-	-	0.868
First Stage Results:										
Coefficient	0.189	0.579**	1.147***	1.221***	0.766	1.006***	0.307	0.402	0.634***	0.936***
	(0.590)	(0.239)	(0.348)	(0.522)	(0.540)	(0.260)	(0.189)	(0.559)	(0.335)	0.196
F-Statistics	0.20	0.43	0.39	0.27	0.05	0.82	0.43	0.29	0.31	0.62

The base year share used in the disaggregation by country groups is calculated from the Labour Force Survey data in 2002 where the country of birth variable is more finely categorised than the 2001 Census data. Standard errors in parentheses * *significant at 10%*, ** *significant at 5%*, *** *significant at 1%*; Δ indicates first difference. Socioeconomic controls, local authority and year fixed effects are all included in the models. Robust standard errors are clustered at local authority level. Δ indicates first difference.

Table 10: Native Mobility Response towards Different Region Groups 2003-2015

Dep Var:	Oceania	Asia			Europe			America and Caribbean		Africa
	(D1)	(D) India	(D3) Indian Sub-Continent and other Middle East	(D4) Rest of Asia	(D5) EU15	(C6) A8	(C7) Rest of Europe	(C8) North America	(C9) Rest of America	(C10)
OLS	1.261***	0.908***	0.988***	1.155***	1.136***	0.951***	1.208***	0.904	0.756***	1.034***
	(0.439)	(0.178)	(0.124)	(0.205)	(0.185)	(0.196)	(0.240)	(0.732)	(0.237)	(0.124)
Observations	2040	2040	2040	2040	2040	2040	2040	2040	2040	2040
R^2	0.919	0.919	0.920	0.920	0.920	0.919	0.920	0.918	0.919	0.921
IV	-7.238	5.088***	1.417**	4.725**	2.494	5.205***	3.153	12.489	0.748	2.067***
	(18.550)	(1.481)	(0.602)	(1.861)	(1.567)	(2.006)	(2.059)	(17.152)	(1.907)	(0.651)
Observations	2040	2040	2040	2040	2040	2040	2040	2040	2040	2040
R^2	0.898	0.900	0.920	0.905	0.917	0.896	0.916	0.888	0.919	0.918
First Stage Results:										
Coefficient	0.193	0.571**	1.132***	1.229**	0.762***	1.029***	0.328*	0.394	0.622*	0.912***
	(0.588)	(0.238)	(0.348)	(0.523)	(0.535)	(0.261)	(0.189)	(0.560)	(0.335)	(0.193)
F-Statistics	0.19	0.42	0.39	0.26	0.32	0.95	0.44	0.27	0.29	0.61

The base year share used in the disaggregation by country groups is calculated from the Labour Force Survey data in 2002 where the country of birth variable is more finely categorised than the 2001 Census data. Standard errors in parentheses * significant at 10%, ** significant at 5%, *** significant at 1%; Δ indicates first difference. Both local authority and year fixed effects are included in the models as well as the lagged share of native population. Robust standard errors are clustered at local authority level. Δ indicates first difference.

3.6.2 House Price Impact of Immigration under Different Labour Market Structures

The section explores the house price effect of immigration under different types of labour market structures, particularly with respect to employment density and average socioeconomic profile of workers. Previous analysis has investigated the effect of immigration without looking at the interaction of native and immigrant households within different types of space. Immigrant effect on house prices may vary if labour market factors are controlled for the areas which ultimately affect the selection of native and immigrant individuals in the area.

Using these two characteristics, four sub-region types are defined: the high density and high skill, the high density and low skill, the low density and high skill and the low density and low skill. Distinguishing areas along these lines may help us observe natives and immigrants selected with distinct set of preferences and behaviours which could potentially lead to alternative interaction – which is in addition to residential sorting or native flight. For areas with high employment density but jobs mainly in high skillsets, I provide some evidence such that immigrants may cause tenure transitions from owner-occupied dwellings to private renting and social renting stocks. An increase in the rate of free renting is likely to reduce the household's overall ability and desire to participate in housing transactions but also reduces the landlord's incentives to maintain the quality of housing stocks. The extra increase in units from the existing dwellings is likely to push the supply further outwards. Both these mechanisms could depress house prices locally.

Why is local labour market structure of areas important in examining the immigration impact on local house prices? Traditional argument has often indicated a native out-migration phenomenon which is responsible for a local house price reduction (Saiz and Wachter, 2011; Sá, 2014). Both theories and empirical studies show that house price depreciation is considered a premium that natives are willing to pay for segregation. However, the kind of native-immigrant interaction through residential housing market might not be saliently observed when areas are divided into different types of local labour markets. The chapter attempts to explore how the effect would vary over different local labour markets. Specifically, the level of employment density and average socioeconomic profile of the working age population are chosen to characterise the areas into different types of local labour markets. I consider these structures to be relatively fixed when compared to population movements including both native and immigrant population movements. I assume that individuals would self-select into the areas according to their own distinct set of preferences, motives and behaviours which would eventually lead to differing patterns of interaction; in turn, the influence on local house prices would be different. I am interested in testing these empirical relationships.

3.6.2.1 Mechanisms

Beyond the mainstream channel through which house prices are affected by immigration, what role would area level job density and socioeconomic profile of the workers play in the immigration-house price link? To examine house price effect under various economic structures, the areas are classified using the skill distribution (socioeconomic profiles) of workers and the employment density of the areas. In this case, I would have four subgroups, i.e. areas with high employment density and high skill professions, areas with high employment density but low skill professions, areas with low employment density but high skill professions, and lastly areas with low employment density and low skill professions. I investigate the house price impact of immigration in each of these subgroups and analyse why the effect would be different from each other.

Three channels are sought to potentially explain the differentials in the house price effect of immigration. The first one is on native out-migration response as having been commonly documented in the literature, the second one is about pressure on native wage and the last is on a kind of tenure "transition".

Pressure on native wage has been outlined in studies including Sá (2014) and Dustmann et al. (2013) in detail. Specifically, if immigrants reduce income of native people, the overall purchasing power of housing would be reduced therefore leading to a fall in demand in housing. House prices therefore drop.

Perhaps, what's more interesting is the area level change in the form of tenure which could potentially explain housing value depreciation. Areas with high job density and high skilled workers tend to observe a higher rate of private renting and free renting (The Migration Observatory Briefing, 2017), but a lower rate of owner occupation as the purpose of stay is more likely to be short-term and employment-focused rather than long-term and residence-focused. There are a number of reasons why immigrants "favour" privately rented and socially rented housing stocks. First of all, privately rented stocks allow more flexibility in accommodation sharing with co-ethnic ties for new arrivals. Secondly, privately rented stocks allow greater mobility as it's contract based, directly accommodating a much more varied socioeconomic goals typically found among immigrant households. Thirdly, immigrants have less familiarity of transactions related housing activities and more limited financial resources upon arrival; residing in these tenure forms are much more straightforward and help on cost savings.

Overall, if immigrants lead to an increase in the rate of inflows of private renters, free-renters and social housing dwellers, they are likely to depreciate house prices through:

1. for free renting immigrant households, directly reducing the members' overall level of ability and desire to participate in transactions related housing market activities such as mortgage finance and buy-to-let schemes, directly inhibiting rises in housing demand;

2. reducing landlords' incentives to maintain and invest in the physical fabric of the housing stocks, gardens, and property exteriors, leading to a structural decline in housing quality and also adversely affecting the physical appearance of the neighbourhood. These drive down housing demand in the local area;

3. increased housing stocks offered on the market. House prices decrease as a result of an increase in supply.

However, tenure transitions increase the supply of stocks offered on the market and provide units with a wider range of prices. These activities are likely to solve the housing needs of new arrivals of different socioeconomic backgrounds and create the flexibility of the local housing market to accommodate the mobile population (Shelter, 2012). It also helps indigenous households to be more exposed to or interact more with newly arrived migrant households, fostering trust among subgroups (Schmid et al., 2014).

In this chapter, I use data to provide some empirical evidence on residential sorting, wage competition and tenure "downgrade", in order to explain the differing impact of immigration on local house prices in different types of local labour market structures.

3.6.2.2 Methodology

To examine the role played by area level employment density and skill characteristic in how immigrants affect local house prices and other housing market variables, the local authorities in England and Wales are divided into categories according to these characteristics. Specifically, the level of job density is used to capture employment density and also an index is derived to characterise the average socioeconomic ranking for each area. A base year in 2001 is chosen to mitigate the endogeneity problem as it is outside the study period between year 2003 and year 2015; therefore, these variables are treated as relatively fixed over time compared to other factors inside the model (Appendix A3). The two measures in algebraic form are:

$$A: = \left(\frac{J}{Pop}\right)_{i,2001} \quad (11)$$

The base year job density A is calculated using the number of jobs (J) divided by the local authority population (Pop) in 2001.

$$B \coloneqq \sum_{i=1}^{8} \frac{S_i}{i} \qquad (12)$$

The skill index B is derived from the socioeconomic variable from NOMIS – Official Labour Market Statistics in 2001. The variable has 8 categories and it includes: higher managerial and professional, lower managerial and professional, intermediate occupations, small employers and own account workers, lower supervisory and technical, semi-routine occupations, routine occupations and never worked and unemployed. The variable is ordinal with the "higher managerial and professional" being the highest level of socioeconomic status and the "never worked and unemployed" category being the lowest level of socioeconomic status. Therefore, the skill index is weighted average of the percentage population at each skill level; each level is weighted by its rank, such that the highest socioeconomic status is given the most weight while the lowest socioeconomic status is given the least weight. The index represents the average skill level for the area. In fact, it is also an indication of the average size of the businesses since not all companies would cover the full socioeconomic rank, in other words, many local trades would not have managerial positions.

Overall, I divide the local authorities into four categories including high job density and low skill, high job density and high skill, low job density and high skill and lastly low job density and low skill areas. In each of these subgroups, I examine the immigration impact on local house prices and other housing market variables.

To model house price impact of immigration, a spatial panel approach is used again (Dustmann, Frattini and Glitz, 2008) and it involves first differenced two stages least squares (2SLS) specification with a settlement pattern instrumental variable (Card, 2001; Saiz, 2007) to exogenously predict the immigration inflows into an area.

$$\Delta \ln(P_{iqt}) = \beta \frac{\Delta Imm_{iqt}}{Pop_{iqt-1}} + \gamma X_{iqt-1} + \phi_t + (\rho_i) + \Delta \varepsilon_{iqt} \qquad (13)$$

3.6.2.3 Results

Among the four categories, i.e. after controlling for the factors of employment density and socioeconomic profile of the population, only the areas with high employment density and high skill professions see a house price reduction. From Table 11, an increase in the stocks of immigrants had led to a 0.29% decrease in local house prices from the IV specification; the corresponding OLS estimate is slightly larger – around 0.35%, but not statistically significant. There could be several

potential explanations behind the house price decrease in this type of areas. I offer three and provide empirical evidence on them.

Table 11. Local House Price Effects Stratified by Employment Density and Socioeconomic Status

	Low Job Density, High Skill		*High Job Density, High Skill*	
	OLS	IV	OLS	IV
Change in Share of Immigration	-0.101	-0.036	0.345	**-0.291*****
	(0.187)	(0.179)	(0.224)	**(0.099)**
Observations	516	516	504	504
R^2	0.870	0.870	0.918	0.913
	Low Job Density, Low Skill		*High Job Density, Low Skill*	
	OLS	IV	OLS	IV
Change in Share of Immigration	0.004	0.872	0.066**	0.008
	(0.198)	(0.836)	(0.082)	(0.331)
Observations	516	516	503	503
R^2	0.923	0.879	0.878	0.877

Notes. IV is the instrumental variable based on the historical settlement pattern of different country of origin groups. Both models cluster standard errors at local authority level and they are included in the parentheses. The local authorities are grouped into four categories using two characteristics – employment density n captured by the number of jobs over population and a skill index derived from the socioeconomic characteristic of the area. Statistical significance is represented by star symbols where * indicates $p < 0.1$, ** indicates $p < 0.05$, *** indicates $p < 0.01$. The first stage coefficients for the immigration variable from top left to bottom right are 0.939**(20.46), 0.826*** (68.32), 0.333 (1.79), 1.398*** (15.24) – First Stage F-statistics are displayed in brackets.

(1) Native Out-Migration Response to Immigration

When stratifying the areas by employment density and socioeconomic status of workers there, residential mobility response of natives is found in high job density and high skill areas: a 1% increase in the stock of immigrants has led to a 1.4% decrease in the native population. However, for this type of area, there is no statistically significant evidence for house price changes. Therefore, the native flight process is ruled out to as one of the explanations for region-specific house price effect of immigration.

Table 12. Subgroup Immigration Impact on Native Out-Mobility 2003-2015

Dependent Variable: Change in Share of Native Population				
	Low Job Density, High Skill		*High Job Density, High Skill*	
	OLS	IV	OLS	IV
Change in Immigration Share	-0.003	-0.003	0.259	0.037
	(0.212)	(0.202)	(0.281)	(0.330)
Observations	473	473	462	462
R^2	0.890	0.890	0.910	0.905
	Low Job Density, Low Skill		*High Job Density, Low Skill*	
	OLS	IV	OLS	IV
Change in Immigration Share	-0.259	0.076	-0.344	**-1.405****
	(0.342)	(0.383)	(0.453)	**(0.575)**
Observations	473	473	462	462
R^2	0.826	0.825	0.843	0.826

Notes. IV is the instrumental variable based on the historical settlement pattern of different country of origin groups. Both models cluster standard errors at local authority level and they are included in the parentheses. The local authorities are grouped into four categories using two characteristics – employment density captured by the number of jobs over population and a skill index derived from the socioeconomic characteristic of the area. Statistical significance is represented by star symbols where * indicates $p < 0.1$, ** indicates $p < 0.05$, *** indicates $p < 0.01$. The first stage coefficients from top left to bottom right are: 0.743*** (75.28), 0.808* (5.05), 1.527*** (28.77) and 0.886** (46.65). The models are run without the set of socioeconomic controls.

(2) Pressure on Native Wage

Robust evidence on the native wage argument in the context of England and Wales could be found in Dustmann et al. (2013). It is shown that natives at the lower end of the wage distribution often face competition against incoming migrant workers and these workers depress the wage of the local people by providing an extra supply to the existing labour force. Lower wage means lower overall income in an area therefore leads to lower demand for housing. House prices reduce through an income effect.

When searching for potential pressure on native wage in any of the density-skill subgroups, no robust evidence is found and it does not seem to help explain the house price reduction in high job density and high skill areas either.

Table 13. Subgroup Immigration Impact on Local Native Wage, 2003-2015

Dep. Var.: Change in log Median Native Wage				
	Low Job Density, High Skill		*High Job Density, High Skill*	
	OLS	IV	OLS	IV
Change in Share of Immigration	0.003	0.082	0.290	0.588
	(0.073)	(0.335)	(0.264)	(0.596)
Observations	516	516	504	504
R^2	0.047	0.046	0.078	0.061
	Low Job Density, Low Skill		*High Job Density, Low Skill*	
	OLS	IV	OLS	IV
Change in Share of Immigration	0.252	0.191	-0.174	-0.288
	(0.234)	(1.821)	(0.106)	(0.409)
Observations	516	516	504	504
R^2	0.051	0.049	0.062	0.061

Notes. IV is the instrumental variable based on the historical settlement pattern of different country of origin groups. Both models cluster standard errors at local authority level and they are included in the parentheses. The local authorities are grouped into four categories using two characteristics – employment density captured by the number of jobs over population and a skill index derived from the socioeconomic characteristic of the area. Statistical significance is represented by star symbols where * indicates $p < 0.1$, ** indicates $p < 0.05$, *** indicates $p < 0.01$. The first stage coefficients from top left to bottom right are: 0.920^{***} (8.01), 0.821^{***} (0.110), 0.326 (1.26) and 1.395^{***} (15.04). The models are run without the set of socioeconomic controls.

However, one may not rule out completely a negative impact on the total income explanation. It is possible that the wage of existing immigrants is lowered by new immigrants. Since those who are at the charge of relatively abundant capital would divide up the existing job units and let the immigrants share the job but receiving a lower wage; the newly arrived migrant workers become a strain upon joining the local businesses because employers may find it difficult to grow enough jobs to accommodate them; the overall income could still decrease due to lower immigrant income, generating weaker demand for housing. The small counts of wage data on immigrants from the Labour Force Survey however make it difficult to test this hypothesis: either on the impact of existing migrants' income or dividing the job units into smaller pieces to accommodate more workers.

(3) Tenure "Transition"

A more robust piece of evidence comes from the tenure "transition". When examining the impact of immigration on the percentage change in different forms of tenure, the results are tabulated as follows.

Table 14. Impact of Immigration on Local Growth of Different Forms of Tenure, 2003-2015

	Low Job Density, High Skill		*High Job Density, High Skill*	
	OLS	IV	OLS	IV
Owner-Occupied Tenure	0.728***	**0.140**	**0.609*** **	**-0.672**
	(0.109)	(0.382)	(0.108)	(0.422)
R^2	0.254	0.178	0.191	.
Rent Tenure	0.965***	0.676	0.975	**0.612*** **
	(0.088)	(0.329)	(0.116)	(0.191)
R^2	0.387	0.357	0.403	0.361
Rent Free Tenure*	0.029**	-0.019	0.032	**0.138*** **
	(0.013)	(0.041)	(0.014)	(0.062)
R^2	0.075	0.019	0.071	.
Observations	516	516	504	504
	Low Job Density, Low Skill		*High Job Density, Low Skill*	
	OLS	IV	OLS	IV
Owner-Occupied Tenure	0.895***	-0.455	0.712***	**0.922*** **
	(0.172)	(1.516)	(0.132)	(0.287)
R^2	0.911	0.016	0.155	0.151
Rent Tenure	0.681***	-0.966	1.014***	**0.965*** **
	(0.120)	(3.273)	(0.115)	(0.283)
R^2	0.110	.	0.220	0.219
Rent Free Tenure*	0.006	0.047	-0.020*	**-0.104** **
	(0.032)	(0.121)	(0.012)	(0.042)
R^2	0.036	0.028	0.039	.
Observations	516	516	503	503

Notes. IV is the instrumental variable based on the historical settlement pattern of different country of origin groups. Both models cluster standard errors at local authority level and they are included in the parentheses. The local authorities are grouped into four categories using two characteristics – employment density captured by the number of jobs over population and a skill index derived from the socioeconomic characteristic of the area. Statistical significance is represented by star symbols where * indicates $p < 0.1$, ** indicates $p < 0.05$, *** indicates $p < 0.01$. The first stage coefficients from top left to bottom right are: 0.940*** (22.19), 0.823***(69.42), 0.325 (74.79) and 1.399*** (16.16). The models are run with the set of socioeconomic controls. *Rent free tenure also includes squatting.

Specifically, an increase in the level of immigration does not affect the level of owner-occupied tenure in any of the four areas. However, regardless of the skill level, the high job density areas see private renting rise with around 0.6% increase in high skill areas and 0.9% increase in low skill areas. The differentiating feature lies in the form of rent free tenure. In high skill and high-density areas, a 1% increase in the stocks of immigrants led to around 0.14% rise in the form of rent free tenure, and in the low skill areas, the effect is the opposite, a 0.1% decrease in the free renting tenure is led by a 1% increase in the share of the immigrant stocks. Increased rate of free renting could be a potential cause for housing value depreciation in the high job density and high skill areas. Additionally, I have used the original period 2003-2010 to conduct the same analysis in which I have found negative house price effects of immigration and rises in the rate of free renting in high density-low skill areas. This could potentially suggest that job density is more of the labour market feature rather than the skills distribution of workers in the area that permits alternative avenue through which immigrants affect local housing values (Zhu, Pryce and Brown, 2018) .

3.7 Conclusion

In conclusion, building on the work of Sá (2014) and Braakmann (2016), the period of analysis has been extended from 2003-2010 to 2003-2015. Results differ substantially with a statistically insignificant house price effect and a weak native displacement effect, indicating the analysis is not robust over an extended period. Although, it was found that immigrant inflows on average shift the income towards the lower end of the distribution, the evidence on their influences on local house prices through shifts in local housing demands is not robust over the alternative period. The chapter continued to use historical settlement pattern instrumental variable to solve a range of endogeneity issues such as the omitted variable bias and reverse causality.

When disaggregating the immigrant group into their regions of origin, the results are mixed. There is a positive effect from country groups from the Indian, Indian-Subcontinent and Middle Eastern and A8 countries. Slower house price appreciation tends to be seen from areas with higher level of migrants from Far East and South East Asians, Central and South America and Africa. However, one should treat these results with caution: due to their low numbers for each group after disaggregation, the IV specifications have most of the first stage F-statistics failing to pass the Stock-Yogo test, and not all region groups have their IVs to predict successfully the actual level of new immigrant settlement, e.g. Oceania and North America. Avenues for future research include using alternative datasets with bigger samples and applying quasi-experimental approaches to help validate the causal processes should be explored.

When disaggregating the areas by different labour market types, along the lines of job density and average socioeconomic status of the workers, only high job density and high skill areas have found immigration led house price reduction for the period concerned. The increase in the rate of free renting and accommodation sharing is attributed to be a statistically significant cause for this housing value depreciation.

Some sections in Chapter 3 are extracted to form the journal article "Immigration and house prices under various labour market structures in England and Wales" published in Urban Studies Journal in 06/2018. It has been co-authored with Prof. Gwilym Pryce and Prof. Sarah Brown.

Appendix

Appendix A1: Instrumental Variables Construction

A1.1 IV based on Historical Settlement Patterns

The IV is formulated based on the past settlement pattern of different immigrant groups in each local authority. It is the dominant methodology in the economic literature on immigration impacts; notable works include Card (2001) and Saiz (2007). Bartel (1989) has argued that immigrants in the U.S. tend to settle in areas where immigrant settlement is already strong. Immigrant networks are an important determinant of locational choices of new immigrants as they facilitate job search process and assimilation into a new culture (Munshi, 2003).

In particular, the IV is defined as:

$$\frac{\sum_c \lambda_{cit_0} \Delta Imm_{it}}{Pop_{it-1}} \qquad (14)$$

where λ_{cit_0} is the share of individuals born in foreign region *c* who settle in local authority *i* in base year t_0; this provides a relative size of the network in each local authority from each ethnic group *c* with respect to the country as a whole. ΔFB_{it} is the change in the stock of immigrants from ethnic group *c* in the UK as a whole in year *t*. Therefore, $\lambda_{cit_0} \Delta Imm_{it}$ is the *predicted* change in the stock of immigrants from ethnic group *c* in year *t* that choose to live in local authority *i*. Summing across all ethnic groups would yield a measure of the expected change in the total stock of immigrants in local authority *i* in year *t*. Specifically, 9 foreign regions are considered: Americas and Caribbean, Africa, India, Republic of Ireland, Other Middle East and Indian Sub-Continent, Asia, Antarctica and Oceania, Europe and other countries.

As mentioned before, for the instrument to be valid, it should satisfy several identifying assumptions. First of all, the instrument should be uncorrelated with the error term in the model. After first differencing, the error term only includes the time effect (ϕ_t) and the random error (ε_{it}). The base year share, which captures the historical settlement pattern of immigrants, should be uncorrelated the current economic performance of each individual geographic area as well as the current level in national economic trends. This is a reasonable assumption provided that the base year chosen is sufficiently "historical" as some shocks can be fairly persistent. Similarly, the annual change in the national stocks of immigrants should be exogenous to these two terms too, this is also a reasonable assumption as the total number of immigrants legally allowed in the UK is subject to strict level of immigration controls, despite the fact that there is a tendency for immigrants to come to the UK if the UK economic conditions become better. Secondly, the predicted change in the immigrant share should not have a direct effect on house price changes. It can only affect the dependent variable

through the actual change in the stocks of immigrants (i.e. exclusion restriction). Although this is not directly testable, it is regarded as a sensible assumption as the base year is set to be 2001, which is 2 years before the start period of the analysis - 2003; therefore it is unlikely to influence current house price change from 2003 onwards.

A1.2 IV based on Proximity to Existing Immigrant Neighbourhoods

The instrument is based on the notion that areas which are close to existing immigrant enclaves would also see a high-level immigration. For the specific construction, I follow Saiz and Wachter (2011) by formulating a geographical gravity pull measure $pull_{it}$ for each local authority *i* in each year *t*:

$$pull_{it} = \sum_{\substack{j \neq i \\ j \in G}} \frac{\frac{Imm_{jt-1}}{Pop_{jt-2}} * Area_j}{d_{ij}^{\beta}} \qquad (15)$$

Within the expression, G stands for the broad government office region where several local authorities are located in it. $\frac{\Delta Imm_{jt-1}}{Pop_{jt-2}}$ is the lagged annual stock of immigrants as a share of initial population two years back for those local authority j_s in the same government office region as local authority i. $Area_j$ is the land area of the corresponding local authority j and d_{ij} is the Euclidean distance between local authority *i* and *j*. Therefore, the measure of gravity is a weighted average of lagged immigrant density in neighbouring local authorities, where the weights are directly proportional to the area of the neighbouring local authorities and inversely proportional to their distance from the local authority of interest. β is the distance decay parameter which I will derive from the data. This IV, in hope could partially predict the patterns of new immigrant settlement in UK local authorities. In addition, the focus in this IV approach is on the immigrant impact on local house prices within a government office region (GOR), I assume the GORs are independent of each other but possess correlation within themselves, i.e. the error accounts for both within unit overtime correlation and spatial correlation among local authorities. Therefore standard errors are clustered at GOR level, and fixed effects are also controlled at the GOR level.

Again, any instrumental variable needs to satisfy several identification assumptions. First of all, the IV should not be correlated with the error term (ε_{it}); this, in principle, should be valid as whether being close to immigrant enclaves or not do not tend to be correlated with uncontrolled local authority characteristics and temporary economic shocks, noting that the amenity levels are differenced out. Secondly, there should be a strong first stage between the instrument and the yearly

change of the immigrant share, i.e. spatial diffusion does occur for immigrants. This could be tested using the Stock-Yogo Test later from the data.

Lastly, the exclusion restriction must hold such that the gravity pull measure should only affect house prices through the actual change in the immigrant flow; it should not have either a direct effect or an effect through other variables. One issue raised in Saiz and Wachter (2011) is that characteristics of previous immigrants can be spatially correlated, and they could also be some of the drives behind native attitude; in this case, provided that the GOR fixed effects and the socioeconomic controls do not manage to capture these omitted characteristics, it can be perceived that the IV can be correlated with the errors, violating the validity of exclusion restriction.

For this reason, a solution is proposed to solve this problem and it is based on the idea that the impact of the proximity to immigrant enclaves is heterogeneous. By using the heterogeneity in the predictive power of the gravity pull measure, new exclusion restrictions could be generated. The first one is to exploit the difference among local authorities with different levels of immigration already there. Intuitively, the gravity pull measure should be a worse predictor for future immigration in local authorities that are already heavily immigrant. Why? If a large share of the population in a local authority is already composed of immigrants, then proximity to other immigrant areas will not likely be predictive of increases in the share of immigration. The interaction between the gravity pull measure and the lagged immigrant density $\frac{Imm_{it-1}}{Pop_{it-2}}$ could be used to capture this heterogeneous effect.

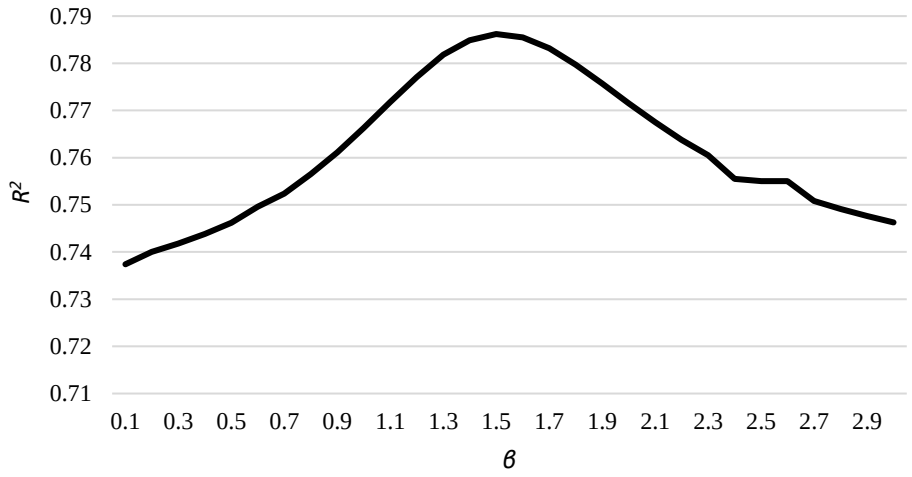
Looking for the optimal distance decay parameter β

Following Saiz and Wachter (2011), I search the optimal β by identifying the value which maximises the R^2 of the following model:

$$\frac{Imm_{i,2008,}}{Pop_{i,2007}} = \rho_G + \gamma * pull_{i,2008,G} + \varepsilon_{i,2008,G} \qquad (16)$$

Including the GOR level fixed effects ρ_G, the model is trying to predict the share of immigrants in 2007 in each local authority i using the immigrant gravity pull measure. The $R^2$is a measure of fit for this model which is then used as a rule to determine the "best" parameter value for β.

Fig. A1. R^2 for Immigrant Model

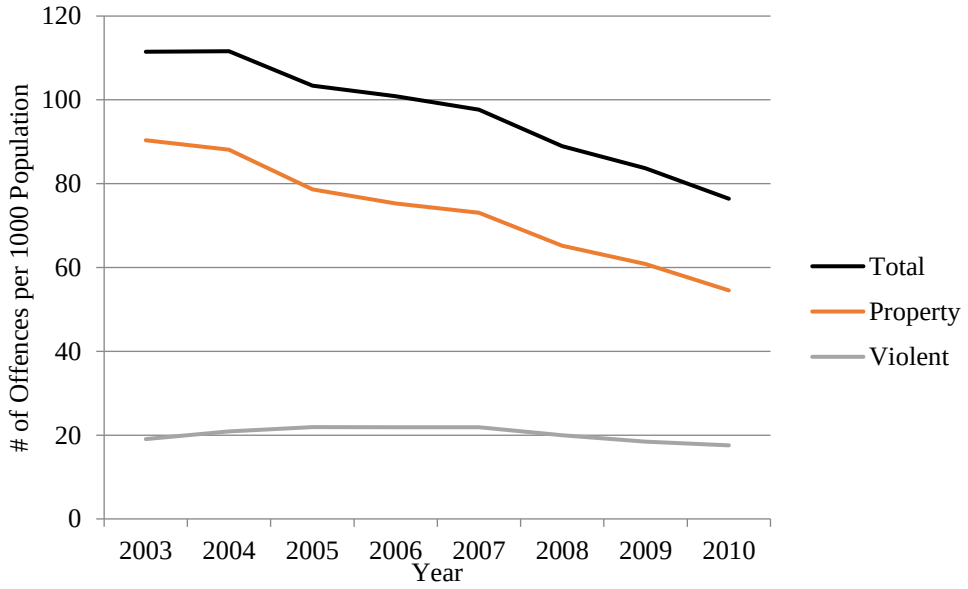


Although the difference among each R^2 value is very small ranging from 0.75 to 0.82, but as one can see from the diagram, it still exhibits some concave shape. The predictive power of the model is maximised when β is 1.5 and this is the value going to be used.

Appendix A2: The Impact of Immigration on Crime

Although in major media channels and opinion polls, the populist views remain that immigration increases crime, hardly any empirical evidence has been found in the past literature. Recent spatial studies including Jaitman and Machin (2013) and Bell et al. (2013) did not find any statistically significant relationships between immigration and the crime rate. Specifically, Bell looked at two waves of immigrants: the asylum seekers in the late 1990s and the A8 migrants from 2004. He found that only the former group has contributed to the rise of property crime but there is no evidence of either group contributing to violent crimes. This section aims to add additional evidence on the same topic.

Fig. A2 Number of Offences Recorded in England and Wales



Source: Police Recorded Crime Data at CSP/LA level by ONS

The general crime trends for the 170 local authorities in England and Wales are plotted in Fig. 9. During the period of analysis, the total number offence recorded has dropped from 111 cases per 1000 population to 76 cases per 1000 population. Among which, the number of property crime cases has dropped from 90 (per 1000 population) to 55 (per 1000 population), while there is hardly any change over time for the number of violent crime cases.

In order to further examine the immigration-crime link, I gathered data from several sources; for the immigration information, I continued to use the special license version of the QLFS, while the crime data come from the police recorded crime at CSP/LA level provided by the ONS. Offences are broken down into different types, from which I classify them into two main categories: violent crime

and property crime. The former includes homicide, possession of weapons offences, public order offences, sexual offences, violence with injury and violence without injury. The latter covers shoplifting, theft from the person, vehicle offences, robbery, non-domestic burglary, fraud, bicycle theft, criminal damage and arson, domestic burglary and all other theft offences. I regress each crime rate change (total, violent and property) on the change in the share of immigrant stocks and the set of socio-economic controls according to the model below:

$$\frac{\Delta Crime_{iqt}}{Pop_{it-1}} = \alpha + \beta \frac{\Delta Imm_{it}}{Pop_{it-1}} + \gamma \Delta Z_{it} + (\rho_i) + \phi_t + \varepsilon_{it}$$

$$where\ q = \{Total, Violent, Property\} \quad (17)$$

The model is broadly similar to that of the house prices, with controls including the change in the proportion of individuals claiming benefits and the percentage change in male population in each local authority. When including fixed effects for area-specific trends, it was decided to use the Police Force Area (PFA) fixed effects instead of Local Authority fixed effects, since major decisions on policing, staffing and so on are decided at the PFA level. Inclusion of these fixed effects could help capture the effects of these decisions over time on the crime trends.

As before, the immigrant variable should not be treated as exogenous. The direction of the resulting bias depends much on the immigrants' economic and settlement decisions. On one hand, if immigrants in general would wish to locate in areas experiencing low crime growth, then there would be a negative bias on the coefficient of interest. It is worth noting that immigrants do not necessarily need to actively seek the low crime places to live, they may be simply attracted to areas where there are perceived better job prospects, and if these areas also at the same time tend to have low inequality level, then they are less likely to have high levels of crime. A bias in the opposite direction is also likely as immigrants may choose in places where there are high levels of crime. Areas with high levels of crime are often associated with falling house prices and perceived better job prospects but high level of inequality, e.g. mega cities like London and New York are ready examples in hand. If immigrants were actually attracted by these features, then they would move there regardless of their concerns about crime or not.

The solution applied is again the use of the settlement pattern instrument to explain the exogenous part of the variation of the change in the immigrant stocks. The model is in its first-differenced form to eliminate area-specific trends at local authority level.

In Table 11, the results are displayed for all three types of crime rate: the change in total crime rate, the property crime rate and the violent crime rate. The OLS estimates for the total and property crime rates are positive and statistically significant. The statistical significance has faded when using the IV strategy. This suggests the omitted variables e.g. the economic characteristics of the area, tends to bias the estimate upwards for the first crime rates. For the violent crime rate, both OLS and IV show a very small and statistically insignificant effect. In addition, from the first stage results, one can see that area level benefit rate does not seem to associate with area level immigration level very much; however, it is highly significantly associated with the change in percentage male population which fits the general impression that immigration does add young male labour to the economy. Overall, the findings are consistent with both Jaitman and Machin (2013) that there is no apparent link between immigration and crime, and Bell et al. (2013). As I do not look at specific waves of immigrants such as asylum seekers vs. A8 migrants, there is no significant effect found on property crime as there is in his paper.

Table A1: Immigration and Crime

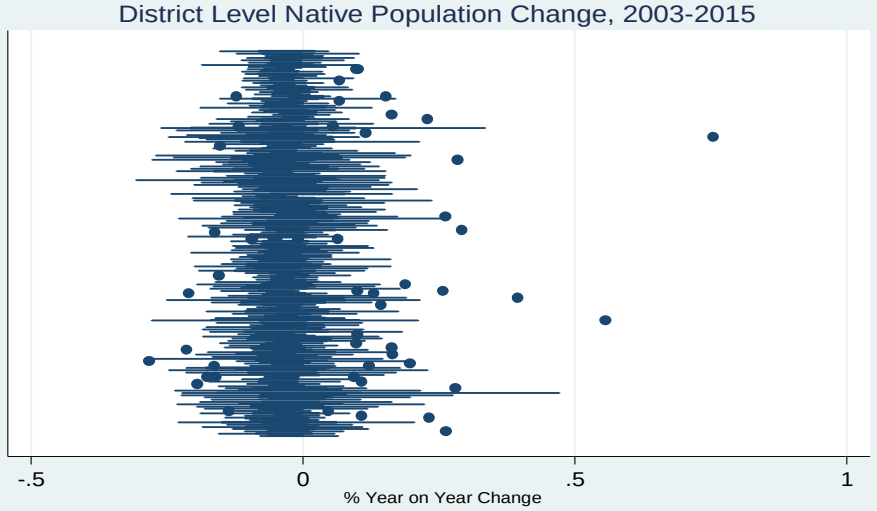
Second Stage Results Dependent Variable:	$\Delta(Total\_Crime_{it})/Pop_{it-1}$		$\Delta(Property\_Crime_{it})/Pop_{it-1}$		$\Delta(Violent\_Crime_{it})/Pop_{it-1}$	
	OLS	IV	OLS	IV	OLS	IV
$\Delta Imm_{it}/Pop_{it-1}$	0.015**	0.013	0.011**	-0.017	-0.000	0.010
	(0.007)	(0.019)	(0.005)	(0.016)	(0.002)	(0.007)
$\Delta(Benefit_{it})/Pop_{it-1}$	0.005	0.005	0.082	0.084	-0.047*	-0.048*
	(0.065)	(0.064)	(0.064)	(0.062)	(0.026)	(0.025)
$\Delta(Malepop_{it})/Pop_{it-1}$	-0.018**	-0.017	-0.013**	-0.000	-0.002	-0.006
	(0.007)	(0.011)	(0.005)	(0.010)	(0.003)	(0.004)
Police Force Area Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
First Stage Results Dependent Variable: $\Delta Imm_{it}/Pop_{it-1}$						
Predicted Change in Immigrant Stocks		0.679***		0.679***		0.679***
		(0.073)		(0.073)		(0.073)
$\Delta(Benefit_{it})/Pop_{it-1}$		0.338		0.338		0.338
		(0.358)		(0.358)		(0.358)
$\Delta(Malepop_{it})/Pop_{it-1}$		0.419***		0.419***		0.419***
		(0.064)		(0.064)		(0.064)
F-Statistics		21.44		21.44		21.44
Observations	1190	1190	1190	1190	1190	1190
R^2	0.220	0.220	0.241	0.223	0.259	0.248

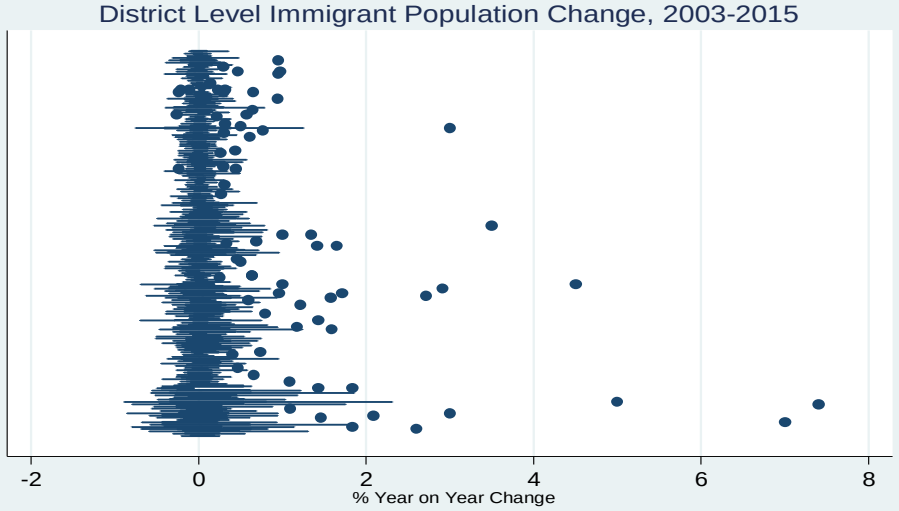
Standard errors are included in parentheses. * *Significant at 10%,* ** *significant at 5%,* *** *significant at 1%*; Δ indicates first difference. Year dummies and Police Force Area fixed effects are included in all models. Standard errors are clustered at local authority level.

Appendix A3: Relative Stability of District Level Labour Market Structure

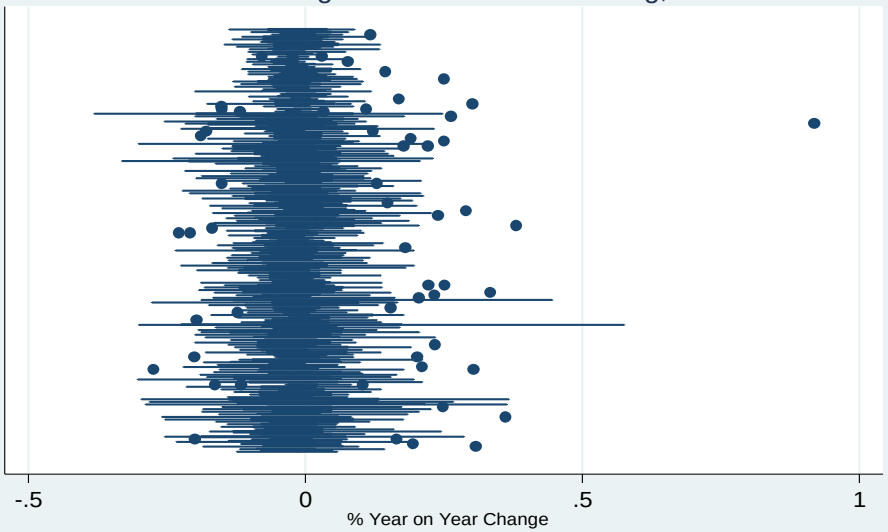
To illustrate the relative stability of the area level labour market structure when compared to sub-group population movements, distributions of the percentage change of each component are plotted using boxplots. the 171 boxplots are stacked up to represent the 171 local authorities in England and Wales. For example, each line represents the distribution of each local authority. The top 2 figures show the features of population movements for all districts, i.e. distributions of the year percentage changes in native and immigrant population. The bottom 2 figures show the labour market structure of each local authority: % change in average socioeconomic ranking and number of jobs in each local authority district. One can see from Fig. A3, population movements have always exhibited a wider range than local labour market indicators. The percentage of growth of immigrants in a local area shows the widest range: from -100% to 200% over the period 2003-2015, demonstrating their high degree of mobility. The range of district level native population movement is also wide, ranging from -25% to 50%. Both are wider than local job growth. In particular, district level job growth rate has mostly been between -10% and 10% over the analysis period. However, the average socioeconomic profile of the area does seem to have similar growth ranges to those of the native population, but this component is less comparable than the other three as the variable is derived by aggregating the socioeconomic profile of population to form an area level index. One sure thing to take away from the evidence is that the number of local jobs varies in a smaller magnitude than native population movements, and a much smaller magnitude than immigrant population movements. The data source for population movements and area level socioeconomic index comes from the Quarterly Labour Force Survey while the data source for number of jobs comes from NOMIS on aggregated data.

Fig. A3 Relative Stability of District Level Labour Market Structures

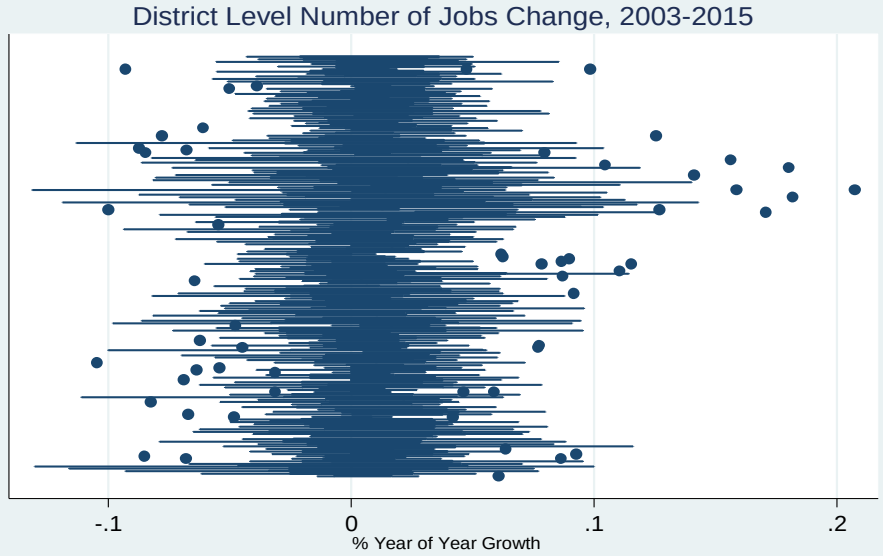




Boxplot Distributions for 171 Local Authorities in England and Wales



Boxplot Distributions for 171 Local Authorities in England and Wales



Boxplot Distributions for 171 Local Authorities in England and Wales

Chapter 4

Impact of Immigration on Local Housing Market in England and Wales – A Spatial Study Using Neighbourhood Spatial Units

4.1 Introduction

The immigration impact on the local dynamics of the housing market (in particular house prices) has been studied in a number of empirical papers (Saiz, 2003, 2007; Saiz and Wachter, 2011; Sá, 2014; Braakmann, 2016). The argument behind the relationship often involves a native out-mobility response to immigration. At the aggregate level, one would expect that immigration increases the overall population hence contribute to the housing demand and push up house prices. However, at the local level, residential sorting and segregation could lead to a reduction in house prices (Card, 2001; Saiz and Wachter, 2011; Sá, 2014). The argument is as follows: both native and indigenous households prefer residing close to those who share similar ethnic and socioeconomic backgrounds; therefore, natives especially at the top of the income distribution may move out in response to an inflow of newly arriving immigrants into the neighbourhood. This could potentially lead to a reduction in the area level income and housing value depreciation as a result of reduced housing demand.

In the previous chapter I looked at these issues at local authority level (LA). However, since many moves are local, and also residents are likely to be much more sensitive to migrant inflows into their immediate locale, it is possible that the analysis at LA level overlooks much of the house price response to immigration which takes place at neighbourhood level. This chapter not only attempts to estimate empirically the effect of immigration on several key housing market variables at a much smaller spatial scale, but also seeks robust evidence on native out-migration response to immigration. Additionally, immigration impact on overcrowding and on local house prices across different housing types and tenures were examined.

In the UK, the topic of immigration has long been in the public debate and their effects on the lives of existing local population have been examined in a wide range of literature. This could partially be prompted by an increasing share of the immigrant population over the recent years, potentially making an increasing impact on the economic and social aspects of the indigenous population; additionally, migrant workers are not randomly scattered across areas or are assigned to locations only based on their skill sets. The unique cultures and practices have brought them to reside close to those who share similar ethnic or country of origin backgrounds. It could be said that the immigrant population in the UK (or anywhere in the world) possesses a certain degree of spatial

persistence (Munshi 2003; Saiz 2007; Meen, Gibb, Leishman and Nygaard 2016). The evolution of their residential practices, education progress, occupational and socioeconomic advancement as well as acculturation process would be different from the local households and also be different among the immigrant subgroups such as different ethnic groups. Therefore, their collective influence on the economies would potentially be substantial and vary from time to time, and from subgroup to subgroup. Together with their differing circumstances, the arrival of migrant workers or immigrants would generate different kind of interactions with the existing population and impact on a variety of dimensions including but not limited to the labour market, the housing market, transport, school quality and other local amenities. In the last decade, empirical studies of the immigration impact on the housing market have risen across the international literature (Saiz, 2007; Akbari & Aydede, 2012; Gonzalez & Ortega, 2013), partly brought by the establishment of the state-of-art econometric methods that allow one to draw causal inferences and also by the importance of housing market in its own right. The housing sector generates significant employment and trade through construction (Akbari and Aydede, 2012) and transactions-related industries (estate agency, surveying, conveyancing, and mortgage finance), thus it is considered to take up a large weight in the overall economy. By directly participating in the housing market, the arrival of UK immigrants could influence the housing market in various ways through contributing labour to the construction sector, adding to the overall housing demand and the level of housing transactions through both consumption and investment and they could also influence the supply of housing stocks. Therefore, the impact of immigration on housing demand and supply is potentially an important component of the overall economic contribution of the immigrant population. Different countries tackle the question of immigrant impact from different angles. Stillman and Mar*é (2008) has examined the economy of New Zealand:* fluctuations in the inflow of migrants have raised concerns about increased volatility of demand for residential housing, and through an econometric model, the effect was empirically measured. Some U.S. literature tended to focus on the degree of residential segregation, housing value growth and occupational densities that immigrants would bring, concerning about its substantial collective influence in certain regions as well as in particular housing submarkets (Munshi 2003, Saiz 2007). Therefore, one can see that immigrants could have different interactions with the local population, space and local economies, depending on the specific country scenarios. In the UK, some research has done to examine housing space change and rearrangement to accommodate immigrant settlement (Braakmann, 2016), native displacement and local housing value growth (Sá, 2014). The chapter would continue this strand of research and attempts to explore further this issue.

However, most of these empirical studies in the UK that use a spatial variation approach have mainly focused on the local authority level (Sá, 2014; Braakmann, 2016) and so are susceptible to the same criticism noted above regarding Chapter 3. To address this shortfall, one needs to understand the immigration impact at a neighbourhood level. This chapter uses a smaller spatial unit, i.e. lower layer

super output area (LSOA) to achieve this. I use LSOAs as a proxy for a neighbourhood, though one should be aware that the definition of neighbourhoods is itself a topic of considerable debate. The goal in the current Chapter is to capture a more localised interaction between natives and immigrants through their residential decisions. The area unit is therefore a pragmatic choice selected primarily as a way of capturing these local effects.

There are four further omissions of Chapter 3 which I seek to address in the current Chapter (1) I revisited the immigration impact on native displacement at multiple neighbourhood spatial scales and examined the distance moved by displaced natives in order to gain more intricate insights into segregation and residential sorting; (2) I also looked at the effect of immigrant inflows on the housing supply and discovered that to what degree housing construction responds towards immigrant settlement. This aspect of work is not investigated in Chapter 3 but is potentially important as it attempts to identify different stakeholders in the housing market and their way to interact and respond to newly arrived immigrants; (3) thirdly, past literature had found evidence that immigrants increase occupational densities in the destination countries, however these studies had traditionally focused more on the country as a whole, and rarely examined regional overcrowding outcomes generated by immigrants. This gap is addressed in this chapter looking at immigrant impact on overcrowding for the country as a whole as well as across different regions; (4) the past literature has focused on house price impact of immigration on its own, by price quantiles as well as by different periods and country locations, but given the specific tenure structure of the UK, immigrants settle disproportionately in one rather than another; therefore, their effects on prices of different dwelling types should also be different. These housing submarket price effects are investigated which again were overlooked in Chapter 3.

In Section II of the Chapter 4 briefly discusses the existing literature backgrounds with regards to the various impacts immigrants bring to the local housing market. In Section II, I set out the methodology for testing different empirical relationships. In section III I describe the data and provide summary statistics. I then present the results of findings in section IV. I conclude in section V.

4.2 Background

4.2.1 House Price Effect and Native Mobility Response across Multiple Neighbourhood Spatial Scales

Robust econometric estimation of the immigration impact on the local housing market was initially found in the U.S. literature (Borjas, Freeman and Katz, 1997; Borjas 2003; Saiz, 2007; Saiz and Wachter, 2011). In this chapter, both house price effect and native mobility response are going to be revisited, however, neighbourhood scale spatial units are used instead. There are multiple mechanisms through which immigrants could influence local house prices. From the demand side, newly arriving immigrants add to the overall population hence demand more housing and housing services, while all factors are kept equal, this would push up house prices; however, the process of residential sorting takes place such that there is significant proportion of native residents moving out of their area, it could reduce the overall demand of housing hence push down local house prices. From the supply side, housing developers and existing landlords are likely to anticipate streams of newly arriving immigrants and increase stocks accordingly, in this case, an increased supply would push down house prices.

For the second mechanism, it brings out an important demographic process called "native flight". The term is used to describe a situation that natives would out-migrate in response to immigrant inflows in a neighbourhood. A similar term such as "white flight" was used in literature examining the Black and White residential segregation in the United States (Galster, 1990; Crowder, 2008; Pais, 2009). The classical approach used to test this type of displacement effect involves estimating the correlation between native population net outflows and immigrant population net inflows at a particular geographical scale. A negative correlation infers a native out-migration response towards incoming immigrants. Nevertheless, there is endogeneity issue that often prevents researchers draw causal inferences, i.e. there is a need to show that it is the newly arriving migrants that induced native outflows. Details of the methodological issue are discussed in the Methodology Section of this chapter. Now I turn to our motivation of examining the native and immigrant interaction within the local housing market.

From the past literature, opposing house price effects of immigration are obtained when using different geographical scales in a study. For example, Saiz (2007) collected immigration information from 306 U.S. Metropolitan Statistical Areas between 1983 and 1997 to study the impact of immigration on housing rents and prices. He found that "an immigration inflow that amounts to 1% of the initial metropolitan area population is associated with, roughly, a 1% increase in rents and housing values." (Saiz, 2007, p23). However, when adopting a smaller spatial unit in his later paper, the effect of immigration on local house prices becomes negative. Specifically, Saiz and Wachter (2011) conducted similar analysis using census tract level area units and found that an immigration inflow

equal to 1% of the initial census tract level population, has led to an around 0.2-0.3% reduction in local house prices (the study was conducted looking at decadal house price changes). For the U.S. spatial studies, the Metropolitan Statistical Area (MSA) is a geographical region contains one or more adjacent counties that have a least one urban core area of at least 50,000 populations, whereas the census tract on average encompasses a population of about 4,000 inhabitants. The latter resembles more of a neighbourhood for residents in the U.S. and native displacement is used to explain the depreciating housing value at the U.S. neighbourhood level. The authors suggested that residential sorting could take place along both ethnic and socioeconomic lines and it is the latter they believe to be more salient in explaining native out-mobility.

Similarly, in the case of UK, two studies are conducted on the topic: Sá (2014) and Braakmann (2016). Sá (2014) has found that an increase in immigrant stocks equal to 1% of the previous year population has led to an around 1.7% reduction in house prices in England and Wales. Braakmann (2016) while looking at only two census periods between 2001 and 2011, discovered that there is no effect of immigration on median property prices. When discarding local authorities with top 10% immigrant shares, the negative effect on house prices was found at the lower end of the distribution up to the median and almost no effect was found on median prices or prices above the median.

Conflicting evidence has been found for native displacement effect of immigration from the U.S. literature. Works from Card (2001, 2007) failed to discover any evidence on native out-migration in response to incoming immigrants at the U.S city level; whereas Borjas (2006) compared the results of the native out-mobility response towards immigration across different spatial scales including the census division, the state and the metropolitan area. His evidence points in favour of native displacement and also finds that this displacement effect of immigration is numerically larger as the geographic area becomes smaller. Model specifications from these papers are evaluated in works such as Peri and Sparber (2011), and it was considered in Sá (2014) that Card (2001)'s model specification produces consistent estimates.

Turning to some empirical results with regards to the size of the "native flight" effect in the UK, they also very much depend on the spatial scale and the period span used in an analysis. Hatton and Tani (2005) conducted a study examining the displacement effect of immigration in the UK at the government office region level. They found that a net inflow of 10 immigrants in a region would generate a net population outflow to other regions of around 4.4. Sá (2014) examined this by regressing immigrant population change on native population change, at the local authority level, and found almost a one-for-one displacement. Another closely related article by Braakmann (2016) discovered there is native displacement at local authority level; however, the magnitude is much

smaller around 34 natives being displaced by every 100 immigrants. The result is not much different from that in the regional study.

This chapter mainly attempts to examine the house price and native displacement effects using a smaller spatial scale, i.e. the lower layer super output area (LSOA). Some analysis is also conducted at the census ward level (a larger spatial unit) and output area level (a smaller spatial unit) over the topics of native out-migration response, migration distance of displaced natives and their mobility across stratified occupation groups. The LSOA is a geographical unit that has a mean population of 1,600 and it is used as a proxy for UK *neighbourhood* for analysis mainly in this chapter. Additionally, the number of census wards recorded in 2011 is 8,570 with the average population of 6,543 and the unit constitutes a larger area than an LSOA. Output area has an average population of 309 and there are over 175,434 output areas recorded in England and Wales in 2011.

Seminal works in this area (Saiz, 2003; Saiz and Wachter, 2011; Sá, 2014; Braakmann, 2016) tend to indicate that it is the native out-migration response towards immigration that drives depreciating housing values in a neighbourhood; the result has been a reduction in local income through which housing demand is reduced and this is reflected in a reduction in house prices. Most of the studies have been conducted at the local authority level but using neighbourhood units could motivate an examination of more localised interaction between natives and immigrants and potentially separate different types of incentives for displacement from that would result from work location contact, residential location contact or other medium of contact such as schools.

It is often the case that longer distance migration is more likely to be associated with a job change and short distance moves tend to be prompted by housing and amenity considerations (Zax, 1994; Andrew and Meen, 2005). Therefore, native households could choose to move away in response to the settlement of newly arrived immigrants for different reasons. If strains over resources have been felt through, short distance out-migration is more likely to be due to scarcity in housing stocks and amenity resources, while long distance out-migration is more likely to be an outcome of job scarcity given the polycentric distribution of employment; on the other hand, housing stocks and amenities are more evenly distributed across the geographical space. However, using residential segregation to explain native outflows is much subtler as the psychological processes behind homophily (the tendency to be drawn to those like ourselves), heterophobia (fear or aversion to those different from ourselves), or metathesiophobia (fear of change) are subjective perceptions held by individuals. Whether native outflows could be interpreted because of residential segregation (or opposition attitudes towards immigrants) depends very much on to what extent one would agree that due to these psychological processes, native households would withdraw from their own neighbourhood by using different means, e.g. change jobs, change houses, or change schools.

In addition, the occupation group and the income background one belongs to also play important roles in their moving patterns. People with higher occupation status, higher income level and more education tend to engage in more frequent migration and longer distance migration when compared to those with lower occupation status and low-income level (Bogue and Thomson, 1949; Schwartz, 1973; Champion and Stillman, 1998). This is mainly because the former group is more likely to work within wider institutional and knowledge networks that require more mobility across regions in its own right. Different occupational groups would respond differently towards immigration inflows. Borjas (2006) has found that natives and immigrants who share similar education backgrounds and years of work experience tend to be close substitutes in the job market therefore displacement is likely to happen along this dimension. While lower occupation and education groups are generally said to experience more restricted mobility (Schwartz, 1973), displacement could still take place given the presence of privately rented sector in the UK, low transport cost, and more extensive kin and social networks that are available to them. These factors could facilitate mobility for households and individuals. I also aim to explore these patterns.

Evidence of segregation does not have to be inferred through examining population inflows and outflows. Kauffman (2014) used isolation indices to measure the extent to which White British are segregated to other ethnic minority groups. Their focus group studies about individual person accounts also demonstrate quality evidence about views and perceptions towards immigration. The main findings worth noting include the examination of local attitudes – i.e. how well White British copes with growth in population of ethnic minorities. Their quantitative analysis points to evidence of residential segregation and attitudes of opposition towards immigration, although the residential pattern in reality could be more complex. The author points to a type of halo effect exists: " [effects of ethnic minority population share on white perceptions of immigration very much depend on the distance of the two groups]. The opposition attitude is greatest when immigrants are close, but not too close. When Whites are in a White close-knit ward embedded within a diverse local authority, they usually show strong hostility towards immigration; while Whites in diverse wards nested in White local authorities would tend to be most tolerant because minorities are perceived as locally established yet are too small a proportion to be threatening to those in the wider area" (Kauffman, 2014, p272).

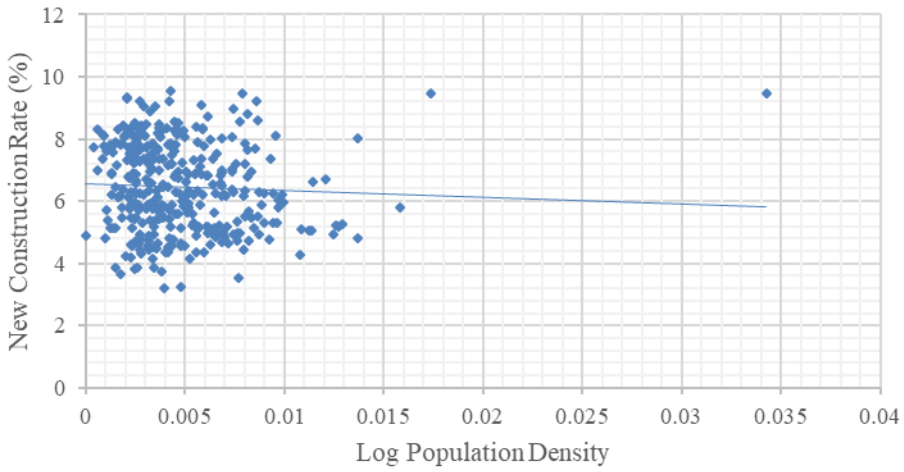
4.2.2 Immigration Effect on Housing Supply in the UK

The UK housing market has been characterised by a long term upward pressure on trend prices and considerable volatility. The average standardised seasonally adjusted house prices have risen from just over £60,000 to £200,000 over a 20-year period between 1995 and 2015 (Data Source: Land Registry). While many factors were believed to have contributed to this rise: the effect of low interest rate, the expectation of greater economic stability, an undersupply in the UK house building industry and poor responsiveness to price signals are also suggested to be dominant factors at play.

Within the housing supply literature, there is a body of research that measures the supply responsiveness to house prices (i.e. house price elasticity of supply) which is generally believed to be weak in the UK housing industry. In Glaeser (2005), it is argued that the two main drivers behind low price elasticity of supply is due to first of all, a shortage of land: the natural limit that inhibits new development projects; and secondly, strict planning control by the Government and the result is often that developers need to go through complex and lengthy planning applications if they wish to start new construction. In addition, in Barker (2003), a third possible explanation is also raised, namely the interaction between the previous two theories: limited land availability interacts with the current planning system which shifts the focus of competition from housing product development to land acquisition; once land is acquired, competition reduces dramatically to enable house builders to hold back production rates to shelter house price volatility. A relatively comprehensive review of the UK housing industry, its interaction with current tax regime and the operation of the planning system are provided by Barker (2003).

However, the main focus of the chapter is to understand more about the responsiveness of housing stock supplies towards immigrant inflows. I first look at some cross-sectional results. Drawing several datasets from the Department of Government and Local Communities and NOMIS, information on dwelling stock counts and population are obtained. For year 2011, the new construction rate (i.e. the number of new starts / total dwelling stock counts) is plotted against log population density (i.e. total population / area size) based on a range of local authority level data points. From Fig 1., one finds that a weak but statistically insignificant negative correlation (-0.0506; p-value: 0.3465) between the two variables indicating a high construction rate is not in general found in high density areas; therefore, it might suggest housing developments are not very much related to rises in population density (hence, a corresponding rise in area level housing demand).

Fig 1. Housing Supply "Response" to Total Population



Once again, by looking at the plot of log immigrant population density against new construction rate in Fig 2., one finds a weak positive but insignificant correlation[1] (0.0197, p-value: 0.7147).

1. Removing extreme values in Fig.1. did not alter the general trends: Tower Hamlet has the lowest new build to local population ratio; Nuneaton and Bedworth, Epsom and Ewell have the highest number of social housing stocks per log immigrant unit.

This suggests a possibility that new starts may respond weakly to immigrant inflows; however, while looking at social housing stock "response" only, a weak and insignificant correlation (-0.0217, p-value: 0.6873) is found suggesting little or no "response" of social housing stock towards immigrants or foreign-born population. This could further indicate housing stock response towards immigration to be highly likely coming from new builds of owner-occupied properties and privately rented accommodation which makes sense, as the two sectors are the areas where profits are generated.

Theoretically, high density areas could be subject to potentially even larger demand side shocks led by larger inflows of population. As far as the housing market is facing an upward supply curve, then new construction will increase or at least will not be 0. Reasons for not seeing a positive correlation may be due to confounding factors that are generally prevalent in cross-sectional data. Turning to a supply response towards the immigrant population, there are reasons to believe housing developers respond to rising housing demand from immigrant inflows. While immigrants add to the overall income to the area, housing developers would find it profitable to build in areas where there is immigrant population growth, therefore supply would increase in these areas. Immigrants exhibit strong spatial patterns: first of all, there are immigrant enclaves which attract future streams of immigrants, this suggests new arrivals are likely to live in a more closely-knit manner together with established immigrants; secondly, migrant workers in general prefer residing close to employment, therefore, one tends to find more of them in cities rather than in countryside. Example observations of explicit supply response towards newly arriving immigrants include high rise student flats being built in anticipation of newly arriving international students; existing landlords renovate properties to accommodate incoming immigrants. However, the empirical relationship needs to be subject to more rigorous test. Additional channels through which immigrants might raise local housing supply includes immigrants' direct contribution towards the labour shortage in the housing sector especially the construction sector. The increased factor of production would increase outputs at least in the short run.

Turning to social housing stocks response towards newly arriving immigrants in Fig 3., a non-response is reasonable as the current UK social housing system is not specifically designed to respond to new population growth. Additionally, most units are developed and managed by not-for-profit organisations such as councils and housing associations which are unlikely to respond to market signals. The availability of social housing was once to provide affordable homes to everyone through providing security of tenure and rent subsidies to tenants; in more recent years, the form of tenure has been perceived as a type of home provision to those in most need especially families with extremely low incomes. A significant proportion of immigrants and ethnic minority members reside in this type of housing estate but the problem is common for all tenants who reside in it. The problems of the

public housing system range from the rise of crime, welfare dependency (Johnston and Mooney, 2007), isolation and exclusion of residents, substantial inefficiency of space usage, low effectiveness of allocation of units to deprived households on the waiting list and so on. For these reasons, the type of accommodation has not been so welcome and has subject to policy reforms such as a direct cut in its supply and implementation of bedroom tax. Therefore, newly arriving immigrants are less likely to be a signal for new builds in this type of housing. However, this could raise serious problems such as increased occupational density due to its limited supply and capped rent, which is particularly severe in certain regions like London. The owner-occupied sector and the privately rented sector might possess a higher degree of flexibility to new immigrant housing demand.

Methodologically, one needs to consider to what extent endogeneity could be an issue in examining the responsiveness of housing supply to immigration. This is to make sure I am not measuring the effect of some other factors which just happen to attract immigrants into the area at the same time. For example, cities with good physical and cultural amenities tend to provide a low cost and highly profitable environment to build properties while these places also attract immigrants due to its higher international reputation (therefore they are more widely aware than other places). I am not measuring the effect of house building on immigrant inflows which could also be true as more new builds in an area would attract immigrants to settle in the area. More explanation will be given to how endogeneity has been treated using first differenced models and spatial diffusion instruments in the Methodology Section.

Fig 2. Housing Supply "Response" to Immigrant Population

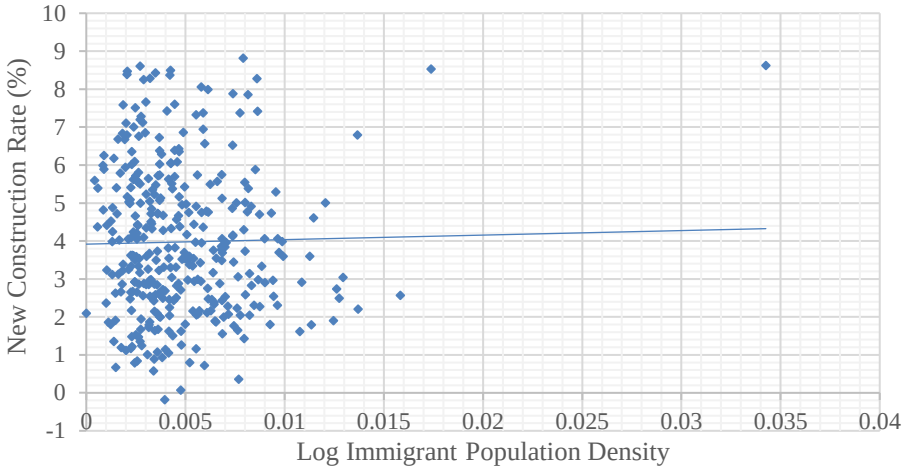
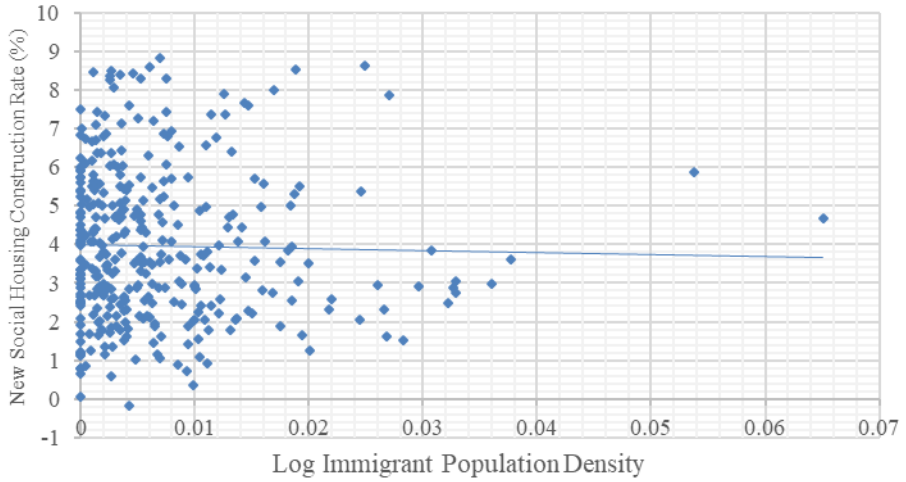


Fig 3. Social Housing Stock "Response" to Immigrant Population



4.2.3 Effect on Property Overcrowding

Immigrants not only affect the local housing supply changes, but also changes the way housing space is re-arranged. Carter (2005), Saiz (2007) and Braakmann (2016) have pointed out that immigrants tend to be more tolerable in terms of sharing accommodation or living in more crowded conditions. In response, house owners and landlords, often divide up existing units to accommodate new immigrants. From the literature, Saiz (2003) examined the influx of Cuban immigrants in Miami after the Mariel Boatlift, and a short run increase in number of persons per room is found; Braakmann (2016) also discovered similar patterns in the UK: he found that an inflow of immigrants increases the share of households living with 0.5 to 1 persons per room and only with certain model specifications, also the share of households with more than 1 person per room. The evidence points towards an overcrowding effect of immigration and a tendency for property owners converting existing larger houses into smaller units that are more easily offered on the rental market.

Similar issue has also been explored in the qualitative literature - the "densification" problem is in fact most acute in London (Johnson et al. 2016). He concluded that housing is occupied at higher densities in the region but "it has [also] been experienced more than elsewhere in neighbourhoods where members of the ethnic minority groups are concentrated." The prevalence of this phenomenon would mitigate the increase in housing demand contributed by immigration but on the other hand prompt smaller housing units offering on the market (therefore increasing supply), the net effect would be very likely a reduction in overall property price. I test the empirical relationship using a neighbourhood spatial scale and aim to discover which region tends to suffer particular strain in housing capacity.

4.2.4 Effect on Submarket House Price Effect by Dwelling Types

The housing tenure distribution in the UK has gone through some substantial changes over the last two decades. In the early 1980s, a significant proportion of housing is in a form of local authority housing; the share is much larger than the private rented sector at the time. It is deemed that this type of housing tenure inhibits spatial mobility. This is because public housing rent is in general below the market rate and there is relatively tougher restriction in transferability within public housing. One needs to put themselves on a long waiting list to be qualified for public housing in the new location once they move there. Therefore, it incurs a higher cost for public housing renters to leave a place in response to a new job offer elsewhere (McCormick, 1981, 1983, 1987).

In 1990s, it was supposed that private home ownership restricts mobility relative to the private renting, due to the cost of buying and selling homes (Oswald, 1996, 1999). However, later empirical tests have rejected this hypothesis and relevant works include Coulson and Fisher (2002),

Van Leuvensteijn and Koning (2004); Munch et al. (2006a). Recent evidence collected also points towards a decline in public housing and a rising migration rate of public tenants (Hughes and McCormick, 2000). The private rented accommodation becomes the main form of tenure that allows population mobility.

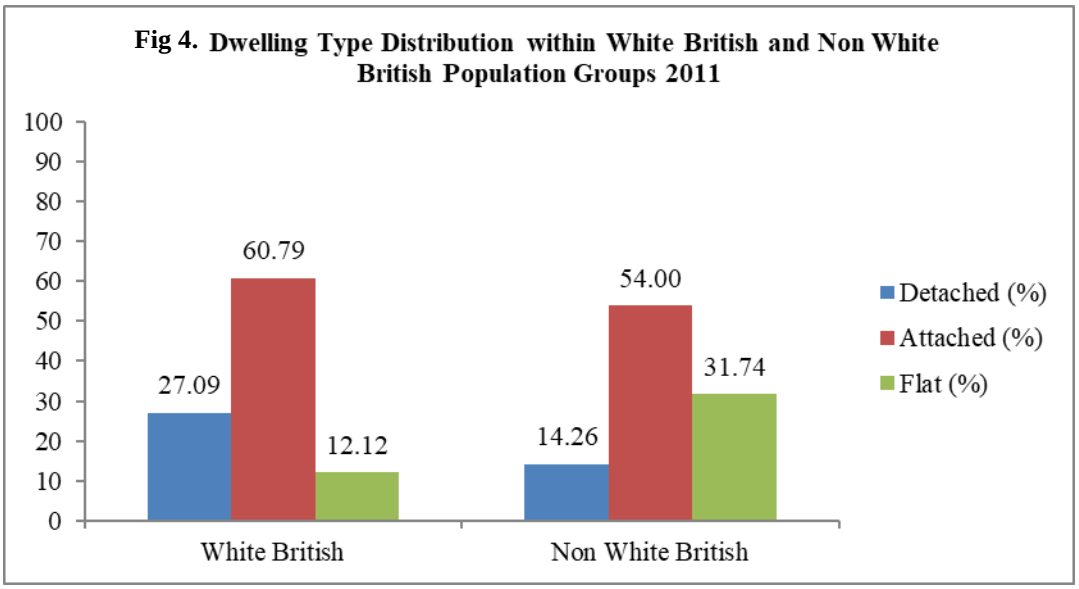
In housing, many different terms are used to describe the tenure of the property. A property can be owner-occupied, privately rented and could also be social housing. Ignoring the public (social) housing sector, majority of owner-occupied properties are freehold; privately rented accommodation is more flexible which could be offered either a freehold or a leasehold (which means owning only for a fixed period). Additionally, Table 1 shows the breakdown of dwelling types of each tenure form – Freehold and Leasehold for both Census years 2001 and 2011. The results show that the attached properties including semi-detached and terraced houses take up the largest share in freehold tenure, whereas flats, maisonette and bungalows that are either detached or semi-detached, purpose built or non-purpose built, and converted or non-converted take up the largest share in the leasehold tenure. Over the decade, the distribution has not changed much.

Table 1: % Dwellings by Tenure and Type

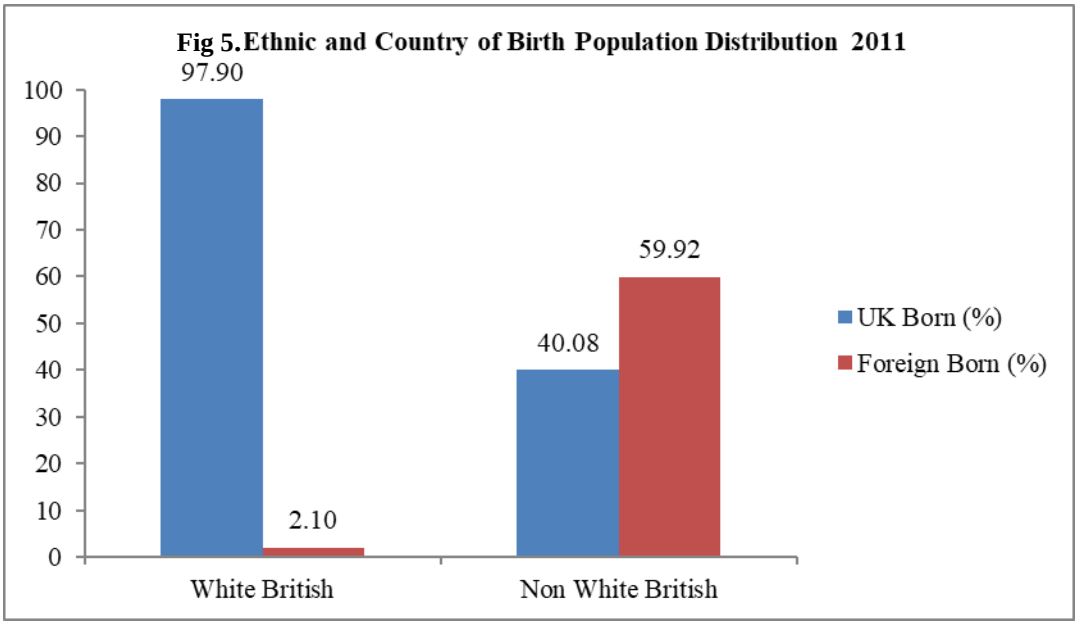
	2001		2011	
	Freehold	Leasehold	Freehold	Leasehold
Detached	29.25%	4.33%	29.81%	3.22%
Attached	**70.13%**	23.76%	**69.65%**	18.45%
Flats	0.62%	**71.92%**	0.53%	**78.32%**

Source: Nomis

Previous studies have looked at immigration effect on the housing market as a whole, but their effects across different dwelling types are unlikely to be homogeneous. Their housing consumption behaviours differ from their indigenous counterparts in many different ways: firstly, immigrants live disproportionately in flats and privately rented sector due to lower affordability for this group on owner-occupied properties (Whitehead, 2011); secondly, the average immigrant population is younger than its native counterpart therefore are less likely to form households, if this were the case, the large space provided in detached or attached houses is unlikely to be necessary and perhaps costly for them. Now, I gather some descriptive statistics from Census 2011 data to paint a general idea about the tenure and property type distribution between the immigrant and native cohorts.



From Fig.5, while over a half of the non-White British population resides in the attached properties, the percentage share of population residing in detached properties for non-White British cohort is only half the size of that residing in the flats. The disproportionate presence of immigrants across different dwelling types leads us to think that immigrants would exert more influence on property prices in one submarket type than another. More importantly, the evidence suggests that the ethnic minorities would disproportionately influence the flat market more than then owner-occupied property market. I aim to test this empirically in section 3.5.6.



Additionally, the chapter uses country of birth to classify natives and immigrants, the census data from 2011 only provides figures for ethnic group by dwelling type; therefore, the piece of descriptive statistics is using the breakdown between White British and non-White British groups. From figures 4 and 5, the majority of White population is British born, however, about 59% of the non-White population is also British born, suggesting a substantial settlement of ethnic minority migrants in the UK assuming Whites settle in Britain first. The two definitions are not perfectly correlated but only moderately correlated. The **comparisons are not made across results** using different definitions and they are treated as standalone results on their own. For example, the subsequent ward level analysis of native displacement effect is conducted using the definition of ethnicity, i.e. the possibility of out-migration of the white population in response to non-white population, which suggests nothing about the displacement effect of non-UK borns on UK born population, even though displacement at other geographies are done using country of birth definitions.

Chapter 4 has substantial difference compared to the previous chapter since the previous chapter looks at the house price effect and native displacement effect across local authority level; various model specifications are utilised from classic OLS, pooled OLS to first differenced model with instrumental variables. It also examines the role of regional labour market structure in the house price effect of immigration with respect to employment density and average socioeconomic status of workers in an area. It was found in certain types of areas, especially those with high employment density but low skilled workers, there is an increased rate of free renting taking place due to an inflow of immigrants. This may be the driver for some of the house price reduction through the demand side.

Overall, the chapter would contribute to the literature in mainly four ways. (1) It attempts to capture a localised interaction (e.g. with a housing unit or a neighbourhood) between immigrants and other different stakeholders in the housing market through examining their effects on changes in local housing values, housing supply, native mobility response and distance moved by displaced natives. To achieve this, multiple smaller geographical units are used instead of using local authorities which has been commonly found in recent empirical studies in the UK (Sá, 2014; Braakmann, 2016). (2) It not only looks at the overall immigration effect on overcrowding, but also examines regional variation over this effect, directly contributing to the existing empirical literature; (3) It attempts to forgo the assumption of a single housing market in the UK and goes on further to examine the house price effect across different housing submarkets by dwelling tenure and type. Then it explains how it could be used to support the evidence in the existing empirical studies. (4) It also adopts the econometric methodology used in Saiz and Wachter (2011) examining a similar issue, which to some degree, allows a U.S. and UK comparison over the same topic.

4.3 Methodology

The goal of this chapter is to extend the model in Chapter 3 to look at the house price response of immigration at a more local level, and also to account for the issues noted above which were overlooked in Chapter 3 including: (1) native displacement at multiple neighbourhood spatial scales and the distance moved of displaced natives; while immigrants tend to displace natives at larger spatial scales, it remains to be tested whether this could take place at a neighbourhood level at which there is perhaps more neighbourhood solidarity among residents, especially for native people; and if native do move out of their area, how far they would move to other parts of the UK; (2) how immigrant inflows affect housing supplies and in particular, whether and to what extent housing developers and existing landlords would respond to immigrant arrivals by increasing stocks; (3) immigrant effects on housing overcrowding for the country as a whole as well as regional overcrowding given the specific context of the UK housing market; and (4) price effects across different tenure forms as one expects that immigrants reside disproportionately in different tenure sectors. When analysing the effects of immigration on various economic outcomes, the existing methodology has often used a fixed effect model with quasi-instruments (IV) constructed based on some theoretical explanation: the shift-share IV in Card (1991, 2001), Saiz (2007), Sá (2014) and Braakmann (2016) ; the spatial diffusion IV in Saiz and Wachter (2011) and the "Gateway" IV in Gonzalez and Ortéga (2013).This chapter attempts to use the spatial diffusion instrument initially developed in Saiz and Wachter (2011) to identify the house price effect of immigration.

4.3.1 Endogeneity Issues in Modelling

Ideally, if all regions are identical and immigrants are randomly allocated across regions, then one can safely accrue any house price differentials to the differences in the level of immigration. That is, changes in house prices in an area are regarded as to be "caused" by changes in immigration level. However, these assumptions are unlikely to be held true. Firstly, regions are not identical; they are different in terms of their social, economic and geographical characteristics, as well as the physical attributes of the dwellings within each region. Secondly, the immigrants are not randomly allocated across areas. Their settlement choice is itself an outcome of their economic decisions.

More often the case, immigrants are attracted to economically more prosperous areas, to experience better public goods and amenities, to be exposed to more job opportunities or to enjoy better-quality housing; and those areas are often observed with faster house price growth. If so, one would find a positive correlation between immigration and house prices, but one cannot directly infer

that it is the high level of immigration which caused the house price to rise. Therefore, these characteristics need to be controlled in the regression equation.

However, even adding various controls to the regression, one could not gather all the neighbourhood level characteristics and housing attributes; these omitted variables could potentially correlate with the level of immigration in an area, making the variable of immigration net inflow endogenous and its coefficient biased.

Another endogeneity issue comes from reverse causality. Immigrants may actively avoid areas where house price growth is too fast and select places that are relatively inexpensive. If this were the case, then one would observe areas with depreciating housing values have more immigrants in them. To single out the causal channel of the immigration-driven housing value changes, one solution proposed in the Saiz and Wachter (2011) for testing the immigration-house price link on their U.S. datasets is an instrument for the change of immigration level that is based on the proximity of the areas to existing immigrant communities.

To account for endogeneity, I use the instruments developed by Saiz and Wachter (2011). In particular, the source of identifying variation comes from the observation that areas which are close to existing immigrant areas also tend to have higher level of immigrant inflows. Such spatial diffusion could be very useful to predict the subsequent immigrant settlement; for the analysis of my data in this chapter, I use immigrants' geographical distribution in 2001 to predict the decadal change of immigration level in each neighbourhood, i.e. from 2001 to 2011.

4.3.2 House Price Model Specification

The model used to estimate the house price effect of immigration is a first differenced model, which eliminates LSOA level fixed effects. The regression equation is constructed as follows:

$$\Delta \ln(HP)_{ij,T} = \beta \frac{\Delta I_{ij,T}}{Pop_{ij,T-10}} + \theta X_{ij,T-10} + \delta \Delta Z_{ij,T} + \rho_j + \varepsilon_{ij,T} \qquad (1)$$

$$where\ i \in \{LSOAs\}, j \in \{LADs\}, T = 2011$$

In this model, $\Delta \ln(P_{ij,T})$ represents the change in log median house price between 2001 and 2011 in LSOA i, local authority j. $\frac{\Delta I_{ij,T}}{Pop_{ij,T-10}}$ represents the change in the stock of immigrants between the same periods as a percentage of previous decade population. The coefficient β is used to identify the effect on median house prices of an increase in the stock of immigrants equal to 1% of the local population in 2001. In addition, I gathered and derived some variables from various datasets to control

for the neighbourhood level characteristics including several demographics, socioeconomic traits and physical geographical attributes. These are characterised by the X attribute vector in the equation and are in lagged values since the over-time change of these variables are endogenous with the error. I also include the area level changes in the physical characteristics of the dwellings (Z) between the two years. And local authority fixed effects are used to pick up area attributes that are relatively fixed over time such the historical, cultural and geographical landscape of these local areas.

4.3.3 Construction of the Instrumental Variables

Immigrants tend to live in close proximity to other immigrants. The main justification for this is that immigrants tend to cluster to take advantage of being part of the same national, ethnic, linguistic or socioeconomic group (George J. Borjas 1995; Markus M. Mobius 2002). Such clustering feature suggests that those neighbourhoods which are geographically close to existing immigrant communities are more likely to become future immigrant areas. Consequently, using the immigration share in surrounding LSOAs could help partially predict the new immigrant settlement in the LSOA of interest, i.e. the attractiveness of a neighbourhood towards new immigrants. This is captured by a gravity pull measure (Saiz and Wachter, 2011):

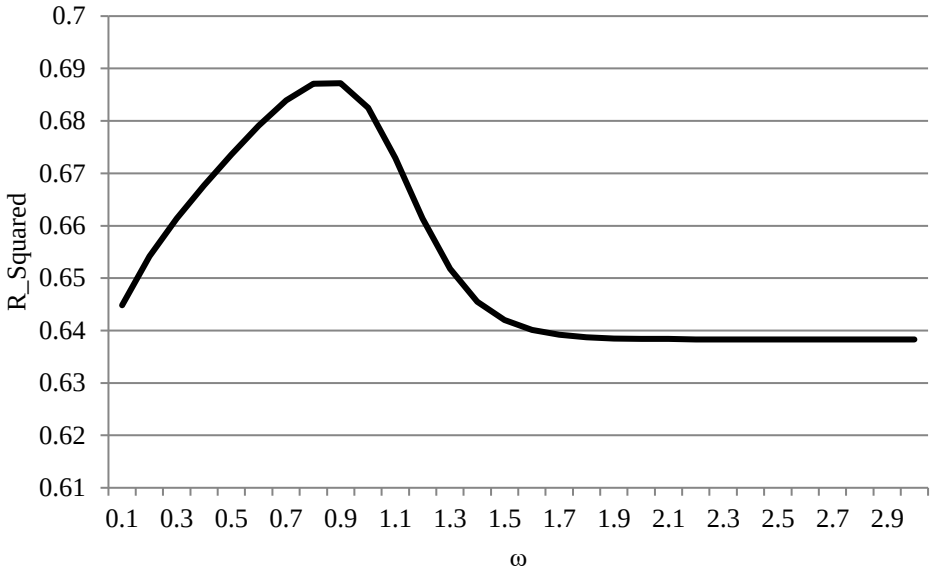
$$Pull_{ij,T} = \sum_{\substack{s \neq i \\ s \in j}} \frac{\left(\frac{I}{Pop}\right)_{s,T-10} {}^{*Area_s}}{(d_{is})^{\omega}}, \ where\ i\ \in \{LSOAs\}, j \in \{LADs\}, T = 2011 \qquad (2)$$

The gravity pull measure $Pull_{ij,T}$ is constructed as a weighted average of the 2001 immigrant densities of surrounding LSOAs. In particular, $\left(\frac{I}{Pop}\right)_{s,T-10}$ is the 2001 immigrant density of all surrounding LSOA *s* in local authority *j* where LSOA *i* belongs to. $Area_s$ is the area of LSOA *s* and d_{is} is the Euclidean distance between LSOA *i* and LSOA *s*. The measure is directly proportional to the area of LSOA *s* and inversely proportional to its distance to LSOA *s*, since the bigger the area and the closer distance of the neighbouring LSOA, the more influence it would impose on LSOA *i*. I only consider surrounding LSOAs within the same local authority and assume areas outside have little influence. The ω value is estimated from the data instead of using a prior from the literature. Specifically, I regress $Pull_{ij,T}$ on the immigration share in 2011:

$$\frac{I_{ij,2011}}{Pop_{ij,2001}} = \rho_j + \gamma\, Pull_{ij,2011} + \mu_{ij,2011} \qquad (3)$$

In the regression equation, I also add local authority fixed effects and the measure $Pull_{ij,2011}$ is computed on a range of ω values between 0 to 3 with a regular interval of 0.1. The "optimal" value is chosen to be that gives the largest R^2 (Fig 6.) As one can see from the plot below, the value of 0.9 is chosen in this case.

Fig. 7: R^2 Evaluation of Distance Decay Parameter ω



One problem for using this gravity pull measure as an instrument is that one's unable to test its exogeneity. In other words, if the instrument has a direct effect on house prices, then the β estimate is biased as one cannot be sure whether they are measuring the actual immigration effect or the predicted immigration effect. Then the IV strategy is said to fail the exclusion assumption. Why is this possible? Remember the IV is constructed based on immigration levels in surrounding LSOAs, if the inflows of these immigrants are correlated with some neighbourhood characteristics that one fails to control in our regression equation, i.e. not included in X and Z, then the IV is correlated with error term which causes the bias. To solve this, I follow the same idea as in Saiz and Wachter (2011) – to generate new exclusion restrictions.

Specifically, there exists heterogeneity in the impact of being close to existing immigrant communities. Different types of neighbourhoods are affected differently by the spatial diffusion of immigrants. Suppose there are two neighbourhoods only, A and B, in which A already has a lot of immigrants in it but B has hardly any, I would expect that the former would be less affected by surrounding LSOAs but B to be more affected. It is assumed that the spatial diffusion process always goes from more densely immigrated areas to less densely immigrated areas. To capture this heterogeneity, I interact the gravity pull measure with the lagged immigrant share in 2001 for each LSOA:

$$Pull_{ij,T} \times \left(\frac{I}{Pop}\right)_{ij,2001} \quad (4)$$

I should expect a negative sign for the effect of this interaction term as neighbourhoods which already have a large share of immigrants should be predicted worse by the gravity pull measure.

The second new exclusion restriction applies the similar concept by considering neighbourhoods in different local authorities. Some local authorities are more immigrant-prone than others. If your local authority hardly attracts immigrants, you would not expect the neighbourhoods inside this LA to possess strong spatial autocorrelation in immigration. Therefore, it is reasonable to assume that the spatial diffusion process of immigration is more likely to take place in immigrant dense local authorities, i.e. the immigrant area is full so new immigrants are somehow "forced" to settle in peripheral LSOAs. The difference is captured by using the interaction term:

$$Pull_{ij,T} \times \left(\frac{\Delta I_{j,T}}{Pop_{j,T-10}}\right) \quad where\ j \in \{LADs\} \quad (5)$$

The term should have a positive correlation with the actual immigrant variable since local authorities with more immigrants should have better prediction.

Overall, I would have three specifications in the IV setup: one with the gravity pull measure only, another with the gravity pull and its interaction with lagged immigrant densities, and the last with the gravity pull and its interaction with local authority level immigration shares.

4.4 Data

Table 2: Descriptive Statistics

Variables	Observations	Mean	S.D.	Min.	Max.	Data Source
House Price Information						
Change in Log Median House Prices (Land Registry) 2001-2011	34,290	0.656	0.24	-1.017	3.289	Land Registry
Log Median House Prices in 2001	34,290	11.372	0.61	8.613	14.238	Land Registry
Population Information						
Change in the Share of Foreign Born 2001-2011	34,290	0.055	0.09	-0.272	3.258	Census
Change in the Share of Native Born 2001-2011	34,290	0.078	0.21	-0.822	9.698	Census
Instrument/Gravity Pull Measure	34,290	3.011	2.01	0.1835	56.55	Census
Socioeconomic Characteristics						
% Population Below 16 (2001)	34,290	0.201	0.05	0.0084	0.437	Census
% Population Above 64 (2001)	34,290	0.16	0.06	0.0037	0.661	Census
% Non-Family Households (2001)	34,290	0.359	0.11	0.0312	0.915	Census
% Households with No Kids (2001)	34,290	0.178	0.05	0.0247	0.444	Census
% Population with below-GCSEs qualifications (2001)	34,290	0.531	0.14	0.0255	0.869	Census
% Population with at least a First Degree (2001)	34,290	0.195	0.11	0.009	0.73	Census
% Male Population (2001)	34,290	0.486	0.02	0.320	0.766	Census
% White Population (2001)	34,290	0.914	0.15	0.0464	1	Census
Log 2001 Population	34,290	7.314	0.12	6.906	8.785	Census
Ownership Rate (2001)	34,290	0.714	0.20	0.019	0.995	Census
Unemployment Rate (2001)	34,290	0.054	0.04	0.0043	0.351	Census
Housing Supply						
Share of Dwelling/Population (2001)	34,290	0.433	0.06	0.102	1.085	Department for Communities and Local Government
Change in Share of Dwelling	34,290	0.036	0.09	-0.422	3.968	Department for Communities and Local Government
Physical Geographies						
Log km to CBD/Urban Centre (2005)	34,290	0.332	0.87	-4.204	2.488	Ordinance Survey (Strategi)
Log km to nearest A-Road (2005)	34,290	-0.90	1.24	-10.31	2.757	Ordinance Survey (Strategi)
Log km to nearest B-Road (2005)	34,290	-0.37	1.22	-8.786	2.769	Ordinance Survey (Strategi)
Log km to nearest Bus/Coach Station	34,290	1.60	0.97	-4.17	3.80	Wikipedia/Google Maps

Log km to nearest Coastline	34,290	2.22	1.57	-5.51	4.49	Wikipedia/Google Maps
Log km to nearest Rail Station	34,290	0.63	0.96	-4.74	3.70	Wikipedia/Google Maps
Log km to nearest Golf Club	34,290	1.00	0.76	-3.39	3.34	Wikipedia/Google Maps
Log km to nearest Shopping Centre	34,290	2.33	1.24	-3.15	5.08	Wikipedia/Google Maps
% Area covered by Woodlands (2005)	34,290	0.014	0.06	0	0.873	Ordinance Survey (Strategi)
% Area covered by Lake (2005)	34,290	0.002	0.02	0	0.712	Ordinance Survey (Strategi)
Housing Attributes						
1. Housing Type						
Δ % LR Detached Properties	34,290	0	0.13	-1	1	Land Registry
Δ % LR Attached Properties	34,290	-0.01	0.17	-1	1	Land Registry
Δ % LR Flats	34,290	0.008	0.12	-1	1	Land Registry
% LR Detached Properties (2001)	34,290	0.225	0.24	0	1	Land Registry
% LR Attached Properties (2001)	34,290	0.637	0.27	0	1	Land Registry
% LR Flats (2001)	34,290	0.138	0.22	0	1	Land Registry
Δ % CN Detached Properties	34,290	-0.141	0.14	-0.674	0.489	Census
Δ % CN Semi-Detached Properties	34,290	-0.195	0.13	-0.662	0.683	Census
Δ % CN Terraced Properties	34,290	-0.148	0.14	-0.845	1.153	Census
Δ % CN Flats	34,290	-.0214	0.09	-0.66	2.606	Census
% CN Detached Properties (2001)	34,290	0.251	0.24	0	0.989	Census
% CN Semi-Detached Properties (2001)	34,290	0.269	0.22	0	0.957	Census
% CN Terraced Properties (2001)	34,290	0.121	0.18	0	0.989	Census
% CN Flats (2001)	34,290	1.601	0.97	-4.165	3.796	Census
2. Age of Dwelling						
Δ % New Builds (2001-2011)	34,290	-0.01	0.18	-1	1	Land Registry
% New Builds (2001)	34,290	0.154	0.129	0	1	Land Registry
Δ % Dwellings Built 10 Years Ago or Less (2000-2010)	34,290	0.002	0.12	-1	0.882	Consumer Data Research Centre Data
Δ % Dwellings Built 20 Years Ago or Less (2000-2010)	34,290	-0.03	0.14	-1	0.884	Consumer Data Research Centre Data
Δ % Dwellings Built 30 Years Ago or Less (2000-2010)	34,290	-0.06	0.17	-1	0.884	Consumer Data Research Centre Data
% Dwellings Built 10 Years Ago or Less (2000)	34,290	0.063	0.115	0	1	Consumer Data Research Centre Data
% Dwellings Built 20 Years Ago or Less (2000)	34,290	0.148	0.183	0	1	Consumer Data Research Centre Data

% Dwellings Built 30 Years Ago or Less (2000)	34,290	0.258	0.244	0	1	Consumer Data Research Centre Data
3. Housing Tenure						
Δ % in Freeholds (2001-2011)	34,290	0.001	0.14	-1	1	Land Registry
% in Freeholds (2001)	34,290	0.801	0.256	0	1	Land Registry
4. Inner Facilities						
Δ % Dwellings with Central Heating (2001-2011)	34,290	0.058	0.07	-0.122	0.775	Census
% Dwellings with Central Heating (2001)	34,290	0.916	0.08	0.1735	1.004	Census
% Dwellings with Bath/Toilet/Shower (2001)	34,290	0.995	0.01	0.5895	1.004	Census
5. Size						
Δ % Dwellings with 1 room	34,290	-0.00	0.01	-0.359	0.253	Census
Δ % Dwellings with 2 rooms	34,290	0.002	0.02	-0.224	0.26	Census
Δ % Dwellings with 3 rooms	34,290	0.007	0.02	-0.328	0.251	Census
Δ % Dwellings with 4 rooms	34,290	-0.01	0.03	-0.418	0.21	Census
Δ % Dwellings with 5 rooms	34,290	-0.02	0.03	-0.554	0.171	Census
Δ % Dwellings with 6 rooms	34,290	-0.01	0.03	-0.357	0.156	Census
Δ % Dwellings with 7 rooms	34,290	0.009	0.02	-0.212	0.153	Census
% Dwellings with 1 room (2001)	34,290	0.008	0.016	0	0.432	Census
% Dwellings with 2 rooms (2001)	34,290	0.023	0.028	0	0.284	Census
% Dwellings with 3 rooms (2001)	34,290	0.086	0.073	0	0.458	Census
% Dwellings with 4 rooms (2001)	34,290	0.193	0.089	0	0.653	Census
% Dwellings with 5 rooms (2001)	34,290	0.273	0.100	0.022	0.804	Census
% Dwellings with 6 rooms (2001)	34,290	0.211	0.085	0.006	0.664	Census
% Dwellings with 7 rooms (2001)	34,290	0.096	0.653	0	0.479	Census

The spatial analysis is carried out at the Lower Layer Super Output Area (LSOA) level. The model includes a series of local area characteristics and physical attributes of the housing units within each LSOA, which are captured by the variables above. Their summary statistics are tabulated in Table 2; I will then describe each category of variables in turn.

Local House Prices

House price information is obtained from the Land Registry Price Paid Data. The dataset records the details of all residential transactions taken place in England and Wales (E&W) annually from 1995 onwards. Each record has the address, price and some basic attributes of the property such as its type and tenure. In 2001, there were over 1 million sales in E&W whereas in 2011, the number of sales has gone down to around 650,000. For both years, each individual dwelling is located on the map and assigned to its LSOA where it belongs to, and then the median house price is calculated for each LSOA area. Due to the LSOA boundary difference between 2001 and 2011, all data were converted to 2001 LSOA spatial unit. For those 2011 LSOA areas splitting into multiple 2001 LSOAs, it is always the one with bigger area coverage that is chosen, e.g. if 60% of LSOA X in 2011 was once part of LSOA Y in 2001 and 40% was once part of LSOA Z, I would assume the dwelling or the person is located in LSOA Y instead of Z. This may not necessarily be true but it is the best I could do to have consistent spatial data over time for this analysis. Overall, from the above descriptive statistics, local house prices have been growing around 0.7% over the ten years which is a fairly small percentage.

Population Information

The immigrant and native population information are gathered from 2001 and 2011 Censuses. Although there is not yet an official and clear categorisation on "who counts as a migrant" (Anderson, 2014), questions from major national surveys and Censuses help researchers identify individual's identity through their country of birth, nationality, ethnicity and length of stay in the UK. For this analysis, I use the country of birth definition to define "Immigrants", i.e. people who were born outside the UK were classified as "Immigrants" whereas those who were born in the UK were categorised as "Natives". Using country of birth is a common approach in the immigration literature; however, it does not come without its limitations. People who were born in Britain but have parents born outside would in general be regarded as second-generation immigrants, when examining the immigration effect on house prices, I exclude this particular group; similarly speaking, those who were born outside Britain but hold British ethnic origin were classified as immigrants too. Therefore, the "immigrant" group should not be seen as a homogeneous group: one should not assume everyone would behave the same way and have the same social interaction with the "native" people. Since I do not intend to investigate any sub immigrant group, the definition does present a good proxy in order to capture the degree of "foreignness" within the group, which in the ends suits the purpose of the

research. Specifically, I calculate the percentage growth in each LSOA for both British-borns and Foreign-borns. From the summary statistics table, the % growth in foreign born population is slightly lower than that in native born population, reflecting an overall increase in population from both groups.

Socioeconomic Characteristics

The variables are used to control for neighbourhood level characteristics, be it social demographics or economic profiles. They are derived from the Census data at the LSOA level. I follow Sá (2014) using lagged socioeconomic controls in 2001 instead of changes between the two years, since the latter are endogenous in the first differenced model. From the data, the average % growth in below GCSEs population is about five times the average % growth in above first-degree population over the decade, however, whether this is contributed mainly by immigrants or natives cannot be gathered from the data. Apart from this, young population grows at a similar pace as the older generation on average and there is an overall increase in non-family households and households with no kids. Unemployment population is on the rise despite that the magnitude is small.

Housing Supply

The dwelling stock data is published annually by Department for Communities and Local Government (DCLG). The number of dwellings in each LSOA is counted and then normalised by the 2001 population.

Physical Geographies

The variables in this section describe the physical characteristics of the area, and they were derived from the Ordnance Survey Open Data Source. It includes the distance to the nearest urban region, the nearest A-road and B-road, the area coverage by lake and woods. All of them could potentially affect house prices in that area. The average distance to the nearest urban centre is around 1.39 km; the mean distance to the nearest A-Road/B-Road is less than 1 km which indicate to some degree a fairly extensive road network throughout E&W. In addition, not all LSOAs are covered by woodlands and lakes, but for those which are covered, the proportion of coverage could reach around 80%, on the other hand, the small mean indicates many LSOAs only have a small coverage. The distances to the nearest shopping centre, golf club, coastline, bus and rail stations are calculated by first pin pointing the coordinates of all amenities on Google Maps/Google Earth, then computing the distance between the centroid of each LSOA to the nearest amenity in QGIS software.

Housing Attributes

The model also controls for the physical attributes of the housing units in each LSOA. They are in the form of both changes and lagged levels. The data mainly come from the Land Registry Price

Paid data which contains the basic attributes such as type and tenure. Additional characteristics are gathered from the Consumer Data Research Centre (CDRC) and the Censuses. The CRDC website holds open data for LSOA level counts of dwellings in different age bands, e.g. 1990-2000, 2000-2010; I then use the information to compute the percentage of dwellings within 10, 20 and 30 years of age. Also, as the Land Registry does not hold any housing quality attributes alongside its transaction data, I use the Censuses data for heating facilities, bathroom/toilet facilities and the number of rooms' measure. The variables are again turned into percentages and changes over the two Census years are calculated.

Overall, after the linkage of various datasets, I was left with a panel of 34,290 cross-sectional LSOA units and two periods for analysis, i.e. 2001 and 2011.

4.5 Results and Analysis

4.5.1 House Price Effect of Immigration

Table 3 Column 1 shows the estimate from the OLS without all the neighbourhood level characteristics and housing attributes controls. The coefficient indicates a small positive effect but it is statistically insignificant. I know the regression is biased due to omitted characteristics and one can see the bias is positively inflating the OLS estimate. Once I added all the controls, the OLS estimate has reversed the sign, as indicated by Column 2. But the size of the effect is almost negligible - around 0.08% reduction in LSOA house prices by an increase in stocks of immigrants equal to 1% of the previous decade population. On the other hand, the three IV specifications produce negative effects around 4-7 times larger than that found in the OLS specification. Specifically, an increase in immigrant stocks equal to 1% of the previous decade population has led to around 0.3-0.5% decrease in local house prices.

While looking at the battery of tests for checking the instrument validity, the spatial diffusion IV seems to work quite well. Firstly, the instruments show weak correlations with the actual immigrant variables; their first stage F-statistics sits above 10 which is the threshold needed to pass for the Stock-Yogo Test in the case of 1 endogenous variable. Sargan Tests for specifications 4 and 5 fail to reject the null under which the instruments are valid, providing statistical evidence that the IVs are exogenous. However, the null hypothesis of Hausman Test is not rejected when comparing the OLS specification (Column 2) with the three IV specifications (Column 3, 4, and 5); indicating OLS and IV are not much different from each other.

Table 3: Immigration Impact on LSOA level House Prices Between 2001 and 2011

	OLS		IV		
	(1)	(2)	(3)	(4)	(5)
Δ Share of Foreign Born	0.044	-0.077***	-0.472**	-0.307**	-0.267*
	(0.028)	(0.026)	(0.223)	(0.149)	(0.155)
LAD fixed effects	Yes	Yes	Yes	Yes	Yes
Δ Housing Attributes	No	Yes	Yes	Yes	Yes
Lagged Housing Attributes	No	Yes	Yes	Yes	Yes
Lagged Socioeconomic Characteristics	No	Yes	Yes	Yes	Yes
Lagged Prices	No	Yes	No	No	No
Instruments for (Δ Share of Foreign Born)	No	No	Gravity Pull	Gravity Pull AND Pull x Share Foreign Born in 2001	Pull x Share Foreign Born in 2001 AND Pull x % Δ LAD Immigration
First Stage F-Statistics			66.94	67.59	67.76
First Stage Coefficient for:					
Gravity Pull			0.007***	0.011***	
			(0.001)	(0.002)	
Pull x Share Foreign Born in 2001				-0.028***	-0.036***
				(0.004)	(0.003)
Pull x % Δ LAD Immigration					0.158***
					(0.014)
Sargan Over-Identification Test (P-Value)				0.5265	0.6076
Observations	34,290	34,290	34,290	34,290	34,290
R_Squared	0.193	0.475	0.467	0.473	0.473

Notes: Standard errors are clustered at LSOA level and are included in parentheses. *** indicates significance at 1%; ** indicates significance at 5%; * indicates significance at 10%.

4.5.2 Native Mobility Response

While looking at the contributor(s) of the small negative house price effect of immigration, one first looks at classic argument of native flight often documented in the literature. An inflow of immigrants; on one hand, adds to the overall population of a neighbourhood therefore contributing to the demand of housing while other factors are kept equal; on the other hand, it may result in an outflow of indigenous population potentially due to native preference towards residing close to other natives. This displacement may reduce the overall demand for housing, in turn driving down house prices. If this were the case, one would expect that the change in the share of foreign born to be negatively associated with the change in share of native born. Therefore, I regress the % change in the native population on the % change in the immigrant population, which is similar to the approach adopted in Sá (2014). The model is specified as follows:

$$\frac{\Delta N_{ij,T}}{Pop_{ij,T-10}} = \beta \frac{\Delta I_{ij,T}}{Pop_{ij,T-10}} + \delta \left(\frac{I}{Pop}\right)_{ij,T} + \rho_j + \varepsilon_{ij,T} \qquad (6)$$

$$where\ i \in \{LSOAs\}, \qquad j \in \{LADs\}, T = 2011$$

In the model, I also added the lagged share of immigration and local authority fixed effects to partially control the time constant neighbourhood characteristics. There are three specifications I use to infer results. Table 4 Column 1 shows the OLS results: one can see that an increase in the immigrant stock equal to 1% of total population in 2001 is associated with around 2% increase in the native population share on average. The endogeneity of the immigrant variable provides us some explanation for this: factors (better job prospects, better quality housing etc.) that attract immigrants would also attract natives. The positive association is mostly due to this common fixed influence which is not captured from the model through any of the controls. Following Saiz and Wachter (2011), I also wish to see whether the result would be different if I exclude certain areas of new housing developments as they often bring about large population increases, attracting both immigrants and natives alike. Specifically, I removed LSOAs that have doubled the population between 2001 and 2011, which leaves me with around just under 80% of the neighbourhoods from the data. The association becomes smaller but remains positive as shown in Column 2. For the last specification, I used the IV strategy similar to that of the main results, which gives a further lower estimate but still positive association: And it's an almost 1 for 1 growth. This is in contrast with the U.S. case where Saiz and Wachter (2011) used census tract level data to examine impact of decadal change in immigration share on decadal change in native population share. In their paper, there is on average 1.3 native being displaced for every 10 additional immigrants moving into a neighbourhood and this is responsible for potential change in local income distribution and depreciating housing values in neighbourhoods. From my results, I conclude at the LSOA level, there is no evidence of native displacement of immigration in England and Wales.

Table 4: Immigration Impact on LSOA level Native Mobility Between 2001 and 2011

	Dependent Variable: % Change in Native Population		
	OLS		IV
	All LSOAs	Exclude New Developments	
	(1)	(2)	(3)
Δ Share of Foreign Born	2.046***	1.421***	0.714***
	(0.071)	(0.021)	(0.105)
% Share of Foreign Born in 2001	-0.191***	-0.033***	0.135***
	(0.023)	(0.013)	(0.032)
LAD Fixed Effects	Yes	Yes	Yes
Instruments	No	No	Pull x Share Foreign Born in 2001 AND Pull x % Δ LAD Immigration
First Stage F-statistics			65.81
First Stage Coefficient:			
Pull x Share Foreign Born in 2001			-0.035***
			(0.003)
Pull x % Δ LAD Immigration			0.149***
			(0.011)
Observations	34290	27049	34290
R_Squared	0.559	0.430	0.379

Notes: Standard errors are clustered at LSOA level and are included in parentheses. *** indicates significance at 1%; ** indicates significance at 5%; * indicates significance at 10%.

Therefore, the empirical pattern of finding larger displacement effect in smaller area unit described in Borjas (2006) and Sá (2014) disappeared at this stage. And one has probably the need to raise the question why this is the case. One explanation for it is that the number of immigrants flowing into a neighbourhood is too small to induce a large enough impact on collective native out-mobility. Instability in neighbourhood racial and income mix might not have been felt through by native households with the scale of foreign population inflows at the LSOA levels. It should be noted that the largest inflow of immigrant population to a neighbourhood during the period 2001-2011 is only around 6.6%, with many LSOAs not even having immigrants moving into the area. To see how different scales of immigration shocks could be one of the factors in influencing displacement results, the number of neighbourhoods is further divided into London neighbourhoods and Non-London neighbourhoods. The former tends to receive more frequent and more number of immigrants than the latter; there is no evidence of displacement found for London neighbourhoods and no evidence of native out-migration in response to immigration in non-London neighbourhoods partly due to the invalidity of instruments. To see a more detailed discussion in this respect, please refer to Appendix Section A; to conclude, one sees that small-scale immigration shock is ruled out to be one of the reasons that their effects on the geographical redistribution of native population is small.

In fact, for small area units, native displacement has not been found across the output areas (OA), the lower layer super output areas (LSOA), and the census wards in England and Wales. The analysis across these three geographical scales is examined in this chapter. For the lowest two levels of geographies, one sees an increase in native net inflows in response to immigrant inflows whereas at ward level, there is also a weak net in-migration rate of White households due to a 1% increase in the share of non-White population. Statistically significant displacement results tend to be found at local authority level and regional level. For example, Hatton and Tani (2005) has estimated the native displacement effect of immigration at regional level while Sá (2014) and Braakmann (2016) have examined about the effect at the local authority level. Table 5 summarises the results for some geographical scales. However, whether a native out-migration response would lead to housing value depreciation depends on its resulting effect on local area income. Native flight led change in area level income is explored at the ward level in the subsequent section.

Table 5. Native Displacement Effects across Spatial Scales

Spatial unit (from largest to smallest)	Native (or White population) Displacement	Source	Method	Period Span	Average Population Size (2011)	Average Number of Households (2011)
Government Office Region	4.4 Natives for every 10 immigrants	Hatton and Tani (2005)	Fixed effects model, lagged values of immigrant stocks as instruments	1982-2000	5,607,591	2,336,604
Local Authority	10 Natives for every 10 immigrants; 3.4 Natives for every 10 immigrants	Sá (2014) Braakmann (2016)	First differenced model, historical settlement pattern instruments	2003-2010, 2001-2011	161,138	67,144
Census Ward	No displacement effect, weak native net in-migration rate due to 1% increase in non-White inflows	This Chapter	First differenced model, spatial diffusion instruments	2001-2011	6543	2726
LSOA	0.7% increase in native inflows due to 1% increase in immigrant inflows	This Chapter	First differenced model, spatial diffusion instruments	2001-2011	1614	672
OA	0.7% increase in native inflows due to 1% increase in immigrant inflows	This Chapter	First differenced model, spatial diffusion instruments	2001-2011	309	129

Notes. For small area scales including ward, LSOA and OAs, the spatial diffusion instruments used are the interaction terms of gravity pull measure and the lagged immigrant densities in 2001 and the change in LAD level immigration share. Since at ward level, census ward does not have detailed country of birth information, I use white population mobility in response to non-white population inflows instead. The data source comes from NOMIS – the official labour market statistics.

Census Ward Level Analysis

When examining the ward level displacement effect, I look at the effect of non-White population inflows on the change in the share of the White population, the in-moving rate derived from the change in the number of Whites moved in as a share of total population in 2001, the short distance out-moving rate derived from the change in the number of Whites moved within the ward as a share of total population in 2001, the long distance out-moving rate derived from the number of Whites moved out of the ward as a share of total population in 2001, and lastly, the net out-migration rate which is the difference between the long distance out-moving rate of Whites and the in-moving rate of Whites. Since the data obtained from NOMIS-the official labour market statistics only have ethnicity information at detail rather than country of birth information (which is slightly different from the analysis in the rest of this chapter which defines natives to be UK born and immigrants to be foreign born), I use white mobility response towards non-White population inflows instead. Specifically, in Table 6., the OLS estimates are all positive but I know endogeneity exists as areas with economic and housing developments would attract both immigrants and natives at the same time; therefore, an inflow of immigrants is likely to be positively correlated with an inflow of native people. Turning to the IV specifications, for the one that uses gravity pull measure only, an increase in the non-White population stocks equal to 1% of the total population in 2001 leads to about 0.6% decrease in the share of the White population. However, statistically significant results were not found for the other two IV specifications. I conclude that at this level of geography, there is no White population displacement effect of non-White population.

By breaking down the movements into in-migration, within-ward out migration and outside-ward out migration, the results show distinct patterns of white and non-white group residential interactions. Turning to the first stage results first, they remain valid at the census ward level indicating the non-White population in surrounding wards serve as a good prediction for non-White population in the current ward. The rate of inflow also goes from the densest ward to the least dense ward therefore, provided the ward already has a high level of non-White settlement, the neighbouring census wards would be less good in predicting the rate of inflow of non-White population in the future for the ward of interest. On the other hand, the overall inflow of non-White population to a local authority (a wider region) positively correlates with the performance of prediction of the gravity pull measure. Surrounding neighbourhoods give a better prediction of future non-White population streams flowing into the neighbourhood of interest if the wider region tends to be more immigrant receiving. Additionally, the F-statistics passes the Stock-Yogo test with the threshold of 10 for 1 endogenous variable. With the valid first stage results, Sargan test results look less promising: for some IV specifications, the p-values are below 5% rejecting the null under which the instruments are exogenous. Overall, the IV model specifications *b* tend to have more valid results for Sargan tests of

overidentifying restrictions. Therefore, I give more credits to model specification *b* for ward level analysis and will mainly report these results.

Turning first to the OLS estimations, an increase in the non-White population stocks equal to 1% of the previous decade population is associated with 0.4% increase in White in-movers, 0.1% increase in within-ward White out-movers and 0.3% increase in the out-of-ward White out-movers, which further leads to an overall 0.1% decrease in the net out-migration rate for Whites. Again, the OLS estimates are positively biased as local economic factors and amenities would influence both white and non-White population inflows and outflows. What is more interesting is the IV results, by controlling endogeneity within the model, the estimates obtain a causal interpretation, i.e. it is the non-White population change that leads to White/indigenous households to relocate not some other factors. Specifically, an increase in non-White population stocks equal to 1% of the 2001 total population has led to 0.9% increase in the share of Whites moving into a ward; for short distance out-migration rate, this is 0.1% and for long distance out-migration rate, this is 0.7%. This leads to overall a weak White population net inflow as a result of a non-White population inflow.

One can see that a 1% increase in non-White population triggers a higher in-moving rate than an out-moving rate. Provided White population movements could be genuinely treated as a response towards different levels of non-White population in an area, an increase in the share of non-White population has led to a weak net inflow of the White population. When looking at different distances of migration made by White households, the number of long distance moves (out of a ward into some other locations) has been made more than the number of short distance moves (within ward to another location). Residential sorting over short distances are often characterised as a result of strain in resources in housing stocks availability and local amenities, while long distance residential sorting is mostly associated with labour market adjustments. One can see that the number of out-of-ward moves is about 7 times the number of within ward moves. This indicates that residential sorting in response to newly arriving ethnic minority groups takes place more often with longer distance migration rather than just moving down a few streets, perhaps also more likely with a job change if that's necessary for the household. Scarcity in local amenity resources or housing resources are unlikely to prompt relocation for the White indigenous households since the evidence on within-ward moves happen so rarely. Additionally, one cannot rule out the possibility of segregation and opposition attitudes potentially held by indigenous White households, since out-migration rates are not zero regardless of distances of moving; however, a higher in-migration rate triggered by non-White inflows also leads us to think that the sorting process is perhaps more complex than it was previously thought.

In principle, the effects of non-White population on net out-migration rate for Whites and the percentage change in the share of White population should be consistent with each other. If an inflow

of immigrants has led to a negative change in the share of White households, its corresponding effect on Whites' net out-migration rate should be positive and vice versa. The inconsistent results are potentially due to the construction of migration variables. The change in the share of White population considers in-moves of White households from outside the UK and out-moves of these households to the outside of the UK, while these moves had been deliberately removed in the derivation of in-moving and out-moving rates of White households in order to focus on internal migration only. This may explain to some extent why non-White households have no influence on the change in the share of White households but have "induced" a weak net inflow of Whites into an area when examining the results on net in-migration rates.

Table 6. Census Ward Level Results on Native Mobility Response

	% Change in the Share of White Population			
	OLS	IV1a	IV1b	IV1c
Δ Share of Non-White Population	0.823***	-0.551*	-0.053	0.056
	(0.149)	(0.311)	(0.097)	(0.111)
Observations	8210	8210	8210	8210
R^2	0.192	0.023	0.123	0.139
	Change in In-Moving Rate of Whites			
	OLS	IV2a	IV2b	IV2c
Δ Share of Non-White Population	0.400***	0.865***	0.876***	0.795***
	(0.037)	(0.225)	(0.072)	(0.103)
Observations	8210	8210	8210	8210
R^2	0.345	0.232	0.226	0.263
	Short Distance (Within Ward) Out Moving Rate of Whites			
	OLS	IV3a	IV3b	IV3c
Δ Share of Non-White Population	0.067***	0.055	0.115***	0.115***
	(0.009)	(0.041)	(0.017)	(0.022)
Observations	8210	8210	8210	8210
R^2	0.216	0.214	0.193	0.193
	Long Distance (Outside Ward) Out Moving Rate of Whites			
	OLS	IV4a	IV4b	IV4c
Δ Share of Non-White Population	0.290***	0.716***	0.700***	0.643***
	(0.028)	(0.181)	(0.056)	(0.082)
Observations	8210	8210	8210	8210
R^2	0.380	0.232	0.243	0.278
	Net Out Migration Rate of Whites			
	OLS	IV5a	IV5b	IV5c
Δ Share of Non-White Population	-0.109***	-0.149**	-0.176***	-0.152***
	(0.013)	(0.061)	(0.022)	(0.029)
Observations	8210	8210	8210	8210
R^2	0.146	0.140	0.129	0.139
Instruments	No	Pull	Pull AND Pull x Share Non-White Population in 2001	Pull x Share Non-White Population in 2001 AND Pull x % Δ LAD Non-White Population
First Stage F-Statistics		29.83	32.14	30.91
First Stage Coefficient:				
Pull		0.016***	0.044***	
		(0.003)	(0.003)	
Pull x Share Non-White Population in 2001			-0.088***	-0.076***
			(0.007)	(0.009)
Pull x % Δ LAD Non-White Population				0.235***
				(0.035)

Sargan over-identification test results show p-value to be 0.0606 for model IV1b, 0.1470 for model IV1c, 0.9144 for model IV2b, 0.0471 for model IV2c, 0.0135 for model IV3b, 0.0017 for model IV3c, 0.8493 for model IV4b, 0.1613 for model IV4c, 0.5131 for model IV5b and 0.0309 for model IV5c. These indicate for some models which have above 5% p-values, the instruments are exogenous while those models have p-values below 5%, IVs are endogenous. Based on the battery of tests, it seems that IV model b tends to have better performance on the whole. I will take more credit in specifications b. Standard errors are clustered at census ward level and are included in parentheses. *** indicates significance at 1%; ** indicates significance at 5%; * indicates significance at 10%.

To see further which groups of white households out-movers are, the analysis is disaggregated by occupation groups: managers and senior officials, professional and technical occupations, administrative, secretarial and skilled trades, personal, sales and customer services, and operational and elementary occupations. The group of managers and senior officials are often associated with the highest mean income and socioeconomic status while the group in operational and elementary occupations are in general associated with lowest mean income and socioeconomic status. I am trying to estimate the % change in white population in each occupation group due to an increase in the non-white population equal to 1% of the 2001 total population. The model is again a first differenced panel data model with a use of spatial diffusion instruments and the results are displayed in Table 7.

While the first stage results are as valid as before, Sargan tests for overidentifying restrictions suggest that some specifications do not produce exogenous instruments. I will judge estimates across all specifications to determine the final effects for each occupation group. Across these groups, there is evidence of displacement only for the managers and senior officials and the administrative, secretarial and skilled trades. These groups tend to have easier out-migration capability when facing inflows of additional population. Specifically, an increase in the non-White share equal to 1% of total population in 2001 would lead to 0.02% decrease in the share of white managers and senior officials and 0.06% decrease in the share of white group in secretarial, administrative and skilled trade roles. As one can see, the outflows of both groups are small and almost negligible. On the other hand, in high non-White share areas, one actually sees net inflows from White population in service roles and elementary occupations. An increase in the share of non-White population equal to 1% of the total population in 2001 has led to 0.07% increase in the White population in personal, sales and customer service roles and 0.13% increase in the White population in operational and elementary occupations. Therefore, outflows tend to take place across groups that have higher income and socioeconomic ranking and inflows are likely to happen to groups that have lower income and socioeconomic status, which provides some weak evidence on socioeconomic status (and potentially income) based residential sorting led by the non-White population. This is broadly consistent with the current literature.

Table 7. White out-Mobility Response towards Immigration by Occupation Groups

Dependent Variable: % Change in Share of White Population				
		Managers and Senior Officials		
	OLS	IV1a	IV1b	IV1c
Δ Share of Non-White **Population**	0.058***	-0.059*	-0.015*	-0.006
	(0.009)	(0.031)	(0.009)	(0.010)
Observations	8210	8210	8210	8210
R^2	0.350	0.239	0.307	0.316
		Professional and Technical Occupations		
	OLS	IV2a	IV2b	IV2c
Δ Share of Non-White Population	0.184***	-0.128	-0.009	-0.016
	(0.034)	(0.100)	(0.025)	(0.036)
Observations	8210	8210	8210	8210
R^2	0.223	0.087	0.170	0.167
		Administrative, Secretarial and Skilled Trades		
	OLS	IV3a	IV3b	IV3c
Δ Share of Non-White Population	0.074***	-0.163***	-0.059***	-0.027*
	(0.017)	(0.049)	(0.013)	(0.015)
Observations	8210	8210	8210	8210
R^2	0.224	-	0.138	0.175
		Personal, Sales or Customer Services		
	OLS	IV4a	IV4b	IV4c
Δ Share of Non-White Population	0.085***	0.110***	0.067***	0.058***
	(0.013)	(0.037)	(0.011)	(0.013)
Observations	8210	8210	8210	8210
R^2	0.254	0.249	0.251	0.248
		Operational and Elementary Occupations		
	OLS	IV5a	IV5b	IV5c
Δ Share of Non-White Population	0.097***	0.001	0.128***	0.165***
	(0.018)	(0.039)	(0.015)	(0.024)
Observations	8210	8210	8210	8210
R^2	0.237	0.189	0.232	0.213

Notes. Sargan Test results show p-value to be 0.0771 for model IV1b, 0.1435 for model IV1c, 0.0705 for model IV2b, 0.0116 for model IV2c, 0.0038 for model IV3b, 0.1006 for model IV3c, 0.1126 for model IV4b, 0.2921 for model IV4c, 0.0001 for model IV5b and 0.0230 for model IV5c. The range of p-values is mostly below 5%, indicating potential endogeneity of the instruments. The first stage results are the same as the ones in A2.

4.5.3 Immigration Impact on Housing Stock Change

The effect of immigration on local housing supply is examined in this section. Whether it be developers building more units in an area or landlords dividing up existing units to accommodate new migrants (Braakmann, 2016; Whitehead, 2011; Johnson et al, 2016), housing supply may respond to the increase in demand from new coming immigrants. One special case is that there is an increase in city centre apartment supply to accommodate inflows of international students every year (Allinson J, 2006; Hubbard, 2009). Although I do not look at specific subgroups of immigrants by different motivations of migration, I aim to estimate the supply responsiveness towards increases in the level of immigration (or the anticipated increase in the level of immigration). The supply side factors could help explain the negative house price effect of immigration if developers anticipate migrants to rise in future in some locations and build properties according to this anticipation, they may push the supply curve outwards to a degree that potentially leads to a small reduction in actual house prices.

In order to test this, I use a similar model to that of the house price; in particular, I regress the change in share of immigration on the change in the dwelling stocks between 2001 and 2011. Although one cannot control the "full" range of factors that could potentially influence the residential development pattern of a local area, the specification attempts to control the neighbourhood level characteristics by including several socioeconomic variables: the age, gender, household composition of an area, the unemployment rate, education level, and the ethnic composition of the White population. It also controls for the geographical traits of each LSOA by incorporating a range of variables such as the percentage woodland and lake coverage, the distance of each area to its nearest shopping centre, golf club, national park, coastline, A-road, B-road, bus and rail station. The accessibility to these amenities and infrastructure may attract developers to build close to them if residents prefer having frequent enjoyment of these services; on the other hand, if these facilities create negative externalities such as air pollution and noise from constant traffic flows, crowded atmosphere as a result of high population congregation, then it may repel the builders from building in the areas. In addition, physical attributes of the housing units including the share of dwelling stocks in the base year 2001, the property type, tenure, age and housing capacity (in terms of number of rooms) compositions of an area are all used to capture the existing residential development pattern of the area. For instance, if an area already has many dwellings to begin with, on one hand it may represent a range of good environmental conditions for construction therefore could attract further developments, however, it could reduce the existing capacity including the land availability, therefore, future developments are probably less likely to happen.

In fact, not all-important factors could be included in the specification due to the inability to quantify the characteristics or simply a lack of data. Two types of variables are worth mentioning here:

the first one is the physical suitability for development in each LSOA (Smersh, Smith and Schwartz, 2003), e.g. the soil type, hydrology, land availability and slopes of the hills; the second one is the level of planning restriction developers face when building in an area. The speed and capacity for development is largely monitored by the planning authority, one tends to see faster and more frequent development in places where planning restrictions are less stringent (Bramley: 1998, 2013; Pryce, 1999; Barker, 2005).[2]

The model specification is as follows:

$$\frac{\Delta(HS)_{ij,T}}{Pop_{ij,T-10}} = \alpha ln(HP)_{ij,T-10} + \beta \frac{\Delta I_{ij,T}}{Pop_{ij,T-10}} + \theta X_{ij,T-10} + +\rho_j + \varepsilon_{ij,T} \quad (7)$$

Overall, the effect of immigration on the LSOA level housing stock change is small and positive across all specifications. The OLS estimation in Table 8 without any additional controls (column 1) gives out the largest positive effect compared to all other specifications. Once the controls are included, the effect shrinks to only one-seventh of the original effect and the effects between the OLS and the IV are not much different. In particular, an increase in the immigrant stocks equal to 1% of the 2001 population, has led to around 0.1-0.2% increase in the housing stocks. Additionally, the lagged log house price has a positive association with dwelling stock changes indicating a positive house price elasticity of supply. After controlling for other physical geographies, the higher the share of existing dwellings in an area, the fewer stocks were built during the study period 2001-2011, strongly inferring an increasing land scarcity and limitation on other construction resources.

2. Although there is no direct index which measures the level of planning restriction each planning authority imposes, there are records available on the number of planning applications received and granted within certain time frames for major developments, minor developments and other developments. The data are published by ONS however are only available for English local planning authorities, the author adds these to the specification and the results are tabulated in the Appendix section.

Table 8: Immigration Impact on LSOA level Housing Stock Between 2001 and 2011

Dep. Var.: Δ Share of Dwelling Stocks	OLS		IV		
	(1)	(2)	(3)	(4)	(5)
Δ Share of Foreign Born	0.777***	0.115***	0.148***	0.192***	0.217***
	(0.033)	(0.009)	(0.046)	(0.031)	(0.029)
Lagged Log Median House Price in 2001	0.046***	0.011***	0.011***	0.012***	0.012***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Dwelling Stock / Population (2001)	0.038***	-0.153***	-0.156***	-0.159***	-0.161***
	(0.012)	(0.018)	(0.018)	(0.018)	(0.018)
Lagged Socioeconomic Characteristics	No	Yes	Yes	Yes	Yes
Physical Geographies	No	Yes	Yes	Yes	Yes
Δ Housing Attributes	No	Yes	Yes	Yes	Yes
Lagged Housing Attributes	No	Yes	Yes	Yes	Yes
LAD fixed effects	Yes	Yes	Yes	Yes	Yes
Instruments for (Δ Share of Foreign Born)	No	No	Gravity Pull	Gravity Pull AND Pull x Share Foreign Born in 2001	Pull x Share Foreign Born in 2001 AND Pull x % Δ LAD Immigration
First Stage F-Statistics			88.05	89.28	89.83
First Stage Coefficient for Gravity Pull			0.006***	0.011***	
			(0.001)	(0.003)	
Pull x Share Foreign Born in 2001				-0.028***	-0.038***
				(0.004)	(0.003)
Pull x % Δ LAD Immigration					0.171***
					(0.011)
Sargan Over-Identification Test (P-Value)				0.2691	0.4591
Observations	34290	34290	34290	34290	34290
R_Squared	0.455	0.907	0.907	0.906	0.904

Notes: i denotes for the spatial unit LSOA; j denotes for the spatial unit local authority; T subscripts for the year 2011. The dependent variable is the change in the dwelling stocks between 2001 and 2011 which is a function of the change in the share of immigrants - $\frac{\Delta I_{ij,T}}{Pop_{ij,T-10}}$ and the lagged house price in 2001 - $(ln(HP)_{ij,T-10}$. The controls - $X_{ij,T-10}$ include a range of neighbourhood traits, e.g. the age/gender/household composition, average education level, unemployment rate, the age of dwelling stocks, log distance to nearest A-Road, B-Road, shopping centre, golf club, rail and bus stations, % woodland coverage, % lake coverage and other housing attributes both in level and change terms.

4.5.4 Immigration Impact on Overcrowding

Upon arrival, immigrants tend to face more uncertainties compared to the local residents, especially with respect to their lengths of stay and their future job prospects. Therefore, it is unlikely for them to treat their housing consumption as a priority. In most cases of their initial settlement, they may often be willing to tolerate overcrowded living conditions or even choose low quality housing. Sharing accommodation with other families is not uncommon. However, there is evidence showing that immigrant households would gradually resemble indigenous households in terms of housing consumption characteristics (Robinson et al., 2007), especially when they think their settlement could be permanent in the UK.

In order to examine whether immigrants overcrowd existing properties, I regress the change in the share of foreign-borns on the change in the percentage of population that have below 0 occupancy rating. The higher the percentage of population that has an occupancy rating below 0, the more overcrowded the accommodation is in each area.

Table 9: Impact of Immigration on Overcrowding

Overcrowding Measure: Occupancy Rating below 0	OLS	IV
	(1)	(2)
Δ Share of Foreign Born	0.469***	0.238***
	(0.027)	(0.044)
First Stage F-Statistics		67.60
Pull x Share Foreign Born in 2001		-0.035***
		(0.003)
Pull x % Δ LAD Immigration		0.158***
		(0.014)
Observations	34290	34290
R_Squared	0.813	0.777

Notes. The dependent variable is the change in the percentage of households that have over 1.5 persons per room. The criterion is used to define whether the household is overcrowded or not. The main independent variable is the change in the share of foreign born. The model again incorporates a range of controls including neighbourhood characteristics, housing attributes and physical geographies. For the IV specification, the combination of instruments includes the interaction between the gravity pull measure and the lagged immigrant density, and the interaction between the gravity pull measure and the change in the local authority level immigration. It is also worth noting the IV specification did not pass the Sargan Test, which deem the instruments not exogenous.

From Table 9, immigrants significantly contribute to the rate of overcrowding. An increase in immigrant stocks equal to 1% of the previous decade population has led to around 0.5% increase in "overcrowded" population in the OLS model and a 0.2% increase in the IV model. These effects are small; it would be interesting to see if there is distinct regional overcrowding pattern since certain regions may experience more overcrowding than others due to different rates of immigrant inflows as well as different mixes of immigrants' ethnic origin.

[1] The author also attempted to run both the house price and native mobility specifications by aggregating data to local authority level. However, the proximity IV does not work particularly well due to a very low association between the immigration inflow in one area and those in "nearby" areas. This is probably because the clustering feature of immigrants tends to happen more "locally", e.g. at neighbourhood level. The fact that the area of a local authority is large makes the immigration level in it a poor predictor of that in "nearby" local authorities. Therefore, we rely on the findings from Sa (2014) and Braakmann (2016) to discuss our results.

4.5.5 Regional Breakdown of Immigration Effect on Overcrowding

To look at regional breakdown of immigration effect on overcrowding, 11 government office regions are considered: London, South East, East of England, South West, Wales, East Midlands, West Midlands, Yorkshire & Humberside, North East, North West, and Merseyside. I run both OLS and IV models for the 11 regions. For Table 10. OLS specifications, all regions show significantly positive effects on overcrowding which are small with values all below 1%. For IV specifications, the 2SLS IV method works less well for the Northern regions but the spatial diffusion pattern is exploited in a much better way in the Midland and Southern regions given these areas tend to have larger streams of immigrant inflows. Apart from Wales and Merseyside, the average contribution towards overcrowding by a 1% increase in the stocks of immigrants is similar across the rest of the regions. Differences exist, but overall they are not large.

Table 10. Regional Immigration Effect on Overcrowding

Overcrowding Measure: Occupancy Rating <0	Overcrowding		First Stage Results
	OLS	IV	
Greater London	0.502***	0.271***	First Stage F-Statistics: 70.03
	(0.031)	(0.091)	First Stage Coefficient:
Observations	4737	4737	-0.005(0.005)
R^2	0.882	0.851	0.084***(0.016)
South East	0.300***	0.181***	First Stage F-Statistics: 36.68
	(0.021)	(0.059)	First Stage Coefficient:
Observations	5317	5317	-0.049*** (0.007)
R^2	0.835	0.823	0.281*** (0.037)
East of England	0.257***	0.160***	First Stage F-Statistics: 33.42
	(0.024)	(0.040)	First Stage Coefficient:
Observations	3547	3547	-0.038*** (0.010)
R^2	0.863	0.850	0.301*** (0.037)
South West	0.386***	0.744***	First Stage F-Statistics: 20.62
	(0.048)	(0.258)	First Stage Coefficient:
Observations	3225	3225	-0.013 (0.025)
R^2	0.848	0.774	0.168*(0.086)
Wales	0.476***	-0.129	First Stage F-Statistics: 15.10
	(0.103)	(0.589)	First Stage Coefficient:
Observations	1889	1889	-0.096**(0.038)
R^2	0.798	0.703	0.147(0.106)
East Midlands	0.353***	0.220***	First Stage F-Statistics: 33.63
	(0.072)	(0.066)	First Stage Coefficient:
Observations	2725	2725	-0.113*** (0.011)
R^2	0.780	0.767	0.377*** (0.048)
West Midlands	0.488***	0.277***	First Stage F-Statistics: 33.58
	(0.082)	(0.047)	First Stage Coefficient:
Observations	3471	3471	-0.082***(0.005)
R^2	0.769	0.744	0.428*** (0.035)
Yorkshire & Humberside	0.575***	0.291***	First Stage F-Statistics: 26.01
	(0.067)	(0.089)	First Stage Coefficient:
Observations	3284	3284	-0.030 (0.019)
R^2	0.871	0.813	0.321*** (0.060)
North East	0.301***	0.310***	First Stage F-Statistics: 7437.39
	(0.061)	(0.113)	First Stage Coefficient:
Observations	1651	1651	-0.049 (0.051)
R^2	0.740	0.740	0.530*** (0.181)
North West	0.524***	0.707***	First Stage F-Statistics: 22.49
	(0.077)	(0.121)	First Stage Coefficient:
Observations	3545	3545	-0.050 (0.032)
R^2	0.739	0.721	0.116* (0.059)
Merseyside	0.887***	-1.173	First Stage F-Statistics: 19.73
	(0.120)	(2.860)	First Stage Coefficient:
Observations	899	899	0.057 (0.260)
R^2	0.896	0.107	0.189 (0.209)

Notes: I use the interaction between the gravity pull measure x lagged immigrant density and the gravity pull measure x change in LAD level immigration as instruments for analysis in the IV specification. Hausman tests fail to provide evidence that the two specifications are not significantly different from each other.

4.5.6 House Price Effect Broken Down by Dwelling Type and Tenure

All previous results assumed the local housing market as a homogenous market and effect of immigration is constant across all dwelling types and tenure. However, this may not be realistic as the immigrant population is likely to reside disproportionately in one type or tenure than another. For this section, I broke down the house price effects by types and tenure to see where the negative effect is the most salient.

Table 11: House Price Effect Broken Down by Dwelling Type

Dependent Variable: Δ Log Median House Prices 2001-2011		
	OLS	IV
Detached	-0.112**	0.029
	(0.049)	(0.307)
Observations	26,543	26,543
R_squared	0.101	0.101
Attached	-0.077***	-0.401***
	(0.028)	(0.135)
Observations	34,129	34,129
R_squared	0.399	0.389
Flats	-0.186***	-0.993***
	(0.033)	(0.325)
Observations	20,535	20,535
R_squared	0.131	0.111

Notes: Standard errors are clustered at LSOA level and are included in parentheses. *** indicates significance at 1%; ** indicates significance at 5%; * indicates significance at 10%. Both specifications are equivalent to those in the main results: neighbourhood level characteristics are kept the same; however, housing attributes are adjusted to only include those from land registry data as dwelling characteristics from censuses are not broken down by type. In addition, when breaking down land registry transaction data, by type, it does not give a good coverage of LSOAs for all types, therefore I pool 2000, 2001 and 2002 together and treat it as a single year; similarly, I pool 2010, 2011 and 2012 data together to increase the number transactions for each LSOA.

From Table 11, the OLS specification indicates the largest reduction comes from the flat prices while the smallest comes from that of attached properties including semi-detached houses and terraced houses. However, effects from all types are generally small, almost negligible. Specifically, around 0.2% reduction in flat prices and almost 0.1% reduction in attached property price were associated with an increase in immigrant stocks equal to 1% of initial decade population. From the IV specification, the largest reduction still comes from the flat price, but there is no evidence on any change in price for detached properties. There is a modest decrease in price of attached properties. An increase in immigrant stocks equal to 1% of 2001 population has led to around 0.4% decrease in attached property price and around 1.0% decrease in flat price. This is somewhat consistent with the findings so far in the literature. Braakmann (2016) discovered that immigration has almost no effect on median prices overall and it decreases house prices at the lower end of the distribution where there could be a large concentration of flats.

Table 12: House Price Effect Broken Down by Dwelling Tenure

Dependent Variable: Δ Log Median House Prices 2001-2011		
	OLS	IV
Freehold Properties	-0.026	-0.532***
	(0.025)	(0.142)
Observations	34,121	34,121
R_Squared	0.402	0.382
Leasehold Properties	-0.147***	-1.083***
	(0.031)	(0.299)
Observations	24,308	24,308
R_Squared	0.121	0.094

Notes: Standard errors are clustered at LSOA level and are included in parentheses. *** indicates significance at 1%; ** indicates significance at 5%;* indicates significance at 10%. Both specifications are equivalent to those in the main results: neighbourhood level characteristics are kept the same; however, housing attributes are adjusted to only include those from land registry data as dwelling characteristics from censuses are not broken down by tenure. In addition, when breaking down land registry transaction data, by type, it does not give a good coverage of LSOAs for all types, therefore I pool 2000, 2001 and 2002 together and treat it as a single year; similarly, I pool 2010, 2011 and 2012 data together to increase the number of transactions for each LSOA.

A similar picture could be found by breaking down properties by housing tenure (Table 12). There is a larger negative effect coming from leasehold properties. In particular, the OLS model provides no evidence of any effect on freehold properties but a very small negative effect on leasehold properties. The IV specification gives out larger estimates for both, i.e. there is an around 0.5% price decrease in freehold properties and more than doubled the size of a decrease in price for leasehold properties. This is consistent with what's been found in the previous breakdown of results by dwelling types as the majority of the detached and semi-detached dwellings are freehold and the majority of the flats are leasehold.

Two reasons for finding larger negative effects from flats and leasehold properties could be provided: (1) immigrants' general lack of incentives to maintain their house living conditions may have led to a structural decline in housing quality; (2) there is an increase in supply either from the developers to build more accommodation or landlords dividing up existing units in response to increasing immigrant inflows.

Much of the literature has documented that the immigrant population are less likely to form families, live disproportionately in the private rented sector (Whitehead, 2011) and also at higher densities (Johnson et al., 2016) as well as their decision to stay longer term is uncertain. Hence, there is a strong motivation for them to choose cheap housing and in general to be less concerned about the standards and qualities of houses they live in. The usage of existing housing space would be different between the two groups: unlike natives, immigrants perhaps are willing to accept more crowded living conditions; and are less prone to spend on housing maintenance and refurbishments (or if they rent, their general lack of concern would provide less incentives for private landlords to spend on housing renovations). This would further reduce the quality of these types of properties or the fact that they are more likely to live together in the same housing stock would not increase demand by much, therefore house prices in these properties will be reduced substantially.

Although housing quality data are quite abundant for example those come from British Household Panel Survey (BHPS) and English Housing Survey, for the period and spatial unit concerned in this study, no suitable data are available to test if immigrants reduce quality of housing, especially by dwelling types. Sá (2014) has examined the link between immigration and housing quality at local authority level but found no evidence of immigrants leading to a structural decline in quality of housing. Additionally, evidence supporting the second hypothesis is provided in Braakmann (2016). There is evidence for increases in the number of available properties on the market and a shift from larger properties toward medium sized ones.

4.6 Conclusion

The chapter uses census data and land registry price paid data to examine the impact of immigration on the local housing market in England and Wales. The spatial study mainly uses the lower layer super output area (LSOA) between 2001 and 2011 but some analysis was carried out at output area (OA) level and census ward level. A first differenced model with the spatial diffusion instruments (Saiz and Wachter, 2011) is adopted to account for the endogeneity problem in modelling. Over the decade, there is a negative but almost negligible house price effect driven by immigration inflows: an increase in immigrant stocks equal to 1% of the total population in 2001 has led to an around 0.3% decrease in local house prices.

In addition, there is no evidence of native net out-migration response at the LSOA level of geography but literature seems to point to a substantial net native out-mobility at much larger spatial scale, e.g. local authorities (Sá, 2014; Braakmann, 2016). A 1% increase in immigrant stocks is associated with 0.7% increase in the share of native population at the LSOA level neighbourhoods. Native out-mobility is also examined at other geographical scales. An increase in immigrant stocks equal to 1% of the total population in 2001 has also led to an around 0.7% increase in the share of native population at the output area level, which is a smaller unit when compared to an LSOA. When conducting census ward level analysis on native mobility response, there is also a weak negative net out-migration rate induced by non-White population inflows, around -0.2%. Therefore, one concludes that for small neighbourhood spatial units, there is an overall net inflow of natives into an area triggered by non-White population inflows, very different from what's been found in larger spatial units.

To explore further the different moving patterns, an overall positive and weak net inflows of White households into a ward led by newly arriving non-Whites is mainly due to a larger rate of in-migration than out-migration. Short distance (within a ward) moves triggered are less common than long distance moves (out of a ward), which might suggest outflows are more likely to be associated

with job changes rather than being associated with local amenity or housing resource competition. In particular, an inflow of non-Whites equal to 1% of the previous decade population has led to a 0.1% increase in the short distance out-migration rate; a 0.7% increase in the long distance out-migration rate and a 0.9% increase in the in-migration rate. Besides, psychological processes such as homophily, heterophobia and metathesiophobia behind residential segregation are subtler to interpret. Some evidence in the empirical literature has pointed towards the existence of opposition attitudes towards immigration (Kauffman, 2014); however, from evidence of population flows, there are no native net outflows triggered by immigration inflows, segregation cannot be concluded from evidence of displacement led by immigration in general. One needs to further look into stratified skill and ethnic identity of native and immigrant group in order to explore the specific underlying motivation for displacement.

Additionally, to see which types of the indigenous Whites are displaced, the analysis is stratified across occupation groups. From the ward level analysis, White indigenous population at the top of the income distribution (top of the occupational ranking) tend to be displaced by non-White in-movers but those at the bottom of the income distribution (bottom of the occupational ranking) exhibit overall net inflows "in response" to non-White inflows. Specifically, there is a 0.02% decrease in White managers, a 0.06% decrease of Whites in administrative, secretarial and skilled trade roles, no significant effect on White professionals, 0.07% increase of Whites in service roles, and 0.13% increase of Whites in elementary occupations. In this light, there is some occupation-status based sorting or displacement, although the magnitude of effect is not very large, and negatively skewed towards low end occupations. Whether the overall income has decreased at the ward level is not conclusive from this piece of evidence.

To examine housing supply response to immigration, there is an around 0.2% (again very small) increase in housing supply stocks led by an increase in immigrant population equal to 1% share of 2001 population. The average effect on the share of overcrowded households (defined by households with greater than 1.5 persons per room) is almost negligible, around 0.05%. Looking across the 11 Government Office Regions, the effects of immigration on local overcrowding rates are broadly similar – all below 1% apart from Wales and Merseyside. Also, when looking at this effect across dwelling types and tenure, the author realises it is the flats and leasehold properties that had the most price reduction. While prices of detached properties are not reduced, prices for attached properties are reduced by 0.4% and prices for flats are reduced by 1.0%. Similarly, there is no evidence for price decrease for freehold properties, prices for leasehold properties are reduced by 1.1%. Since immigrants are most likely to live in flats (and leasehold properties) therefore they have direct influence on them, it could be the case that immigrants reduce the quality of housing due to their general lack of incentive for maintenance, or they increase the supply of units of these types.

Appendix

B1. Differences in Native Mobility Results between London and Non-London Neighbourhoods

B1. LSOA Level Results: London and Non-London Differences in Native Out-Mobility

Dependent Variable: % Change in Native Population				
		London LSOAs		
	OLS	IV1	IV2	IV3
Δ Share of Foreign Born	1.208***	0.525***	0.531***	0.629***
	(0.022)	(0.118)	(0.116)	(0.057)
% Share of Foreign Born in 2001	-0.073***	0.141***	0.139***	0.108***
	(0.010)	(0.042)	(0.041)	(0.023)
Observations	3958	3958	3958	3958
R^2	0.618	0.450	0.453	0.497
		Non-London LSOAs		
	OLS	IV1	IV2	IV3
Δ Share of Foreign Born	1.373***	-3.049*	1.292***	0.290***
	(0.035)	(1.691)	(0.115)	(0.102)
% Share of Foreign Born in 2001	-0.123***	1.455**	-0.094**	0.263***
	(0.015)	(0.606)	(0.041)	(0.042)
Observations	23,091	23,091	23,091	23,091
R^2	0.192	-	0.192	0.114

Notes. IV specification 1 only uses gravity pull measure, IV specification 2 uses both gravity pull measure and the measure interacted with lagged immigrant density in 2001; IV Specification 3 uses the previously mentioned interaction term as well as the interaction term between the gravity pull measure and the change in the share of local authority level immigrant population. The corresponding first stage results are: for London neighborhoods, model IV1 has first stage coefficients 0.008***(0.001) with F-Statistics 602.87; model IV2 has first stage coefficients 0.008***(0.005), -0.002(0.001) with F-Statistics 555.01; model IV3 has first stage coefficients -0.023***(0.004), 0.086*** (0.005) with F-Statistics 678.31. For non-London boroughs, model IV1 has first stage coefficients **-0.0005*****(0.0001) with F-Statistics 247.86; model IV2 has first stage coefficients 0.002***(0.0002), -0.029***(0.003) with F-Statistics 328.18; model IV3 has first stage coefficients -0.037***(0.002), 0.076***(0.004) with F-Statistics 427.30. Sargan test results show p-values to be 0.1470 (IV1) and 0.0881 (IV2) for London LSOAs and 0.0000 for non-London LSOAs.

The initial purpose of examining London and non-London differences is to check whether there is difference in native out-mobility response due to different scales of immigration shocks at the LSOA neighborhood level. The London areas tend to see stronger immigration inflows than non-London areas: the maximum net inflow into a London neighborhood is around 6.6% and this is only 0.4% in a Non-London neighborhood. Therefore, one expects that running models on London and non-London neighborhoods separately would lead to different results.

Specifically, the native mobility response models were run using both OLS and IV specifications for both London LSOAs and Non-London LSOAs. While the OLS estimates are positively biased due to the economic and housing factors attracting both natives and immigrants alike, the IV specifications also produce positive estimates for London neighbourhoods, but the results are not conclusive for non-London neighbourhoods as the gravity pull measure predicts poorly about the future immigrant inflows into an LSOA, perhaps due to small counts in this type of areas. One can see that spatial diffusion IVs produce good predictions for small geographies but not when the immigrant counts are small to begin with, i.e. no previous immigrant community is obvious to begin with. Even for London neighbourhoods where immigration shocks are supposed to be larger as the region constantly receives immigrants from different parts of the world, natives are not displaced by newly arriving immigrants and on the contrast, an increase in the immigrant stocks equal to 1% of the previous decade population leads to around 0.5% increase in the share of natives in specifications IV1

and IV2, and 0.6% increase in the share of natives in specification IV3. From here, one cannot conclude that natives would interact differently towards immigration shocks due to geographical, employment and economic differences of the regions, but certainly, the scale of immigration shocks is not a factor that leads to no evidence of native displacement. This is true because the effect is interpreted using percentage terms in the regression model, i.e. a 1% increase in immigrants would lead to β% change in native population change.

B2. Native Mobility Results across other Spatial Scales

Since in the main part of the chapter, native out-mobility response towards immigration at a lower layer super output area (LSOA) is not found, spatial units of alternative scales have also been tested to see what economic effects immigration would bring at different levels of geographical scales. The native displacement model has been run again for both output areas (smaller unit) and census ward level (larger unit).

To give a brief detail about the spatial units used in this chapter so far, "there are overall 175,434 output areas in England and Wales in 2011, the average population is 309 with 95% of OAs having a population of between 171 and 486; the average number of households is 129 with 95% of OAs having between 79 and 189 households." (ONS Output Geography, 2001). This level of geography resembles closely with that of a neighbourhood when compared to other larger geographies. On the other hand, there are 34,753 LSOAs in 2011 with an average population size of 1,614 and an average number of households of 672. 95% of the LSOAs have population between 2,240 and 4,824 and households between 473 and 1,000. The number of census wards recorded in 2011 is 8,570 with the average population of 6,543 (95% lie between 1527 and 16,943) and the average number of households of 2,726 (95% lie between 643 and 7,071).

Output Area Level Analysis

Table B2 shows results for native mobility response towards immigration at the output area level. An increase in the immigrant stocks equal to 1% of total population in 2001 has led to a 0.4% increase in the share of native population into an output area for the OLS specification, and a 0.7% increase in the share of native population into an output area for the IV specification. The first stage F-statistics sits well above 10 which is the threshold of the Stock-Yogo test for the case of 1 endogenous variable. Sargan test fails to reject the null at 5% under which the instruments are valid so that the IVs are exogenous in the model specification. From the results, there remains no native displacement effect in such a small spatial scale.

B2. Output Area (OA) Level Results

	Dependent Variable: % Change in Native Population	
	OLS	IV
Δ Share of Foreign Born	0.383***	0.676***
	(0.014)	(0.136)
% Share of Foreign Born in 2001	0.025**	-0.021
	(0.011)	(0.027)
LAD Fixed Effects	Yes	Yes
Instruments	No	Pull x Share Foreign Born in 2001 AND Pull x % Δ LAD
First Stage F-Statistics		
First Stage Coefficient:		129.85
Pull x Share Foreign Born in 2001		-0.104***
		(0.023)
Pull x % Δ LAD Immigration		0.322***
		(0.058)
Sargan Over-Identification Test (P-Value)		0.09
Observations	165,050	165,050
R^2	0.074	0.053

Notes: Standard errors are clustered at OA level and are included in parentheses. *** indicates significance at 1%; ** indicates significance at 5%; * indicates significance at 10%.

Census Ward Analysis

To examine residential sorting issues at the census ward level, I use White and non-White divide rather than the original country of birth definition commonly used in the main part of the chapter as the former has more detailed records on different types of moves. Specifically, I look at the effects of an inflow of non-White population into a ward on the in-migration rate, the within ward (short distance) out-migration rate, the outside-ward (long distance) out-migration rate and net out-migration rate of the White population. The four specifications are run separately for each type of move which range from the OLS, the IV specification with gravity pull measure only, the IV specification with the gravity pull measure and the gravity pull measure interacted with lagged non-White share in 2001, and the IV specification with the gravity pull measure interacted with lagged non-White share in 2001 and the gravity pull measure interacted with wider region change in non-White population share. The results of first stage and Sargan test of overidentifying restrictions are also included at the bottom of the table. The results are tabulated in B3.

B3. Census Ward Level Results on Native Mobility Response

	% Change in the Share of White Population			
	OLS	IV1a	IV1b	IV1c
Δ Share of Non-White Population	0.823***	-0.551*	-0.053	0.056
	(0.149)	(0.311)	(0.097)	(0.111)
% Share of Non-White Population in 2001	-0.423***	0.115	-0.080**	-0.123***
	(0.063)	(0.126)	(0.036)	(0.041)
Observations	8210	8210	8210	8210
R^2	0.192	0.023	0.123	0.139
	Change in In-Moving Rate of Whites			
	OLS	IV2a	IV2b	IV2c
Δ Share of Non-White Population	0.400***	0.865***	0.876***	0.795***
	(0.037)	(0.225)	(0.072)	(0.103)
% Share of Non-White Population in 2001	0.011	-0.172*	-0.176***	-0.144***
	(0.018)	(0.090)	(0.034)	(0.045)
Observations	8210	8210	8210	8210
R^2	0.345	0.232	0.226	0.263
	Short Distance (Within Ward) Out Moving Rate of Whites			
	OLS	IV3a	IV3b	IV3c
Δ Share of Non-White Population	0.067***	0.055	0.115***	0.115***
	(0.009)	(0.041)	(0.017)	(0.022)
% Share of Non-White Population in 2001	-0.010**	-0.006	-0.029***	-0.029***
	(0.004)	(0.016)	(0.008)	(0.010)
Observations	8210	8210	8210	8210
R^2	0.216	0.214	0.193	0.193
	Long Distance (Outside Ward) Out Moving Rate of Whites			
	OLS	IV4a	IV4b	IV4c
Δ Share of Non-White Population	0.290***	0.716***	0.700***	0.643***
	(0.028)	(0.181)	(0.056)	(0.082)
% Share of Non-White Population in 2001	0.032**	-0.135*	-0.129***	-0.107***
	(0.015)	(0.073)	(0.027)	(0.036)
Observations	8210	8210	8210	8210
R^2	0.380	0.232	0.243	0.278
	Net Out Migration Rate of Whites			
	OLS	IV5a	IV5b	IV5c
Δ Share of Non-White Population	-0.109***	-0.149**	-0.176***	-0.152***
	(0.013)	(0.061)	(0.022)	(0.029)
% Share of Non-White Population in 2001	0.021***	0.037	0.047***	0.038***
	(0.006)	(0.025)	(0.010)	(0.012)
Observations	8210	8210	8210	8210
R^2	0.146	0.140	0.129	0.139
Instruments	No	Pull	Pull AND Pull x Share Non-White Population in 2001	Pull x Share Non-White Population in 2001 AND Pull x % Δ LAD Non-White Population
First Stage F-Statistics		29.83	32.14	30.91
First Stage Coefficient:				
Pull		0.016***	0.044***	
		(0.003)	(0.003)	
Pull x Share Foreign Born in 2001			-0.088***	-0.076***
			(0.007)	(0.009)
Pull x % Δ LAD Immigration				0.235***
				(0.035)

Sargan over-identification test results show p-value to be 0.0606 for model IV1b, 0.1470 for model IV1c, 0.9144 for model IV2b, 0.0471 for model IV2c, 0.0135 for model IV3b, 0.0017 for model IV3c, 0.8493 for model IV4b, 0.1613 for model IV4c, 0.5131 for model IV5b and 0.0309 for model IV5c. These indicate for some models which have above 5% p-values, the instruments are exogenous while those models have p-values below 5%, IVs are endogenous. Based on the battery of tests, it seems that IV model b tends to have better performance on the whole. I will take more credit in specifications b. Standard errors are clustered at census ward level and are included in parentheses. *** indicates significance at 1%; ** indicates significance at 5%; * indicates significance at 10%.

Table B4 further investigates the effect of non-white population inflows on the % change in the share of white population across different occupation groups. The groups include: managers and senior officials, professional and technical occupations, administrative, secretarial and skilled trades, personal, sales or customer services, and operational and elementary occupations. The four specifications are continued to be used together with the spatial diffusion instruments to infer causal effects.

B4. White out-Mobility Response towards Immigration by Occupation Groups

Dependent Variable: % Change in Share of White Population				
		Managers and Senior Officials		
	OLS	IV1a	IV1b	IV1c
Δ Share of Non-White Population	0.058***	-0.059*	-0.015*	-0.006
	(0.009)	(0.031)	(0.009)	(0.010)
% Share of Non-White Population in 2001	-0.003	0.043***	0.026***	0.022***
	(0.004)	(0.012)	(0.004)	(0.004)
Observations	8210	8210	8210	8210
R^2	0.350	0.239	0.307	0.316
		Professional and Technical Occupations		
	OLS	IV2a	IV2b	IV2c
Δ Share of Non-White Population	0.184***	-0.128	-0.009	-0.016
	(0.034)	(0.100)	(0.025)	(0.036)
% Share of Non-White Population in 2001	-0.132***	-0.010	-0.056***	-0.054***
	(0.014)	(0.041)	(0.010)	(0.014)
Observations	8210	8210	8210	8210
R^2	0.223	0.087	0.170	0.167
		Administrative, Secretarial and Skilled Trades		
	OLS	IV3a	IV3b	IV3c
Δ Share of Non-White Population	0.074***	-0.163***	-0.059***	-0.027*
	(0.017)	(0.049)	(0.013)	(0.015)
% Share of Non-White Population in 2001	-0.038***	0.055***	0.015***	0.002
	(0.007)	(0.020)	(0.005)	(0.005)
Observations	8210	8210	8210	8210
R^2	0.224	-	0.138	0.175
		Personal, Sales or Customer Services		
	OLS	IV4a	IV4b	IV4c
Δ Share of Non-White Population	0.085***	0.110***	0.067***	0.058***
	(0.013)	(0.037)	(0.011)	(0.013)
% Share of Non-White Population in 2001	-0.055***	-0.065***	-0.048***	-0.045***
	(0.006)	(0.015)	(0.005)	(0.005)
Observations	8210	8210	8210	8210
R^2	0.254	0.249	0.251	0.248
		Operational and Elementary Occupations		
	OLS	IV5a	IV5b	IV5c
Δ Share of Non-White Population	0.097***	0.001	0.128***	0.165***
	(0.018)	(0.039)	(0.015)	(0.024)
% Share of Non-White Population in 2001	-0.004	0.034**	-0.016***	-0.031***
	(0.007)	(0.016)	(0.006)	(0.010)
Observations	8210	8210	8210	8210
R^2	0.237	0.189	0.232	0.213

Notes. Sargan Test results show p-value to be 0.0771 for model IV1b, 0.1435 for model IV1c, 0.0705 for model IV2b, 0.0116 for model IV2c, 0.0038 for model IV3b, 0.1006 for model IV3c, 0.1126 for model IV4b, 0.2921 for model IV4c, 0.0001 for model IV5b and 0.0230 for model IV5c. The range of p-values is mostly below 5%, indicating potential endogeneity of the instruments. The first stage results are the same as the ones in A2.

Chapter 5

Examining Key Factors Affecting Housing Deprivation and Overcrowding in England and Wales Experienced by Ethnic Groups

5.1 Introduction

In Chapter 4, the immigration impact on overcrowding was examined for England and Wales and it was found that immigrants contribute to the overall level of overcrowding only to a very small amount, around 0.5% using UK census data in 2001 and 2011. The contribution of immigrants to regional overcrowding is similar when using the occupancy rating measure, i.e., no distinct regional differences are found for immigrant effects on overcrowding. This chapter again focuses on high density living and overcrowding experiences that different ethnic group members face. The issue is important as it has detrimental impact on household members' wellbeing and family relationships as well as children's health and education (Gove, Hughs and Galle, 1979; Evans, Wells and Moch, 2003; Solari and Mare, 2012; Boyko and Cooper, 2014). The questions I focus here include how ethnic groups with different periods of arrival to the UK would experience different degree of housing deprivation and how a household's cultural backgrounds and financial circumstances would potentially affect their overcrowding experiences differently across ethnic groups.

In principle, the inflow of migrants into an area represents extra demand for housing. If adequate housing stocks are limited, the new comers will need to compromise, particularly if they face severe income and time constraints. As a result, they are likely to settle in more crowded living spaces, whether it be sharing dwellings with others or accommodating many family members in a small space. Therefore, the decision for a household to compromise to settle in an overcrowded living condition is perceived to be an interaction between one's personal circumstances, individual preferences led by cultural and ethnic traditions, and the availability of suitable housing in a neighbourhood within a specified timeframe. As such, there are divided opinions over whether overcrowding should be treated as primarily a type of housing deprivation or a life style choice adopted by households. Glazer (1967), for example, suggests that those who perceive overcrowding to be a problem would in general find ways to avoid it. This has emphasised the households' general inclination towards more housing space if permitted. The opposing side of view is generally due to the cultural background of migrants. For some ethnic minority groups, living in close intimacy within a dwelling unit demonstrates a household's collective behaviour and willingness to show mutual support towards each other. Given the specific housing type available in the UK, a high number of members in a housing unit may be perceived by outsiders as unacceptable, but it is conceivable that

the household members themselves might not consider it as a deprived living condition, either psychologically or physically. The chapter takes the stance in the former view that overcrowding should be treated as a type of housing deprivation, at least in the short term. The more persistent the experience is, the more severe the deprivation problem presents. Nevertheless, it remains important to disentangle the financial factors and cultural factors that could potentially explain household overcrowding experience differently across ethnic groups. One can think of the location decision as one that seeks to balance trade-offs between living space, access to employment and amenities, and proximity to friends, family and social networks. Individuals will have different preferences leading them to make different choices for a given set of income constraints, and these preferences, it is argued, are affected by cultural and ethnic backgrounds.

As household income or occupational status rise, these trade-offs become less restrictive, and migrants gain the financial ability to escape overcrowding (Spain, 1990; Myers & Woch, 1995) without compromising their need to access employment, amenities and so on. Other cultural and demographic factors include the size of household, the strength of co-ethnic clustering in space and the degree of internal mobility of the different ethnic groups. An increase of one extra person in a household always imposes strain on the capacity of the housing stock which raises the chance of the family experiencing an overcrowded living condition. Additionally, co-ethnic group clustering in space stems from a preference towards residing close to those who share similar ethnic backgrounds (Munshi, 2003; Bartel, 1989). On one hand, a high degree of mutual support would allow joint improvements in the group's living condition including housing; on the other hand, for an ethnic group that focuses more on individual achievement but limited mutual support, co-ethnic clustering is likely to represent a sustained level of housing deprivation. Furthermore, variation within the degree of internal mobility could arise from both cultural preferences and households' current financial circumstances. In general, higher income or occupational status permits greater mobility (Carlsson-Kanyama and Liden, 1999) and there also exist cross-cultural differences in migration aspirations (Benson and O'Reilly, 2009; Cohen and Jónsson, 2011). Cultural-led differences in mobility rates from one ethnic group to another would directly affect the extent to which their co-ethnic remain-ers experience overcrowding in an area. The motivations and meaning behind migration are usually interpreted differently by different ethnic groups; therefore, a higher rate of out-mobility would lead to different area level overcrowding results for different groups.

Besides these individual factors, the overcrowding rate of different ethnic groups could also respond to different local housing options. Specifically, we explore the house price effect, the effect of tenure composition as well as the mixes of different property sizes of an area across tenure forms on the overcrowding rate of each ethnic group. How would different ethnic groups interact with the local area housing conditions? This part of analysis mainly focuses on whether each group would

reduce overcrowding in response to higher house prices, larger size housing stocks and decreases in the share of social housing and privately rented stocks and whether they would increase overcrowding in response to lower house prices, smaller size housing stocks and increases in the share of social housing and privately rented stocks.

In particular, this chapter attempts to address the questions relating to individual ethnic group experiences in overcrowding in the recent census decade. Closely related studies include Saiz (2007) and Braakmann (2016), both of which expose the tendencies for immigrants to increase occupational densities in a dwelling unit. Other studies tend to focus more on the descriptive accounts of minority group households' housing experiences and choices, ranging from Peach (1998), Tomlins (1999) and Ferrari and Lee (2008). However, this area of research is particularly important as the evolution of income and socioeconomic status vary across ethnic groups and their preferences towards household size and inclination towards co-ethnic ties would develop differently over time. Therefore, it would be worthwhile examining the group-wide differences in overcrowding outcomes as well as factors that drive these outcomes. Overall, the contribution of this chapter towards literature is fourfold: (1) it firstly aims to investigate the contribution to overcrowding of each ethnic group by different years of arrival, in order to identify potentially any persistent overcrowding experiences for certain ethnic groups; (2) from both the financial and cultural dimensions, it secondly explores the relative importance of different individual factors in driving different overcrowding rates across ethnicities, these factors include length of settlement, occupational ranking, household size, internal mobility and degree of co-ethnic clustering in space; (3) it thirdly examines potential overcrowding responses of each ethnic group towards changes in several key local housing options such as housing values, property size mixes across tenures, and tenure compositions of areas; (4) it also summarises some important descriptive results that help understand the demographic, socioeconomic, and housing characteristics of ethnic minority groups in the UK in the recent census decade.

5.2 Background

5.2.1 Definition of Overcrowding

The housing career of different ethnic groups has been studied extensively in various literatures ranging from economics, sociology and urban studies. For both the indigenous and immigrant population, households are considered to possess a housing career. A series of life cycle transitions may need different types of housing. For example, during the time of education or initial stage of career, one is more likely to reside in private rented accommodation. After having children, or when children enter school age, the individual in question may need to search for larger housing space and start to consider owner-occupied properties to purchase or to mortgage. Housing hardship

can be experienced by both groups but the way they experience it, the motivations behind their housing choices and the constraints they face are all different. Settlement patterns of immigrants and integration from economic arena to social domain in the UK are reviewed in a range of literature including White (1998), Ellis and Wright (2005), Phillmore and Goodson (2006), Catney and Simpson (2010) and Luthra et al. (2014).

While housing deprivation is a multi-faceted concept, overcrowding is one of the main indicators commonly used in empirical studies (Townsend, 1979; Saiz, 2007; Braakmann, 2016). It usually represents the household's inability to find suitable accommodation to match household size and this could be due to various reasons which will be explored in later sections. The definition of overcrowding not only varies from country to country, but also changes from time to time. In the U.S., the classic definition of overcrowding used the number of persons per room. It considers any housing units with 1.01 or more persons per room to be overcrowded and units with more than 1.5 persons sharing a room to be severely overcrowded. In academic literature, there is no strictly valid ratio that determines overcrowding. However, a simple ratio is not sufficient to describe all aspects of overcrowding. Just as Fisher (1976) pointed out the definition [of overcrowding is] too narrow as it ignores many other dimensions that capture housing hardship. Firstly, the household could still be considered overcrowded with limited floor space per person even if there are plenty of rooms available within a unit. Secondly, the ratio does not consider the age and sex of household members; for instance, differing gender of siblings need more rooms than same gender siblings. Thirdly, the objective measure neglects the residents' subjective perception which could be potentially influenced by various other physical aspects of the housing units: the design and furnishing of the dwelling – room with a large double bed seems more overcrowded than a roll-away bed; access to sunlight, fresh air and other characteristics can now be provided by artificial ventilation, lighting and air conditioning now to many units, dwellings furnished this way could make people feel less crowded even with more number of people per room.

The definition of overcrowding given by World Health Organisation (WHO) is based more on the concern over certain types of disease transmission in overcrowded environments. Overcrowding is an important risk factor for a wide range of diseases such as pneumonia and tuberculosis. It mainly uses the average floor area per person as the key criterion. The EU definition of overcrowding is more nuanced and attempts to take into account household structure. The "Bedroom Standard" for the EU is defined as follows: a household is considered to be overcrowded if it has fewer rooms than the sum of: one room for the household, one room per couple in the household; one room for each single person aged 18 or more, one room per pair of single people of the same gender between 12 and 17 years of age, one room for each single person between 12 and 17 years of age and not included in the previous category, one room per pair of children under 12 years of age.

The official definition of overcrowding given in the UK is the statutory overcrowding standard established by Housing Act 1985 (Section 324) which is laid out as follows: "[overcrowding is defined such that] there are so many people in a house that any two or more of those persons, being ten or more years old, and of opposite sexes, not being persons living together as husband and wife, have to sleep in the same room".

For household members, children under ten are disregarded and the room does not need to specifically be a bedroom, but any living room and kitchen which could fit a bed. At the same time, floor space has also been used to define overcrowding (Lloyd, 2010). While the definition of overcrowding has been clearly set out in the related laws and regulations, in academic research, persons per room measure was used for empirical studies (Saiz, 2007; Braakmann, 2016). Specifically, an above 1.5 persons per room is considered for a household to experience overcrowding in the UK. In the past, the official census definition of overcrowding was changed in 1961 from two or more persons per room to over one and half and shows signs of being changed again in the 1970s (Townsend, 1979, pp.477).

An alternative measure has also been given in the census data. Occupancy ratings for bedrooms (and rooms) were collected for the first time in Census 2001. The rating shows whether a household is overcrowded or under-occupied. This is based on the number of bedrooms or rooms available minus the recommended bedroom standard, which is derived by applying a standard formula on the ages of the household members and their relationships to each other. An occupancy rating of -1 implies that a household has one fewer room/bedroom than required, whereas +1 implies that they have one more room/bedroom than the standard requirement. The English Housing Survey provides a similar measure that estimates the level of overcrowding based on the number of households living in properties that are one or more bedrooms below the "bedroom standard". This standard, which differs considerably from the statutory room/space standards, has been used to measure overcrowding since the 1960s. For this chapter, I use the occupancy rating to measure overcrowding in the models because I believe the number of persons per room measure underreports the severity of overcrowding as a dwelling unit includes kitchen and living room. However, I also ran the same model using the number of persons per room measure and included the results in the Appendix Section C4-C5.

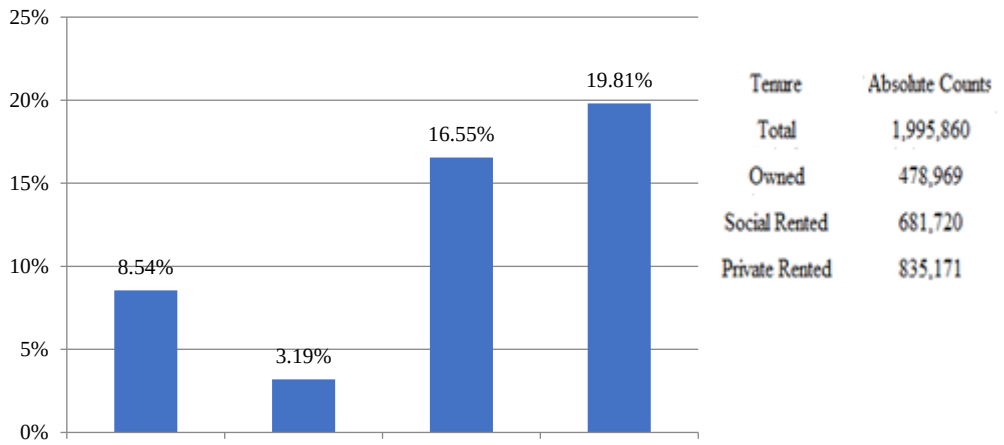
5.2.2. Extent of Overcrowding

In England and Wales, there are in total almost 2 million "overcrowded" households measured by occupancy rating, of which 479,000 dwelling stocks are owned, 682,000 stocks are socially rented, and 835,000 stocks are privately rented according to the Census 2011 data. When overcrowding is

measured by the number of persons per room being over 1.5, the total number of overcrowded households comes to around 122,000; of which 24,000 are owned, 38,000 are socially rented and 60,000 are privately rented. Overtime, there is no substantial variation in the level of overcrowding between year 2008 and 2015 (Data Source: English Housing Survey), remaining at around 4% of the total number of households. I now examine the extent of overcrowding by the following subcategories: tenure, region, ethnic group by tenure.

- *Overcrowding by Tenure*

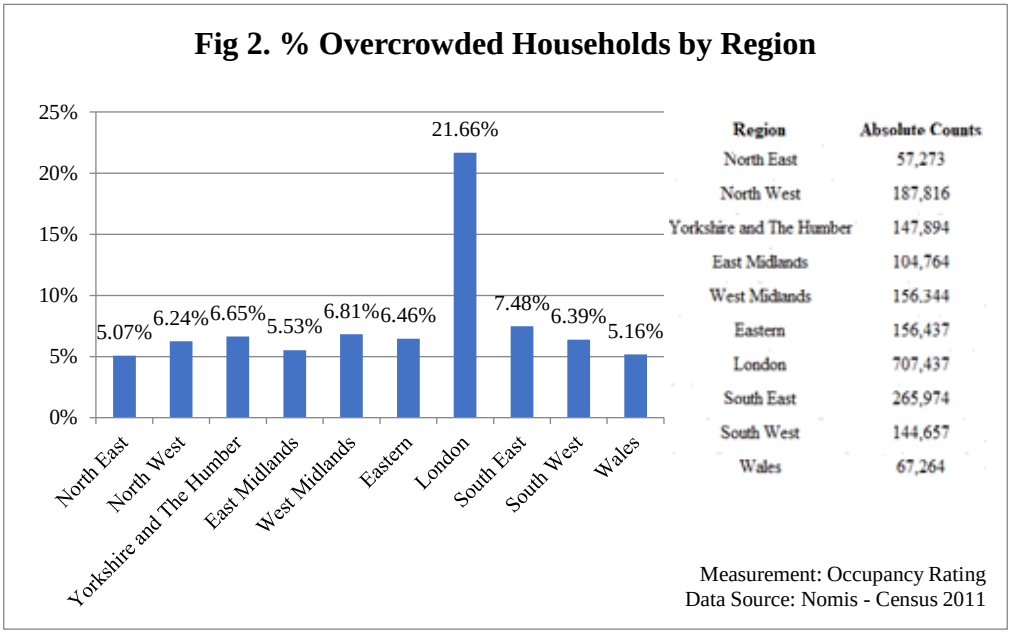
Fig 1. % Overcrowded Households by Tenure



Measurement: Occupancy Rating
Data Source: Nomis - Census 2011

From Fig 1, the level of overcrowding is mostly concentrated in socially rented and privately rented sectors. The percentage share of overcrowded households in ownership is only one-fifth of the share in socially rented sector and one-sixth of the share in privately rented sector.

- *Regional Breakdown of Overcrowded Households*



The % overcrowded households by region is shown in Fig 2. All the regions have around 5-7% overcrowded households apart from London with 22% overcrowded households in the region which reflects its much denser population. The absolute counts are also tabulated by the 10 regions at the side of the chart.

- *Ethnic Group Breakdown of Overcrowded Households*

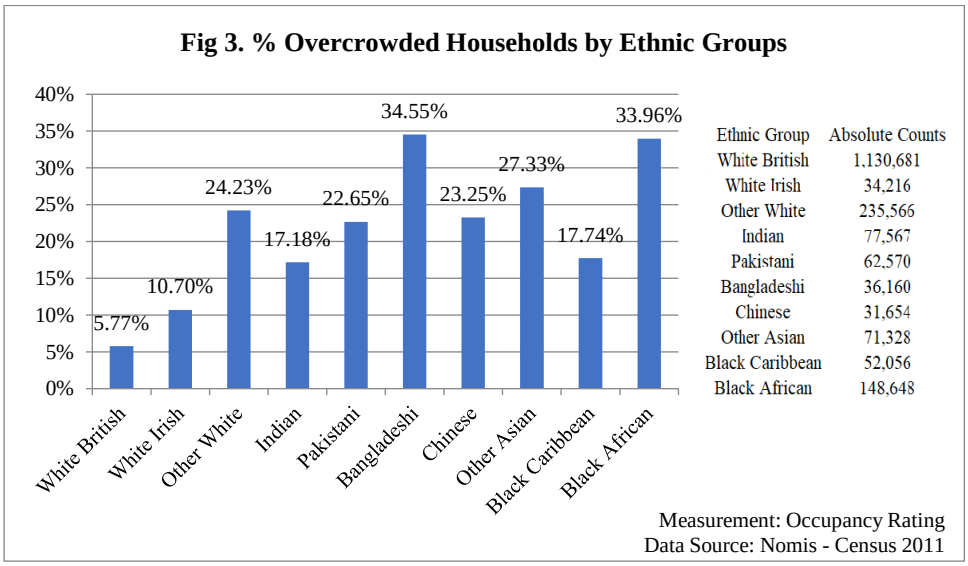
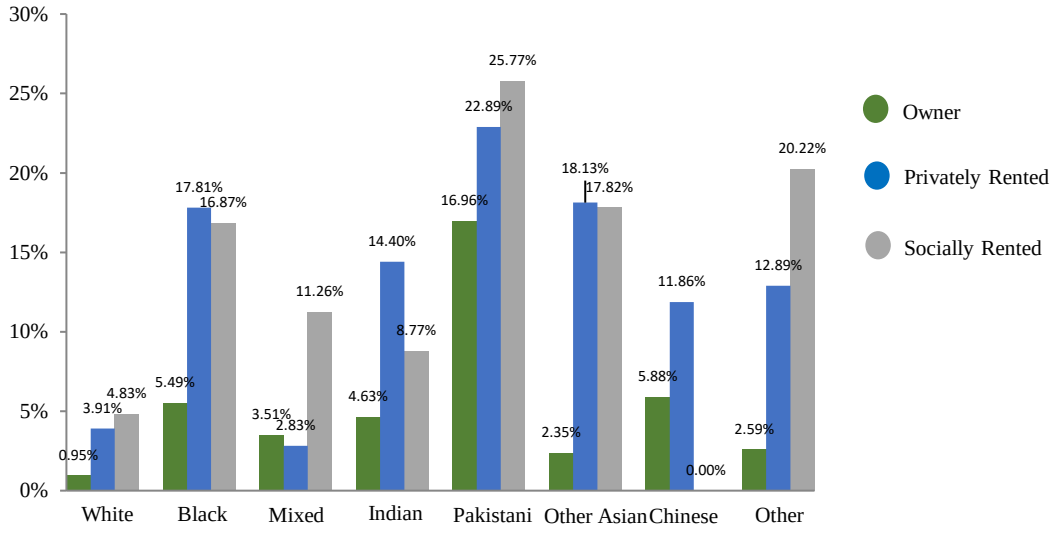


Fig 3. shows the breakdown of % overcrowded households by different ethnic groups. While the White British shows the lowest share of overcrowded households, its absolute count remains the largest out of all groups as shown by the actual numbers tabulated on the right of the chart. From the data, ethnic minority groups tend to have a higher proportion of the population experiencing overcrowding than the White British group. This suggests, overcrowding is not an ethnic minority group specific phenomenon and the drivers behind high density living are likely to be multi-faceted.

- *Overcrowding by Ethnic Group and Tenure*

Fig 4. % Overcrowded Households by Ethnic Group and Tenure



Measurement: Occupancy Rating
Data Source: English Housing Survey 2010-2012

The data used to derive the within ethnic group-tenure overcrowding rate is the English Housing Survey from year 2010 to year 2012. Majority of the overcrowding experience takes place for the ethnic minority group members in the private and social sectors. The exceptional case is for the Pakistani group (the category also includes the Bangladeshi) which has a substantially high share of overcrowded households in the owner-occupied sector. Across the different ethnic groups, the White population tends to have the lowest overall level of overcrowding and this is followed by the Mixed, Indian and Chinese groups. It is also worth noting that there is almost no presence of overcrowding for Chinese group in the social housing sector. However, the Black group (including Black Africans and Black Caribbean) and the Pakistani group show substantially high level of overcrowding across all sectors.

5.2.3 Impact of Overcrowding

The impact of overcrowding on individuals is examined initially and comprehensively in Baldasarre (1979). Throughout the analysis, the book was not just examining about increasing density in a dwelling unit, but also about increasing density within an urban space. The dimensions affected by crowded home living are multi-faceted. On one hand, dense urban life raises the level of *crime and violence* and unmet housing needs could cause *social problems* (Morris & Winter, 1975; Fischer, 1984); on the other hand, overcrowding could seriously affect household member's mental health, physical health, life satisfaction and general well-being (Gove, Hughs and Galle, 1979; Evans, Wells and Moch, 2003; Boyko and Cooper, 2014). The effects of overcrowding on *family structures and family relationships* are also challenging, although the area of empirical research has been less developed compared to its health and education counterparts. Limited housing resources may force families to alter family structures and to reduce their sizes, e.g. through reducing the number of children born to the family or making children leave home early. It also affects the role performance of family members forcing them to adapt to space shortages. Unnecessary frictions could also be raised due to loss of privacy and perceived unfair allocation of spaces among family members.

Additionally, the effect is asymmetric across subgroups with certain types of people affected more than others. For example, children are more vulnerable to the impact of high density situations than adults. Evidence has found that children experience social deficits (Mitchell, 1971; Davis et al., 1974), impairments in well-being (Booth and Johnson, 1975; Rodin, 1976; Solari and Mare, 2012) and deterioration in school performance (Goux and Maurin, 2003) when living in crowded conditions. Mothers in overcrowded homes are also found to be more stressed, leading to mental health issues (Gove et al., 1977). The impact on overcrowding tends to be different for different groups, e.g. those from different socioeconomic groups, those at different stages of life cycles as well as those with different psychological attributes. The research on these subgroup effects of overcrowding are not explored at length in this chapter.

In the UK overcrowding literature, quantitative methodologies measuring the health and education impact of overcrowding mainly reside in health economics and epidemiological research. Martin (1976) found that coughs, colds, asthmas, influenza and diarrhoea are associated with household size and number of children per household. Brennan and Lancashire (1978) found a clear association between housing density and children mortality under 5 years. Williams and Lloyd (1990) found weak correlations between crowding and stillbirths and prenatal mortality. Ranson (1991) in the British National Child Development Study showed that children in crowded homes were more likely than others to miss school for medical reasons. Health outcomes of overcrowding with respect to different ethnic groups were examined by Smith et al. (1992) and Ambrose (1996). It was found that

minority ethnic groups living in crowded housing experienced particular problems with cold, damp and similar illnesses. Because overcrowding is concentrated in London, many reports look only at this region. Reports have been produced by several charity organisations include Shelter (2005), Lloyd (2010), 4in10 (2012) and Runnymede Trust (2014). The Labour Government also published reports examining the impact of overcrowding on health and education in 2012. These studies were mainly qualitative, providing personal accounts and experiences of members of overcrowded households especially children. Overall, several key findings are identified that black and minority ethnic households (BMEs) are more likely to overcrowd than their White British counterparts; the negative effects on children tends to range from missing homework, to the deterioration in family relationships as a result of increasing depression, anxiety and stress in crowded living space.

Baldasarre (1979) suggested that overcrowding may not be as detrimental as one might initially expect, since people can adapt to constrained environments by re-organising their space and reducing their unwanted contacts or limiting the time spent with these contacts through various means, e.g. increasing outdoor activities and time in other local amenities and generating more efficient coordination among family members over daily schedules. Myers et al. (1996) also argued that overcrowding does not necessarily have harmful effects on families (contradicting many previous empirical studies). Instead, it was thought to be merely socially distasteful to outsiders who observe its presence. Indeed, overcrowding could arise from an ethnic group's distinct life style choice such that living in a crowded dwelling demonstrates the tendency for providing mutual support or to manage migration by family members. For example, Pader (1994) conducted a study of Mexican households living in Los Angeles in which she found sharing a bed to be seen as preferable and normal reflecting their desired values of interdependence and sharing. The cultural appropriateness of overcrowding in this case violates the assumption of physical privacy, independence and individualism typically found in White ethnic groups. It is their preference to have a large family unit that is simply undividable, e.g. many children and elderly in the family.

Alternatively, overcrowding could be perceived to be merely a process of self-correction upon arrival in the destination country where migrants face conflicting priorities within a short time limit restricted by immigration regulations. Migrant households may accept the temporary compromise of living in crowded housing until their employment prospects improve which prepares them for better housing at a later stage. Therefore, overcrowding may be only a short-term socioeconomic deprivation which could be mitigated over a longer period of settlement. However, the more severe is the problem the greater the imbalance between local residents' income and employment conditions and the housing market in an area, leading to affordability issues. It is not uncommon to observe households sharing a dwelling unit with other households or compromising on living space in order to live in high housing cost areas. In this case, overcrowding is again another measure taken for households in

response to high house prices in an area while attempting to stay close to employment. Other things being equal, we would still expect households to exhibit a preference for larger housing space which allow them to enjoy more freedom, perform more household activities and endow them a higher socioeconomic status (Hirsch, 2005; Frank, 2007).

Therefore, unmet housing needs will always exist but the problem only becomes severe if it is structural and persistent, e.g. if an ethnic group interacting with the current housing system has generated persistent level of overcrowding; or, if it has detrimental effects on vulnerable groups such as women and children. Whether this is an important policy issue depends very much on firstly, the ability of a migrant household to self-correct the overcrowding situation within an appropriate timeframe; and secondly, to what extent adjustments in the housing system to minority member groups or rehousing could improve housing satisfaction.

The remainder of this chapter attempts to analyse the issue in order to achieve a clearer understanding of both migrant households' housing behaviours pertaining to their ethnicity characteristics and the role of the current housing system (i.e. key housing attributes in areas) that play in minority group overcrowding. It is assumed, adjustment mechanisms vary from individual household to household but there could still be patterns drawn across ethnic groups. Some may compromise employment and housing for co-ethnic social capital while others would prefer the opposite compromise. We also recognise that households may cut household sizes to devote more resources to achieve higher occupational status and vice versa, so there are potential interactions with household formation and fertility issues which are not explored at length here.

5.3 Literature Review

5.3.1 Related Empirical Studies Examining Housing Effects across Ethnicities

It would be worthwhile looking at individual ethnic group contribution towards local overcrowding rates since most research in the UK have so far only examined potential housing deprivation experiences of immigrant groups. However, one needs to recognise that the immigrant population is not a homogenous group and each individual group possesses disparate but not mutually exclusive socioeconomic and cultural profiles. Key empirical studies worth highlighting that examine overcrowding experience of immigrants include Braakmann (2016) for the UK and Saiz (2007) for the U.S. Neither of these studies disaggregated the effect by different ethnic groups. Searching through the wider literature examining ethnic group differences in behaviours within their housing careers, the topics could range from homeownership (Alba & Logan, 1992; Painter, Yang & Yu, 2004; Haurin & Rosenthal, 2007), housing deprivation mainly around overcrowding (Myers & Lee, 1996;

Clark et al., 2000; Painter & Yu, 2010), to other housing consumptions (Fan, 1998; Fan & Lewis, 1999; Dyer et al., 2006). However, these studies all come from the U.S.

For example, Alba & Logan (1992) looked at home ownership patterns across various ethnic groups in the United States. Based on analysis of a logistic regression model, determinants that explain ethnic group differences in home attainment could be both individual and contextual. The former is directed by the assimilation theory and the latter is directed by the social stratification theory.

On the one hand, the assimilation perspective considers the difference between recent arrivals and long settled immigrants. Similar to education and occupation advancement, homeownership is a result of acculturation and social mobility improvement of minority group members. Clearly, advancements in different dimensions are interrelated. As one's education level and income level rise, they are more likely to acquire homeownership status. Therefore, a range of individual level variables could well describe the likelihood of ownership for immigrants.

On the other hand, the stratification approach suggests group membership is an important determinant of housing ownership. In particular, "homeownership [is considered] a critical gatekeeper in mapping hierarchically ordered groups into locations." (Alba & Logan, 1992, p1318). Therefore, factors influencing the likelihood of housing ownership ought to be more contextual rather than individual. Applying to the specific context of the U.S., suburbanisation is a process that constant out-migration of the majority of White households in search of larger housing space, i.e. acquiring owner-occupied properties as opposed to living in crowded conditions in the central city. Hence, the suburban areas are mainly concentrated with owner-occupied housing from which most minority groups are excluded. Their housing options remain in the inner-city areas where "the likelihood of their homeownership would be especially sensitive to the relative availability and cost of owned versus rented housing, but relatively affected by characteristics of the suburban [housing] market." (Alba & Logan, 1992, p1319).

The findings show that the determinants derived from both theories are powerful in explaining ethnic group differences in home attainment, reflecting the fact that not only the decision to buy a home is a result of change in ethnic minority group's individual circumstances, e.g. determination in long term settlement in the destination or representation of advancements in one's own socioeconomic status, but also is sensitive towards shocks in local housing conditions of the inner cities.

Other articles also looked at specific ethnic groups and identified specific factors that would affect their likelihood of home ownership. Haurin & Rosenthal (2007) also examined ethnic group

differences in home ownership but took the perspective of controlling for within group propensity to form households. While the paper does not consider overcrowding per se, the methods and findings are relevant to the present study as the authors explore housing size and location decisions and the effect of ethnicity. It was found that after controlling for differences in household formation behaviours, the White-Black homeownership gaps become more severe, but the reverse is true for White-Hispanics gaps. Studies analysing ethnic group effects on other aspects of housing include Fan and Lewis (1999) and Dyer et al. (2006). The first article investigates the differences in household budget allocation patterns across various ethnic groups with a focus on African Americans. They found the group of focus has a significantly different spending practice from Asian Americans, Hispanic Americans and Caucasian Americans. The second article examines ethnicity effects specifically on durable and non-durable home furnishing expenditure. Significant effects are also found from empirical models. Another interesting article attempted to investigate each different ethnic minority group's change in household size as their period of settlement becomes longer and to what extent the local geographic concentration of co-ethnic group would impact on minority group's household size (Cartney & Simpson, 2014). The findings suggest that the differences between household sizes of ethnic groups will converge over time. Household size would likely be in decline if minority group families live in areas of lower co-ethnic concentration and this decrease are mainly attributable to changes in the number of children per household than adults.

The focus of this chapter is on housing deprivation and overcrowding across ethnic groups. While quantitative studies remained limited, there is substantial amount of qualitative research on the issue. For instance, Peach (1998) has dealt the issue with housing choice and constraint for specific ethnic minority groups in Britain, particularly for South Asian and Caribbean ethnic minorities. The tenure preferences within each ethnic group are contrasted and compared as well as how macroeconomic conditions in Britain would lead to the evolution of their migration and settlement patterns. Tomlins (1999) has also reviewed in detail ethnic minority groups' housing experiences in the UK including the overcrowding experiences. By drawing insights from minority group's cultural practices, their housing choices and constraints are examined. It was noted that certain types of ethnic groups such as Pakistani and some Asian communities show cultural antipathy towards local authority housing. While the Pakistani group shows in general a distinct preference towards owner-occupied properties even of a low physical quality, some Asian groups were deterred from social housing since the form of tenure is considered "welfare tenure" and is often treated as a last resort. In addition, potential discriminatory practices and stereotypical treatments in minority groups' housing outcomes were also documented, providing a detailed review for the housing experiences of ethnic minority groups by the time it was written. More recent examination of spatial, ethnic and tenure patterns in England is found in Ferrari and Lee (2008). By combining past historical housing conditions, areas of

specific ethnic group population growth were identified as well as how housing tenure are changed over time and spatially to meet ever-changing neighbourhood aspirations. Housing renewal programmes are usually in place to accommodate these demographic and population changes in space. For historical reasons, housing demand in England and Wales show significant regional patterns due to different economic processes from de-industrialisation in North and Midland regions, an expansion of the tertiary economies to suburbanisation in London and South East regions. Therefore, substantial variation in house prices should expect to be observed across space which in turn lead to geographically different settlement patterns across ethnic groups. In the most recent census decade, the tenure preferences had hardly changed across ethnic groups when compared to 20 years ago (see Fig. 6). However, it is worth noting that Chinese and Africans have shown increased share of homeownership and the private rented sector for the Other White group has expanded since 2001.

However, little research so far has looked at key drivers influencing the degree of area level overcrowding across ethnic groups as well as the persistency in overcrowding potentially experienced by them. By focusing on both cultural and financial dimensions, the chapter aims to test a list of ethnicity specific factors in affecting the overcrowding situations of each individual ethnic group through an empirical quantitative model. By disaggregating population flows by different periods of arrival into the UK, the effect of each inflow on overcrowding rate is estimated in order to identify any persistency in housing deprivation potentially experienced by any ethnic group. Also, overcrowding responses towards a range of local housing attributes are examined and these include house prices, property size mixes across tenures and tenure compositions of areas.

5.3.2 Factors Affecting Overcrowding

The chapter examines individual ethnic group specific factors and local level housing attributes that lead to variation in the degree of overcrowding across different ethnic groups.

- *Length of Settlement*

In order to settle in the UK, immigrants face different time constraints imposed through immigrant regulations and visa expiratory deadlines. This would greatly reduce the likelihood of adequate housing search that meets the immigrant household demand. Generally, households which settle for longer in the UK would find themselves more at ease to obtain adequate housing resources for the family. This is because, longer length of settlement may be an indication of the household's labour market stability, better knowledge of local housing markets and amenities, as well as stronger assimilation within the surrounding neighbourhood. Therefore, one would expect that across ethnic

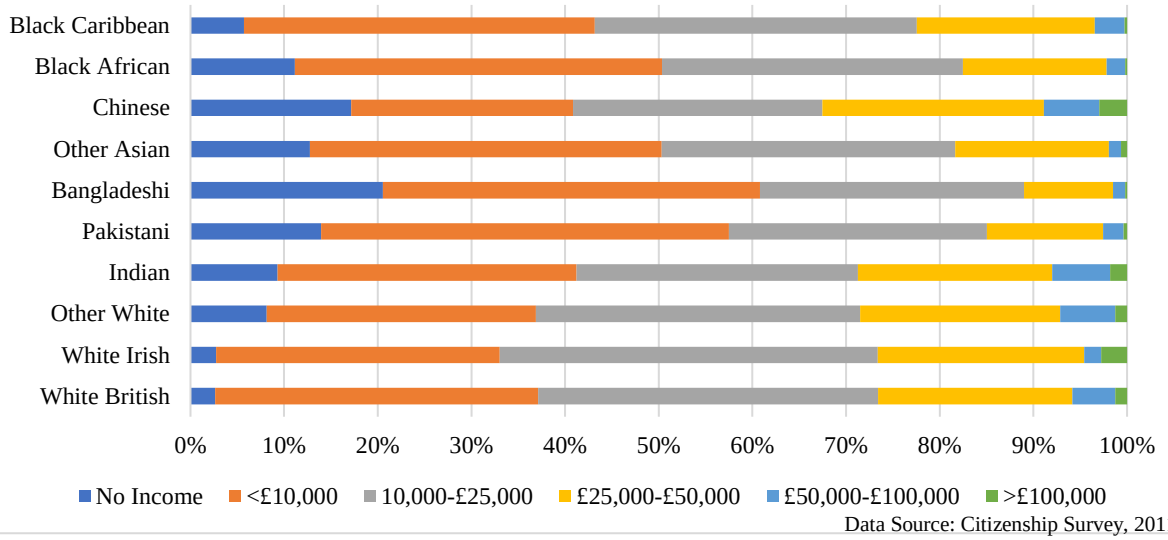
groups, most recently arrived cohorts are more likely to overcrowd and early arrivals tend to reduce their overcrowding experience.

- *Financial Capability – Occupational Ranking and Wage*

A household's financial capability is a crucial determinant in their decision of whether or not they would compromise in an overcrowded living arrangement. I use both occupational ranking and hourly wage as indicators of financial capability of each ethnic group in each area. In general, housing space is considered a normal good that rises with income simply because households would use the extra money to purchase larger housing space which permits them to enjoy greater comfort and to perform more household activities. Besides, a rise in occupational ranking would have a similar effect. Not only it would raise the income of the household, but also raise the socioeconomic status of the household which in turn increases the chance for the household to acquire more housing space to reflect the improvement in their status (Hirsch, 2005; Frank, 2007). On the other hand, having a lower income or occupational status is more likely to encourage cost savings and reduced consumption on housing space.

According to Fig. 5, the UK national income distributions are found to be similar across ethnic groups between £10,000 and £25,000 that takes up the majority of the population, therefore it is not unreasonable to hypothesise that the effect of moving up 1 occupational ranking or increasing 1 unit of income would have not very much difference on overcrowding among these ethnic groups. Extreme income values tend to vary much more across groups: for example, Bangladeshi and Chinese tend to have higher rate of no income households; Bangladeshi and Pakistani have lower share of households with income greater than £25,000. Overall, a rise in average income or occupational status of an ethnic group would increase their capability and desire to acquire more housing space therefore reduce their corresponding group level of overcrowding.

Fig 5. % Ethnic Group Population Share by Income Bands



Data Source: Citizenship Survey, 2011

- *Household Size*

The tenure and size structure of the UK housing stocks are relatively fixed, i.e. there only exists a limited range of size options across tenure forms; the number of rooms allowed in any given stock is around 4 to 5, with properties of more than 8 rooms being generally rare (Statistics from Census Open Data). However, household size varies to a much larger extent across ethnic groups led by differences in economic circumstances and cultural practices of each (Tomlins, 1999, p13). Given this particular imbalance, it is hypothesised that a one extra person in the average household would always raise the group's chance of experiencing crowding.

- *Internal Mobility*

Due to disparate evolution of histories and cultures, different ethnic groups would take distinct perspectives over the motivation and the aspiration to migrate. There is a body of literature orienting towards individual migrant incentives to move and meanings of migration has been interpreted at the individual level (Hahn and Klute, 2007), but Syed Ali (2007) defined migration to be a learned social behaviour such that people learn to migrate, they learn to desire to migrate. However, the theory of migration culture more useful for establishing the results in this chapter perhaps comes from Cohen and Johnson (2011), which theorised the concept of migration to be more of a kind of cultural value: the aspiration to migrate is transmitted across generations and between people through social networks. Therefore, migration habit is considered "in their blood". These movements are often perceived as a solution to remove social stasis, unemployment and deprivation. Additionally, these migrants would have profound influence on the remain-ers in the neighbourhood of their source country, motivating and encouraging them to aspire socioeconomic progress. This cultural expression is very different from that of life style migration. The latter has grown as a result

of particular historical and material conditions, particularly globalisation, increased mobility, flexibility and increased relative wealth. Life style migrants are prompted to move in search of a better way of life with some sort of ideology of escape (Tremblay and O'Reilly, 2004; Benson, 2007; Benson and O'Reilly, 2009). Residential tourism such as short-term residence, second-home ownership and extended holidays is one example of lifestyle migration. Other motivations for migration include flight from undesirable neighbourhood traits, work travel and personnel transfer in alternative locations but these typically happen to more affluent individuals. In general, one tends to find more life style migrants, more professional travellers and fewer deprivation-escaping migrants in the developed world where individuals tend to possess more economic privilege, while for some developing countries, migration is more widely accepted as a vehicle for economic mobility and there would be a smaller proportion of life style migrants and professional travellers.

Since the purpose of migration is closely tied with the historical, economic and geographical conditions of migrants' origin countries, it is hypothesised that ethnic groups which use migration to achieve economic mobility give migrants opportunities to reduce overcrowding as well as the chance to reduce the overcrowding rate of co-ethnic cohort in their neighbourhood of origin if potential chained migration (Peach, 1998) could take the co-ethnic members out of the deprived neighbourhood and their migration provide a source of inspiration that encourage remain-ers to migrate as well (Cohen and Johnson, 2011); however, if migration does not create chain effect or provide economic resources back to the deprived area, high level of housing deprivation only force people to move out, then one would observe high level of overcrowding to positively coincident with high level of migration flows (Peach, 1998). For example, between 1973 and 1996, the oil crisis and a series of economic restructuring under the Thatcher government has led to a substantial level of reduction in production and employment, directly hurting the minority communities. Immigrants have chosen to relocate and establish themselves in new localities through chained migration.

However, those ethnic groups who don't use migration as a way to reduce overcrowding but migrate for alternative purposes such as change of life styles or professional travels, would have little effect on the existing overcrowded households in their place of origin. Therefore, to a large degree it depends on individual ethnic group's own settling experiences under different economic and social constraints which led to the housing patterns we observe today.

- *Co-ethnic clustering in Space*

According to Hofstede's cultural dimension theory (Hofstede, 1980), there are two main types of culture: individualist and collectivist. The former refers to a society in which ties between individuals are loose and everyone is expected to look after him/herself and his/her immediate family (Hofstede, 2011). The latter refers to a society in which people are cohesively integrated (Bhugra, 2004). For individualistic ethnic groups, individuals are rational and able to make personal choices and the interaction among them is based on equality, equity, non-interference and detachability. However, the collectivist ethnic groups tend to support common good and social harmony. Individuals are bound by relationships and are encouraged to put other people and the group's interest before their own. Although it is recognised that one ethnic group could share many similarities in terms of culture with another ethnic group, therefore one cannot simply rank groups by culture, i.e. being more "cultural" or less "cultural"; however, the idea of individualism and collectivism is one of the perspectives that might potentially explain different degree of mutual support towards co-ethnic members across ethnic groups. For this analysis, I use spatial residential clustering (i.e. the size of ethnic minority group enclave) as a proxy to predict the level of mutual support each group shows towards its co-ethnic members, in turn inferring the relative collective-ness for each at the destination country. Specifically, the larger the minority group enclave, the more likely members exhibit habits to show support to alleviate deprivation to each other and vice versa.

For this reason, for collectivistic ethnic minority groups, the larger a concentration, the members are more likely to gain through mutual support (Qadeer and Kumar, 2006; Basolo and Nguyen, 2009), e.g. alleviating deprivation; and for individual ethnic minority groups, having a larger concentration might not have much effect on member's welfare (Xie and Gough, 2011). This leads to two opposing effects of ethnic minority group enclave on their housing deprivation experiences. On one hand, the larger the minority enclave, the greater the chances of survival and assimilation for minority group members. In other words, co-ethnic networks are helpful when new arrivals try to settle in an area. Specific channels that facilitate new migrants to settle and assimilate within the main stream society cover a variety of dimensions from language, traditions and life styles (Bartel, 1989; Munshi, 2003). On the other hand, for more individualistic ethnic minority groups, individual achievement such as occupational and educational status are more effective channels for economic mobility, therefore the presence of a larger minority group enclave could have little association with group members' deprivation. Following from this argument, a higher rate of residential clustering is more likely to help new arrivals (either just arrived at the UK from an outside country or moved in from other parts of the UK) to secure suitable housing if the ethnic group under investigation is more collectivistic and if the group is more individualistic, co-ethnic community has little effect on group members' housing deprivation outcomes. The degree of mutual support or collective-ness is proxied

by how each ethnic group spatially cluster and its effect on overcrowding will be tested through an empirical model for each ethnic group.

However, one should also recognise that the analysis does not explore why certain groups behave collectivistically or individualistically. On one hand, it could be the inherent cultural practice they bring from their origin countries; on the other hand, it could also depend on their relations with the indigenous households and the wider society: for instance, closer geographical proximity with respect to UK allows better knowledge sharing of institutions, laws and regulations permitting the ethnic minority group to act more individualistically, local tolerance towards foreign cultures, housing market discriminatory practices such as landlords and estate agencies' xenophobic behaviours ranging from refusal to let to discriminating against minority households during housing resources provision, ethnic or racial harassment when being alone in the ethnic majority group (Nandi,2017) etc.. Apart from interpreting the size of enclave as the cultural practice of immigrants or attempt for value preservation, it could also an instinctive survival mode that's adopted by the group. Co-ethnic mutual support could be interpreted as a counter response against discrimination or harassment. Additionally, ethnic groups which behave collectivistically at a destination does not mean that they need to be collectivistic at the origin. However, in general, despite that many different factors could a group's internal mutual support, the size of spatial enclave is treated as a strong proxy for it. That is, a bigger an enclave, the more likely to members would show support or share resources with each other.

while, minority group communities could indicate the group's preference of sticking close to each other, to one extreme, it could also be interpreted as a counter-discriminatory measure in the housing market to escape housing/economic deprivation at their origin neighbourhoods. That is, mutual support is likely to be a counter response towards individual or institutional level discriminatory practices in the housing market; if one is not able to obtain adequate housing resources through official means, one is more likely to rely on their co-ethnic networks to achieve this.

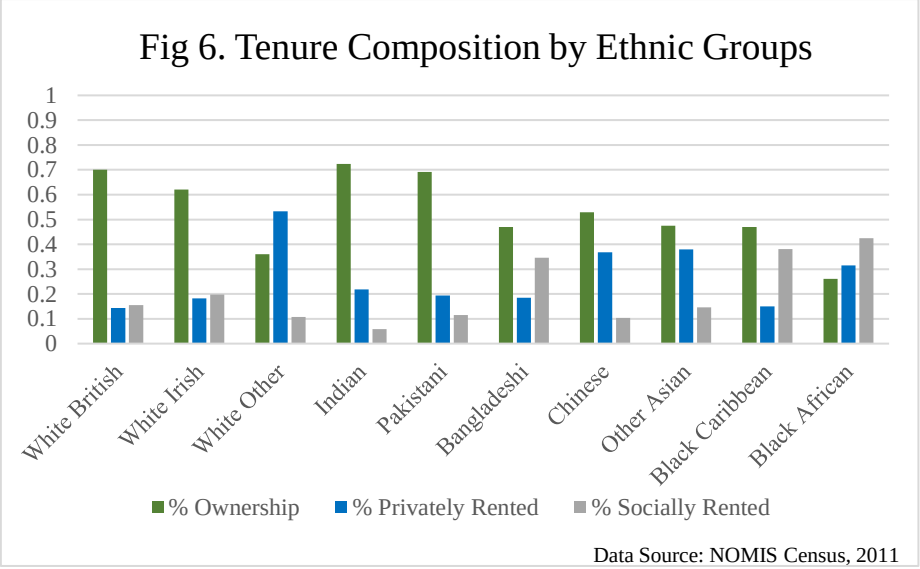
As mentioned in Tomlins (1999), housing option availability is also crucial in determining overcrowding outcomes, the range of local housing attributes of different prices, sizes and types available in each local authority is considered. If suitable options are limited, an in-moving household may choose to overcrowd, given a specific set of time and income constraints and cultural preferences.

- *House Price Index*

How do different ethnic groups would respond to changes in local house prices? A rise in house prices would imply an increase in capital gains for house owners but a rise in cost of living for private renters and social housing dwellers. For house owners, a rise in house prices would allow them to see a rise in the values of their properties and especially if they do not live in the dwelling themselves, they would receive increasing financial returns from their investments. This gives them stronger financial capabilities and greater incentives to escape overcrowding. For renters, an increase in house prices often leads to increases in the cost of living because high house prices deter first time home buyers to buy houses that leave them to face the option of paying expensive rents and also in the buy-to-let market, mortgage owners tend to put up rents in response to house price rises so the renters need to share the burden. Therefore, we hypothesise that ethnic groups with disproportionately larger presence in the owner-occupied sectors would experience a boost in the financial strength of the households therefore reduce their corresponding share of overcrowded population in the area whereas, ethnic groups with disproportionately larger presence in privately rented and social housing sectors would see their cost of living rise through the rise of the index therefore increase their group level overcrowding rate as a potential response.

- *Tenure*

Given the specific tenure structure of the UK housing market, different ethnic groups tend to reside disproportionally in different sectors, depending on their own financial capabilities at the time as well as their short-term and long-term aspirations. The data in Fig 6. are derived from 2011 Census. As one can see, the White British, White Irish, Indian and Pakistani groups tend to have comparatively high rate of home ownership; the White Other, Chinese, Other Asian and Black African also have a relatively stronger presence in the privately rented sector and it was the Bangladeshi, Black Caribbean and Black African groups which have relatively large proportions residing within the social housing sector.



Over the years, the social housing sector has gone through residualisation and presents itself as a stigma for local neighbourhoods. Residents in them are typically stereotyped as underclass (Taylor, 1998; Wassenberg, 2004; Hastings, 2004). The properties in this sector are managed by housing associations and social registered landlords and two most commonly found problems for residents is firstly, an inefficient use of space and secondly, mobility restriction.

The inefficient use of space in general arises from a mismatch between household size and property size. Under-occupation creates problems in social housing as households lack incentives to search alternative housing to free up space for other deprived households which potentially need larger space. In addition, the restricted mobility within the sector is mainly due to a slow process of transfer across geographical locations. To move to social housing in another location, residents are usually required to go through lengthy procedures. Typically, there is a long waiting list for applying to a social housing unit and benefit entitlements are in general not transferrable to the destination location. Due to these reasons, residing in a social housing unit strictly reduces a household's incentive to move, creating situations for them to compromise in more overcrowded properties. Due to the specific situation of the social housing sector in the UK, the sector is considered a place for overcrowding to be most likely to happen. It is hypothesised that an increase in the number of social housing stocks are likely to be positively associated with the overcrowding rate for ethnic groups especially if they heavily rely on this form of tenure.

On the other hand, the privately rented sector provides a relatively more flexible tenure form for residents. The flexibility is reflected in rents, sizes, additional service provisions as well as the length of stay. With the increasing availability of online accommodation search and easier access of local real estate agents, rents are afforded at a competitive level; developers or local landlords also

have built private accommodation to suit the needs of different types of the moving population, ranging from students to professionals and from singles, groups to families. As the form of tenure is contract based, length of stay could be agreed from 3 months to multiple years, with possibility of extensions. The flexibility of this tenure form attracts a more mixed variety of tenants with different socioeconomic backgrounds and short term/long term housing aspirations. Therefore, I hypothesise that an increase in the rate of this tenure form would lead to a more uncertain result on overcrowding across different ethnic groups.

- *Property Size by Tenure*

On the surface, an increasing availability of larger size housing stocks would help reduce household overcrowding experience since the more supplies of larger stocks, households would have more units to dwell in on average and reduce residential living densities. However, in reality, there exists a feedback process that might make a relationship less obvious from the evidence of statistical associations. Specifically, one might argue that those who intentionally search and purchase large size stocks in general prefer having a large family size and once owning a large stock, the household also stands a higher chance of expanding their size further as a process of continuation of their cultural norms. In this situation, a rise in the number of large size stocks would be positively associate with living densities of the dwelling unit instead.

How would the property size effect vary across different tenure sectors? Different tenure sectors often select residents with different socioeconomic backgrounds and housing aspirations. For the owner-occupied sector, residents tend to have a higher level of socioeconomic status than those in the other two sectors and their home ownership also represents a stronger commitment of long term settlement in the area. For the social housing sector, residents tend to come from a more deprived socioeconomic backgrounds and ethnic minority groups tend to reside disproportionately in this sector. For the private rented sector, residents tend to be more mobile, younger; dwelling households tend to be smaller in size and their settlement period tends to be shorter in this type of units. Given these traits, one expects that building larger houses in owner-occupied sector and social housing sector would more effectively mitigate overcrowding across ethnic groups than building larger stocks in the private rented sector since the latter tenure contains more flexibility. Building small would raise overcrowding as the size of stocks is most likely to restrain households.

5.4 Methodology

The first stage of econometric analysis examines the effect of population inflows on overcrowding rates from each ethnic group across different periods of arrival. I then analyse several key factors which might affect housing deprivation, especially pertaining to overcrowding. There are two categories of determinants under close examination: one is ethnicity specific characteristics ranging from occupational ranking, wage, household size, residential clustering, internal mobility and duration of residence in the UK; the other is area level housing market characteristics including house prices, tenure composition, property size mixes and size mixes across various tenure forms.

To examine time persistency, cultural, financial factors and local housing attributes affecting ethnic group level overcrowding rates, two models are constructed. The first model takes ethnic group population inflows across different periods of arrival as the independent variables and examine the effects on their corresponding group overcrowding rate. The second model estimates factors that could influence group overcrowding situation. The factors are drawn from both each ethnic group's socioeconomic and cultural backgrounds and one expects the overcrowding outcomes of each individual group would be affected to a varying degree by these factors.

To model the effect of these factors and inflows on group overcrowding rate at the local authority level, a set of fractional logit regression models is used. Since the outcome variable is the percentage share of overcrowded population in each local authority, its value lies between 0 and 1, hence it could be interpreted in a probabilistic manner, i.e. the probability of overcrowding of an area. Fractional outcome regression models allow one to model non-linear relationships between independent variables and outcome response. The model uses quasi-likelihood estimation technique and the logit link function assumes that the conditional mean (i.e. expected share of overcrowded population given the set of factors) to follow a logistic distribution.

In the lengths of settlement model (1), I regress the local authority level ethnic group population share (F) together with the region fixed effects (r) on the local authority level share of overcrowded population (Y). For the factor model (2), I regress the list of factors including both ethnic group specific characteristics (X) and local housing attributes (H) as well as local authority fixed effects and year effects on group overcrowding rate (Y). Regression is run separately for each group.

Specifically, the models are constructed as follows:

$$\ln\left(\frac{Y_{i(g)}}{1-Y_{i(g)}}\right) = \sum_{l=2}^{5} F_{il(g)}\gamma_{(g)} + r_i + \varepsilon_{i(g)t} \qquad (1)$$

$$\ln\left(\frac{Y_{i(g)t}}{1-Y_{i(g)t}}\right) = X_{i(g)t}\beta_{(g)} + H_{it}\delta_{(g)} + \rho_i + \tau_t + \varepsilon_{i(g)t} \qquad (2)$$

The logit link functions for the two models are as follows:

$$E[Y|F] = \frac{\exp(F\gamma)}{1+\exp(F\gamma)} \;\&\; E[Y|X,H] = \frac{\exp(X\beta + H\delta)}{1+\exp(X\beta + H\delta)} \qquad (3)$$

In model 1, the log odds of overcrowding are a function of inflows of ethnic group population across different duration of settlement bands and region fixed effects. The ethnic group breakdown includes White British, White Irish, White Other, Indian, Pakistani, Bangladeshi, Other Asian, Chinese, Black Africans and Black Caribbean. It is subscripted by g. The duration of settlement is categorised into five groups: those who were born in the UK, non-UK borns arrived before year 1981, non-UK borns arrived between year 1981 and year 2000, non-UK borns arrived between year 2001 and year 2006 and finally, those born outside the UK who arrived between year 2007 and year 2011. To eliminate collinearity problem, inflows of UK borns for each ethnic group is dropped so only 4 categories are included. In the equation, the period of arrival is subscripted with letter *l*.

In model 2, for each ethnic group, the log odds of overcrowding are modelled as a function of ethnic group specific characteristics (X) and local housing market attributes (H). The former includes occupational ranking, hourly wage, household size, spatial clustering and internal mobility. The latter includes a range of housing attributes from log medium house price index, % share of social housing and privately rented housing stocks, % share of small, medium, large and extra-large size properties, % share of owner occupied properties, privately rented properties and social housing properties in different sizes. Local authority fixed effects (ρ_i) are included to pick up additional area level trends and year fixed effects (τ_t) are used to pick up macroeconomic trends. The age, gender and marital status profiles of each ethnic group are included as controls in model 2 regression. Since the publicly available census data on NOMIS do not contain individual records, I run regressions based on the spatial unit of local authorities (*i*); therefore, both ethnicity specific characteristics and local attributes are allowed to vary across geographical locations. Details of variable derivation are provided in the data and descriptive statistics section.

Model 1 looks at the ethnic group population inflows arriving in different periods on their own group overcrowding rate. γ is interpreted in a way that an increase in 1% of the ethnic minority group population arriving in the last l years would lead to an increase in their corresponding local overcrowding rate by γ%. Model 2 interprets β and δ in a similar way. For example, a 1% increase in the group's occupational ranking would lead to a $\beta_{(g)}$% increase in the group's overcrowding rate. Additionally, each group's overcrowding outcome is a result of their interaction with the local housing attributes. δ measures the response in terms of percentage changes in overcrowding rate for the ethnic group in question towards a 1% increase in share of large size housing stocks in the social housing sector, for example.

5.5 Data and Descriptive Statistics

The census data for both year 2001 and year 2011 contain rich information on area level counts describing characteristics ranging from personal, housing and employment aspects. The data are publicly available on NOMIS – the website for official labour market statistics. The various data tables are combined to form a panel data with 348 local authorities and 2 years.

Ethnicity Information

Data for both years tabulate each ethnic group by various attributes. Across different levels of geographies, detailed statistical counts are available for each group by household composition, dwelling type, qualification, occupation, socioeconomic status, year of arrival in the UK and many more. We discuss in turn the most relevant factors that are included in our model. The categorisation for ethnic groups ranges from White British, White Irish, White Other, Indian, Pakistani, Bangladeshi, Other Asian, Chinese, Black Africans and Black Caribbeans.

% Share of Overcrowded Households

The chapter mainly uses occupancy rating as the primary measure for capturing local level overcrowding rate but uses number of persons per room as a source of reference. The summary statistics in the Appendix Section II Table 1, 2 and 3 include statistics for both measures in general as well as the local authority level overcrowding rate across ethnic groups.

Using the occupancy rating measure, the mean and range of values are larger as compared to those using the number of persons per room measure. and 0.01% for number of persons per room. Across the ethnic groups, the level of overcrowding is somewhat more salient for Asian households with the Bangladeshi households peaking the average share of overcrowded households in a local

authority. The White population counts towards the lowest rate of overcrowding, but nothing could be concluded on the absolute counts of overcrowded households for each ethnic group.

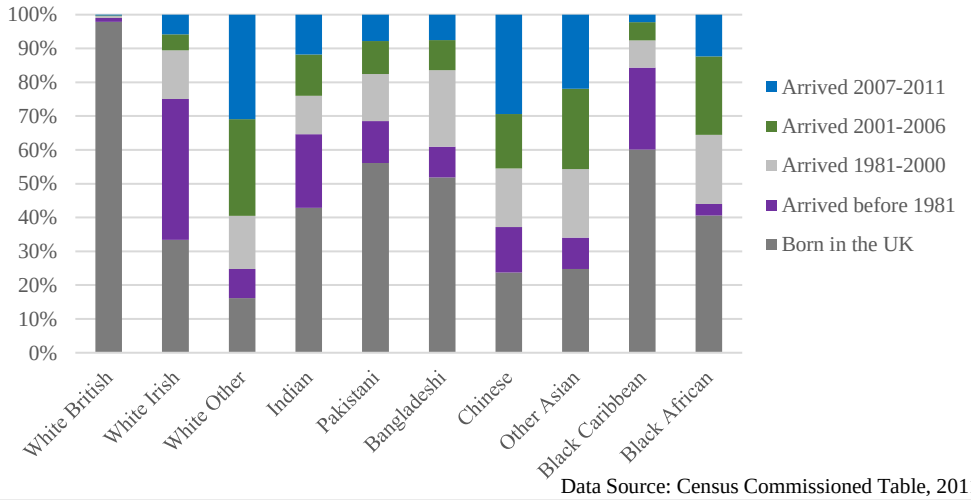
Using the measure of persons per room, the statistics become much smaller on average. However, the ethnic group pattern of overcrowding remains broadly similar when compared to using occupancy rating. Asian households again have an overall higher rate of overcrowding than other ethnic groups and this is followed by the Black African group. The White groups remained the lowest rate of overcrowding.

Lengths of Settlement in the UK

The length of settlement data come from a source of Census Commission Table in 2011 which has a detailed breakdown for the number of counts of population in each ethnic group and in each period of arrival. The Commissioned Table is specifically constructed to fulfil the research purpose of this chapter. The making of the dataset is conducted by the UK Census Customer Service and it required a fee in exchange of the final data table.

Based on the summary statistics in Table 4, the share of non-UK born White constitutes the smallest share of population, only around 1-2%. As of 2011, the minority group migrants tend to have come to and remained steadily in the UK over different periods. Across different lengths of settlement, the distribution of population of ethnic minority groups is more evenly spread out but their UK born population has always been the majority. Drawing closer to the census year 2011, only the Chinese have found to have steady increases in the number of recent arrivals remained in the UK. The inflows of other minority groups tend to be going up and down across different year of arrival categories.

Fig 7. % Ethnic Group Population Share by Lengths of Settlement



Data Source: Census Commissioned Table, 2011

From Fig 7., for the White British, those who claimed themselves to be born outside the UK are small in numbers, while the minority groups show much larger fractions of people born outside the UK. Long term settlers tend to be the Indians, Pakistani, Bangladeshi and Black Caribbean and Africans, as shown by higher proportions of "older" immigrants in these categories. Short term immigrants tend to be the Chinese, Other Asian and the White Other groups, however, there are steady inflows from these ethnic groups into the UK arriving from different periods.

Occupational Score

To calculate the occupational score of each ethnic group in both census years, the data on group population counts in different occupational categories are used to derive a score for each ethnic group and each local authority. From NOMIS data, there are 9 occupational categories: managers, directors and senior officials (the highest ranking of occupation); professional occupations; associate professional and technical occupations; administrative and secretarial occupations; skilled trades occupations; caring, leisure and other service occupations; sales and customer service occupations; process plant and machine operatives; and elementary occupations (the lowest ranking of occupation). Specifically, the occupational score is constructed as follows:

$$Score = \frac{Pop_i * (9 - i)}{Totalpop} \qquad (4)$$

The population in each ranking i is multiplied by its weight $(9\text{-}i)$ and the final product is divided by the total population. For example, the occupational ranking of 1 is given the highest weight 9 and so on. The score is calculated for each local authority and each ethnic group in each year. For some of the highlights in its corresponding descriptive statistics in Appendix Table 5, constant lower occupation score has been found for the Bangladeshi group while in 2011, the White Other group has reduced its average ranking of occupation when compared to 2001.

Average Hourly Wage

The average hourly wage data are obtained from the special license access of Quarterly Labour Force Survey. To increase the sample population counts for each ethnic group, the year 2003 and 2004 data are pooled to form a single year of data to represent year 2001; similarly, the year 2010 and 2011 data are pooled together to form a single year of data to represent year 2011. Even by pooling data, not all ethnic group is sampled for each local authority; with small counts of observations of wage data for each ethnic group, the wage data used here is considered of ***poor quality***. Despite of the data limitation, the wage of sample individuals for each ethnic group is averaged for each local authority, while missing entries are treated as 0 (excluded in the wage calculation) and so is the wage of inactive population of each ethnic group (included in the wage calculation).

The author has also sought other income data sources available in the UK: for example, Citizenship Surveys (CS) and Understanding Society (US) data both have detailed individual level income, ethnic identity and local authority information, which allows one to analyse minority group income situations in depth. However, the access of small spatial units requires formal application to the UK Data Service. Additionally, the Family Resource Survey does not have fine scaled geographical attributes but permits one to analyse minority group income at a national level or a broader regional level. The Annual Surveys for Hours and Earnings (ASHE) also have income records but do not break down by ethnic groups.

Since the inactive population is included in the data, the mean hourly wage comes across in general lower than the current minimum wage of £7.5. From Appendix Table 6, it is worth noting that the average wage for Pakistani, Bangladeshi are particularly low with £2.6 per hour and £1.5 per hour respectively in 2001, £3.2 per hour and £2.1 in 2011. In addition, the White group tends to show high average hourly wage, but its range is smaller when compared to other ethnic minority groups. This suggests that while hourly wage for ethnic minority group is low, there are more extremely affluent individuals in these groups when compared to their White British counterpart. For example, the Bangladeshi group while being the one with lowest mean hourly wage, has an area reaching average wage up to £36.5 per hour, higher than maximum wage for all other ethnic groups.

Average Household Size

The average household size is derived by dividing the total population in each ethnic group by the number of households headed by that ethnic group. Data are downloaded from the NOMIS website. From Appendix Table 7, the Asian households show persistently larger average household size compared to the White and Black groups. The former is around 3-4 persons per household while the latter is only around 2 persons per household. The range of Asian household is also wider, for some minority households such as Pakistani and Bangladeshi, the number of persons per household could go up to 19, this is also true for the Black African households. Although the mean distribution of household size across ethnicities are similar between the two census years, the extreme household size was brought down for some ethnic minority groups such as Pakistani, Bangladeshi, Black African and Black Caribbean.

Internal Mobility

The internal mobility rate of the 10 ethnic groups are derived from data outputs of an earlier demographic project utilising census data to project future ethnic population in the UK (Rees et al., 2011; Pia et al., 2017). The project built a model for projecting the ethnic group populations of UK local authorities, which handles 352 LAs, 16 ethnic groups, 101 ages and 2 sexes. Without specific migration data with detailed ethnicity disaggregation available publicly, two datasets are drawn from their research outputs on the UK Data Archive. The internal out-migration rates for each ethnic group is calculated in the 2001-2002 dataset and the 2011-2012 dataset. This is assuming that the projected data close to census years will also be close to the actual migration information recorded on the census form. In fact, using 2001 census, the project has estimated population, in-migrants and out-migrants by age, sex and ethnic groups up to 2051 while using the 2011 census, the projections have been done for the period up to 2061. For consistency in methods (hence estimates) across census years, the two datasets are chosen to align the ONS assumptions over projected population and migration flows. The share of population that has moved out of their own local authorities to other local authorities for each ethnic group is used to determine how mobile the group was at each point in time, i.e. 2001 and 2011, capturing both their ability to move and willingness to move.

Highlights from Appendix Table 8 include: all ethnic groups have moved less in 2011 than in 2001. Persistently larger share of movers across census years include Indians and Chinese while other groups tend to decrease or increase mobility from one time to another.

Co-ethnic Clustering in Space

The index of absolute clustering (Massey and Denton, 1988) is used to capture the level of concentration of each ethnic group in each local authority, i.e. the strength of preference of residing close to those who share similar ethnic and cultural backgrounds (in turn, this preference has led to higher degree of mutual support; therefore, the two are close proxies for each other). A high degree of clustering implies the residential structure where minority areas are contiguous and closely packed, creating a single large ethnic or racial enclave. A low level of clustering means that minority area units are widely scattered within a local authority. Specifically, the index is constructed as follows:

$$ACL_{Igt,i\in I,g\in G} = \frac{\sum_{i=1}^{n}\frac{x_i}{X}\sum_{j=1}^{n} c_{ij}x_j - \frac{X}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n} c_{ij}}{\sum_{i=1}^{n}\frac{x_i}{X}\sum_{j=1}^{n} c_{ij}t_j - \frac{X}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n} c_{ij}} \qquad (5)$$

The index is a measure of segregation that measures the separate-ness of each ethnic group *g* in each local authority *I* in each year *t*. The base unit is output area *i* and each local authority *I* on average contains around 500 output areas. We use the ethnic group population in each output area and their relative distance structure within the local authority to measure the degree of clustering of that ethnic group. The terms are defined as follows:

i: output area subscript, $i \in I$, a set of local authorities I in England and Wales
g: ethnic group subscript, $g \in G$, a set of ethnic groups G in England and Wales
C_{ij}: negative exponential of the distance between output area *i* and output area *j*, within each local authority *I*; specifically, C_{ij}: = exp(-d_{ij}); where *dij* is the distance between output area unit centroids, calculated by using QGIS, a specialist geographic tool.
xi, *xj*: ethnic group population in output area *i* or output area *j*
X: total ethnic group population in local authority *I*
t_j: total population in output area *j*
n: number of output areas in local authority *I*

Appendix Table 9. and Fig C1. summarise the descriptive statistics about the spatial clustering index for each ethnic group and each year including 2001 and 2011. Table 9. describes the average cross-sectional characteristics of the spatial clustering of ethnic groups while Fig. C1 displays the distributions of ethnic group spatial clustering through histograms in both years. Over the decade, many groups exhibit increasing degree of spatial strengths across local authorities and those which are visually salient include the other White, White Irish, African, Caribbean, Indian and other Asian. This potentially indicates an emergence of larger immigrant concentration for these minority groups. While

the Bangladeshi group has halved its spatial strength in between the two census years on average but some local authorities show more extremely clustered pattern when compared to other minority groups. On a relative term, spatial clustering is more of a feature for the Asian groups, especially south Asians, as reflected by higher averages of the index for Indian, Pakistani and Bangladeshi than those of other groups. The other White group experienced a substantial increase in spatial clustering not just reflected in a large overall upward shift in the distribution of the index but also the average index has been doubled between 2001 and 2011 although the range has remained similar. This is most likely due to the free entry of migrant labours from accession countries in 2004 as a result of the new EU member states status of these countries. In addition, the other Asian group, Black Caribbean and Black African groups are showing visually salient upward shifts in spatial strengths but these are not reflected in the averages.

Overall, the average of the index is all close to 0. While the index is theoretically restricted between 0 and 1, but the calculation tolerates rounding errors which may lead to small negative values. In addition, the spatial clustering index is invalid for the White British group which is the ethnic majority in the UK. Large values beyond the limits are found indicating the measure is not appropriate for this particular ethnic group.

In fact, other measures of clustering are also widely used in the literature. For example, White (1986) proposed an index of spatial proximity. The average proximity could either be estimated between members of the same ethnic minority group or between members of different minority groups. A distance-based index of dissimilarity has been developed by Jakubs (1981) and Morgan (1983). The measure represents the ratio of the minimum distance that minority members would have to move to achieve evenness, over the minimum distance that would be required under conditions of maximum segregation. Overall, Massey and Denton (1988) had surveyed over 20 measures of segregation through the methodological literature, each one of them has both advantages and drawbacks. For the purpose of the research in this chapter, the constructed index aims to capture the average size of concentration in each local authority for each ethnic minority group and examines how strength of ethnicity specific spatial clustering could explain the degree of overcrowding across ethnicities. Therefore, it is sufficient to use one index throughout the analysis; despite of potential computation errors, assumptions are made on the closed boundary of local authorities such that clustering is measured within each local authority however, output areas are not disjointed at local authority borders and a minority group concentration is possible to be found at these borders which will be neglected. This is considered one of the drawbacks of the construction. However, essentially, the index measures the within minority group spatial variation in residential clustering. Therefore, the index is comparable across local authorities when keeping ethnic group unit fixed and is also comparable across ethnic groups when keeping local authority unit fixed.

Local Housing Market Characteristics

Summary statistics for local housing market attributes are tabulated in Appendix Table 10 and 11. Specifically, we look at the log median house prices, % share of stocks in social housing, % share of stocks in privately rented housing and % share of stocks in different sizes in different tenure forms: % small/medium/large/extra-large stocks in owner-occupied/privately-rented/social housing.

5.6 Results and Analysis

5.6.1 Results of Lengths of Settlement Model

To examine whether there is persistent overcrowding situation experienced across ethnicities, I disaggregated the inflows of population of each ethnic group arriving at different periods in the UK. Specifically, fractional logit models are run to estimate the effects of different periods of inflows on local overcrowding rates. The coefficients are interpreted in a way such that, for instance, a 1% increase in the percentage share of Pakistani population arrived in the last 4 years would change the share of population experiencing overcrowding by γ %.

Since population arriving from different periods would develop different life time experiences depending on economic and social conditions of both the source and destination countries, their development in occupation progress, education achievement, advancements in socioeconomic status, family formation and housing careers would all follow different trajectories. Additionally, their integration and assimilation within the mainstream society would also take different paths. That said, it is generally found that those who settle in the destination country for a longer period would find themselves more assimilated within the society than short term migrants. Therefore, one would expect that households which settle for ten years are more likely to resemble the indigenous population in terms of housing practices than those who have just settled for a few months.

The inflows of ethnic group population across different periods of arrival help identify potentially persistent overcrowding experiences for any ethnic group. In this chapter, overcrowding is treated more than just individual ethnic group cultural practices but rather a type of housing deprivation that should be mitigated over a longer-term horizon. Therefore, it is important to look at overcrowding experiences of each ethnic group across different periods of arrival. However, that is not to say that overcrowding cannot arise for cultural reasons: ethnic minority groups which tend to have larger number of family members would overcrowd regardless of their periods of arrival if the local housing market does not provide the adequate size of housing stock. Generally, there are compromises from both sides. Perhaps, sharing a dwelling unit with other households would represent a better measure for housing deprivation as this is more likely to be a result of a compromise. Ethnic group difference in dwelling sharing will be examined subsequently.

Turning to the results in Table 12, there is some consistency across ethnic groups. Most overcrowding experiences are concentrated in the recent arrival cohorts especially for White Irish, White Other, Indian and Chinese while early arrivals show decrease in overcrowding rates. In particular, a 1% increase in White British households decreases the percentage overcrowded population by 1.8% but those arrived in the last 10 to 30 years would increase the share of

overcrowded population by 4.6%. For the more recent arrival cohorts, the effects are not statistically significant perhaps due to a small proportion of these arrivals in these two categories. Negative effects have been found for the early migrants arrived more than 5 years ago but only those arrived in the last 10 to 30 years presents a statistically significant effect on overcrowding reduction; specifically, a 1% increase in the population of this cohort has led to a 0.1% decrease in White Irish overcrowding rate. Contribution to Irish overcrowding rate comes from their most recent arrival cohort. A 1% increase in the share of White Irish arriving in the last 4 years increases overcrowding by 0.3%. The Other White group exhibits a slightly more persistent overcrowding experiences such that a 1% increase in the population arrived in the last 4 years increased the group overcrowding rate by 0.2%, and for those arrived in the last 5-10 years, this is around 0.3%. However, early arrivals tend to decrease the group overcrowding rate. Those arrived between 1981 and 2000 decrease overcrowding by 0.2% and those arrived before 1981 decrease overcrowding by 0.3%.

Turning to the Asian households, the pattern is broadly similar apart from the Bangladeshi group. For the Indian group, overcrowding tends to come from the most recent arrivals (around 0.4% increase). Earlier arrivals manage to reduce their group overcrowding. For those arrived in the last 5 to 10 years, the reduction is around 0.1%, for those arrived in the last 10 to 30 years, the reduction is also about 0.1% and for those arrived more than 30 years ago, the decrease is about 0.2%. The data do not reflect any changes in Pakistani overcrowding rate when there are different periods of arrival of population of this group; however, the reduction comes from earliest arrivals. Specifically, for those arrived before 1981 show a 0.3% decrease in overcrowding rate. For the Other Asian group, decreases for overcrowding situation have been found for those arrived in between 5-10 years, 10-30 years and more than 30 years ago. The corresponding effects are -0.2%, -0.5% and -0.7%. This demonstrates improvements in the housing situation as households in this group has settled for longer. Additionally, the most recent arrivals do not contribute to group overcrowding level significantly. On the other hand, the Chinese group shows a slightly more persistent level of overcrowding contributed by the group's two most recent arriving cohorts. Their effects are 0.1% and 0.3% respectively. However, again, earlier arrivals tend to reduce the group overcrowding rate, e.g. a 1% increase in Chinese arriving more than 30 years ago would decrease overcrowding rate by 0.3%. Strong persistency in overcrowding experience is found for the Bangladeshi group, with households from all periods of arrival show rises in overcrowding experiences. However, the significant effects only come from two periods, i.e. those arrived more than 30 years ago and those arrived in the last 10-30 years. A 1% increase in population of both groups have led to a rise in overcrowding rate of 0.3-0.4%.

Lastly, the differing overcrowding outcomes experienced by the Black African and Black Caribbean groups are not reflected in the data, although some early arrivals of Africans show decreases in their group overcrowding situation.

In Table 13, the effects of lengths of settlement on the percentage share of households living in the same dwelling unit are also investigated. From the author's perspective, this dependent variable captures more on the deprivation side and emphasises less on the cultural side. As one can see, the magnitude of effects is smaller than overcrowding effects in this case. Increases in the % households in shared dwelling are typically found in the most recent arrival cohort across ethnicities, i.e. those who arrived in the last 4 years. The earliest cohorts across all groups show evidence of reducing the practice of dwelling sharing. Relatively higher level of persistency in dwelling sharing practice is found for the White Other, Pakistani and Bangladeshi groups as more than 1 cohort has positive effects on increases in % households in shared dwelling units.

Overall, by disaggregating the ethnic group population by different periods of arrival, we gained insights into how the housing experience of each ethnic group develops over time. Longer term settlers tend to reduce the group's overcrowding rate while overcrowding tends to be concentrated in the most recent arrival cohorts. This is valid for the majority of ethnic groups. Slightly more persistent experience in overcrowding are found for the other White and Chinese groups. Bangladeshi shows the most persistent experience of overcrowding as households from all periods of arrival show positive contribution to overcrowding.

Additionally, when using the percentage share of households in shared dwelling units, one reduces the cultural elements that motivate households to compromise in their current housing condition. It is more likely to be considered a socioeconomic deprivation since sharing with other households has little to do with increasing family members. From the results, the White Other group tends to practise dwelling sharing across cohorts from multiple periods of arrival and some Pakistani households also tend to have persistent practice in dwelling sharing. Otherwise, the rest of the groups are more likely to have dwelling sharing in their most recent arrival cohort and their earliest arrival cohorts are more likely to reduce the level of this practice.

Table 1. Average Marginal Effects of Lengths of Settlement on Overcrowding Rates across Ethnic Groups

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Overcrowding Measure: Occupancy Rating										
% Share Arrived before 1981	-1.833**	-0.030	-0.313**	-0.179**	-0.308*	0.364*	-0.697***	-0.284**	-0.064	-0.702***
	(0.878)	(0.041)	(0.146)	(0.076)	(0.176)	(0.219)	(0.111)	(0.142)	(0.0568)	(0.206)
% Share Arrived between 1981 and 2000	4.635***	-0.128*	-0.245**	-0.149*	-0.052	0.235	-0.450***	-0.130	0.144	-0.196*
	(0.948)	(0.0723)	(0.112)	(0.090)	(0.172)	(0.169)	(0.080)	(0.125)	(0.098)	(0.108)
% Share Arrived between 2001 and 2006	-2.713	-0.035	0.281***	-0.082*	-0.071	0.313**	-0.157***	0.333***	-0.086	-0.068
	(2.00)	(0.173)	(0.103)	(0.047)	(0.091)	(0.157)	(0.057)	(0.120)	(0.065)	(0.018)
% Share Arrived between 2007 and 2011	0.073	0.322***	0.241***	0.366***	0.031	0.128	-0.018	0.147*	-0.024	-0.051
	(0.772)	(0.089)	(0.078)	(0.052)	(0.105)	(0.152)	(0.044)	(0.075)	(0.062)	(0.076)
Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	348	346	346	346	346	346	346	346	346	346

Table 2. Average Marginal Effects of Lengths of Settlement across on % Households in Shared Dwelling

VARIABLES	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Dependent Variable: % Household Sharing a Dwelling										
% Arrived before 1981	-0.108***	0.001	0.008	-0.010	-0.004	-0.024	-0.040**	-0.013	0.001	-0.094***
	(0.033)	(0.006)	(0.030)	(0.008)	(0.006)	(0.016)	(0.018)	(0.019)	(0.005)	(0.029)
% Arrived between 1981 and 2000	0.512***	-0.031***	0.035*	-0.003	0.009*	-0.002	-0.018*	0.006	0.016	-0.009
	(0.102)	(0.010)	(0.019)	(0.012)	(0.005)	(0.007)	(0.010)	(0.022)	(0.014)	(0.018)
% Arrived between 2001 and 2006	-0.317**	-0.011	0.020*	0.001	0.003	0.033***	-0.011	0.030	0.007	-0.001
	(0.149)	(0.014)	(0.017)	(0.005)	(0.004)	(0.008)	(0.007)	(0.021)	(0.006)	(0.008)
% Arrived between 2007 and 2011	-0.178**	0.029***	0.044***	0.014**	0.012**	0.006	0.002	0.026**	0.008	0.004
	(0.090)	(0.009)	(0.014)	(0.006)	(0.005)	(0.007)	(0.007)	(0.011)	(0.006)	(0.008)
Region Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	348	346	346	346	346	346	346	346	346	346

5.6.2 Factor Model Results

When discussing the results of different factors affecting overcrowding outcomes across ethnic groups, one needs to interpret the model results in combination of each group's cultural and socioeconomic backgrounds. This helps explain why certain traits bring up the overcrowding averages for some groups but not the others while other characteristics mitigate the overcrowding problem for some groups but have no effects on other groups. The section attempts its best to interpret the coefficients using this approach.

5.6.2.1 Individual Ethnic Group Specific Factors

Each factor is examined in turn and the results are interpreted for different ethnic groups. Firstly, the effect of age is examined. Overall, there is no statistically significant difference in overcrowding across stratified age groups for each ethnicity. This shows that local age composition does not play an important role in overcrowding. Additionally, a 1% increase in the share of married couples reduce overcrowding by 0.1%, 0.1%, 0.1% and 0.3% for White British, White Irish, White Other and Indian. This is because, intuitively, an increased share of married couples in an area might demonstrate an increased share of households which have improvements in financial ability and a stronger determination to settle long term in the area; in turn, their decision on housing related consumption would be more considerate and the chance of overcrowding for that group would be reduced as a result. However, for the rest of Asian and Black households, the marriage effect is not statistically significant in mitigating their group level overcrowding, which might suggest that the in-migration of this type of cohort is less likely to represent either an improvement in their overall financial ability or a decision for long term settlement in the area.

Having more females in an area overall does not affect the co-ethnic group overcrowding significantly. However, an extra person in an average household almost certainly increases the rate of overcrowding for that group as shown by the results albeit the effect is weak. The extra person always imposes constraints on the existing housing stocks of the area and increases the chance of space shortage. Specifically, one extra person in an average White British household would increase the group's overcrowding rate by 0.06%. For Indian, Pakistani and Bangladeshi households, the increase of overcrowding rate due to 1% increase in population of these ethnic groups, is around 0.05%, 0.02% and 0.03% respectively. For African households, the increase is about 0.04%.

Turning to ethnic group level financial ability, two variables are used to estimate its effect on group level overcrowding rates. Since the hourly wage has almost 0 effect on overcrowding across ethnic groups and none of the results are statistically significant. they will not be commented further,

and one must recognise the limit of low cell counts when computing income for ethnic groups using sample surveys such as Labour Force Survey. However, for individual data model, the data could be much more useful for serving the research purpose. On the other hand, the occupational score is derived from the Census data which contain information on the full population in the UK. The effect of this variable is examined in detail. Since a rise in one's occupational status reflects their higher financial ability and socioeconomic status, therefore it would reduce the likelihood for them to compromise in an overcrowded situation. The extent to which this is true across various ethnic groups is validated by its estimates in Table 14 again. From the results, one can conclude that there is *generally* a negative relationship between occupational status and area level overcrowding rate. Significant results have been found for the White British, White Irish, White Other, Bangladeshi, Other Asian and the Chinese and all of them show a reduction in overcrowding rate due to a 1% increase in occupational score. The exceptional case is the Black Caribbean group in which a rise in occupational status has led to around 0.1% rise in overcrowding, perhaps due to their generally lower distaste towards space or room sharing such that households may increase ("welcome") more members into the dwelling unit in response to rises in income.

Considering the percentage share of movers of each ethnic group affecting their local overcrowding rate, the variable is used as a proxy for the group's internal mobility, i.e. how easy and willing each group is to move to alternative parts of the UK. It is derived such that the share of the moving population only captures one snapshot of the moving pattern of each ethnic group around the census years. These patterns could vary greatly from time to time as also being indicated by the summary statistics in the Appendix Section C1.

For the analysis period concerned, internal migration is not effective in mitigating overcrowding for the British, Irish, Indian, Pakistani, Bangladeshi, Other Asian and African due to the historical evolution of settlement in each ethnic group. While the local British possess little internal migration premium, migrants from the Ireland which is geographically the closest compared to the other groups, are likely to have more monotonic internal migration routes. Their longer migration history is also likely to affect the effectiveness of further migration. The South Asians and the other Asians are known to go through encapsulation in central cities (Peach, 1998), forming large concentrations and initial housing deprivation (if any) is likely to be sustained. For Africans, a significant proportion has historically possessed refugee or asylum seeker status, making them reside disproportionately in the social housing sector. This could be one of the reason migration is treated as a less effective way to remove housing deprivation.

On the other hand, White Other, Chinese and Caribbean tend to have relatively larger presence in the private rented sector, therefore, they are likely to be more mobile. From several past

literature, Laud (2015, p98-99) has documented the lives and practices of the Caribbean group in the UK as being "accustomed to travelling abroad to find suitable work and proved highly adaptable to new nations and labour markets" as well as being "industrious and adventurous" while Champion et al. (1998) also identified the Chinese group are generally more migratory than the other ethnic minority groups and tend to move longer distance. In these situations, migration generally reduces overcrowding for these groups but again this depends on a further range of factors such as chain migration and/or the culture expression of migration of co-ethnic members. A 1% increase in the share of movers from the White Other group reduces their group level overcrowding rate by 0.11%; for the Chinese, this is around 0.14% and for the Caribbean, the reduction is around 0.19%.

The presence of ethnic minority group concentration is another factor that could influence the overcrowding rate of each ethnic group. As discussed earlier, for collectivistic ethnic minority groups, a high degree of clustering of members from the same ethnic background tend to find mutual support to be effective for helping new arrivals improve their information and better integrate within the society, therefore one expects for them, the more clustered a group is, the more likely they are to improve their housing condition through this method. For example, Peach (1998) observed the existence of the South Asian encapsulation in some inner cities. Although these bubbles do not exhibit a strong habit of migration, they still demonstrate steady improvements in socioeconomic progress and housing conditions as their co-ethnic concentration grows larger and their integration with the rest of society becomes more effective over time. On the other hand, for individualistic ethnic groups, a larger presence of co-ethnic group concentration would potentially indicate a generally lower socioeconomic aspiration of the members, therefore more deprived housing situations; on the contrary, a larger concentration could potentially mean the individuals put less focus on personal socioeconomic achievement. If this generalisation is to some extent true, it would help explain why extra housing strain could be brought to the neighbourhood as the concentration becomes larger through the inflow of new immigrant streams.

Specifically, the South Asians, Other Asians, Other White and Africans tend to have positive concentration effect. Among the significant results, 1% increase in the clustering index for the White Other reduces overcrowding by 0.2%; for Pakistani, this is 1.3% and for Africans, this is -0.8%. The opposite significant effect is found for White Irish: 1% increase in the degree of clustered-ness increases the overcrowding rate by 2.9%. For Chinese and Caribbean, the concentration effects are not statistically significant.

5.6.2.2 Local Housing Attributes

Table 3. Average Marginal Effects of Socioeconomic and Cultural Factors on Overcrowding Rates across Ethnic Groups

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Dependent Variable: Occupancy Rating										
% Share of Population Aged 0-15	0.140*	0.404***	0.057	1.164***	-0.100	-0.397	-0.077	0.326	-0.058	-0.057
	(0.078)	(0.054)	(0.103)	(0.156)	(0.193)	(0.256)	(0.166)	(0.267)	(0.191)	(0.170)
% Share of Population Aged 16-49	0.019	0.073	0.209***	0.853***	0.024	-0.158	-0.001	0.440**	-0.191	-0.111
	(0.060)	(0.052)	(0.070)	(0.159)	(0.196)	(0.264)	(0.155)	(0.200)	(0.178)	(0.133)
% Share of Population Aged 50-64	0.0678	0.087	-0.185***	0.683***	-0.160	-0.078	-0.324	0.101	-0.113	-0.269
	(0.082)	(0.075)	(0.063)	(0.194)	(0.329)	(0.297)	(0.211)	(0.301)	(0.190)	(0.180)
% Share of Married Population	-0.140***	-0.107**	-0.128*	-0.285***	0.085	0.012	-0.024	-0.046	0.048	-0.075
	(0.051)	(0.0590)	(0.069)	(0.057)	(0.077)	(0.081)	(0.056)	(0.069)	(0.0546)	(0.062)
% Share of Female Population	-0.180	0.089	0.144	-0.138	0.089	0.024	-0.173	0.056	0.087	0.134
	(0.118)	(0.066)	(0.123)	(0.093)	(0.122)	(0.169)	(0.113)	(0.072)	(0.088)	(0.096)
Household Size	0.058***	0.019	0.028	0.047***	0.020***	0.028**	0.007	-0.001	-0.013	0.041***
	(0.013)	(0.013)	(0.020)	(0.007)	(0.008)	(0.012)	(0.009)	(0.006)	(0.012)	(0.015)
Log Occupational Score	-0.0400	-0.092***	-0.173***	0.011	0.056	-0.099*	-0.248***	-0.141***	0.098**	0.015
	(0.0360)	(0.031)	(0.029)	(0.052)	(0.079)	(0.055)	(0.060)	(0.051)	(0.049)	(0.066)
Hourly Wage	0.000	-0.000	-0.001	0.000	-0.000	0.000	0.001	0.001	0.001	0.001
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
% Share of Movers	0.080	-0.041	-0.111*	0.054	0.109	0.111	0.090	-0.139**	-0.189**	0.106
	(0.055)	(0.088)	(0.067)	(0.072)	(0.126)	(0.242)	(0.072)	(0.054)	(0.084)	(0.076)
Residential Clustering Index	-	2.907**	-0.239*	-0.151	-1.339***	-1.970	-0.690	0.356	0.472	-0.809**
	-	(1.409)	(0.130)	(0.341)	(0.473)	(1.336)	(0.856)	(0.756)	(0.916)	(0.332)
Observations	652	652	652	650	644	626	650	650	651	650

How would each ethnic group "respond" to local housing attributes? High house prices in general do not have statistically significant overcrowding effects on most groups. however, among the significant results, house price in an area tends to be negatively associated with overcrowding rates for the White British and White Other groups. In particular, a 1% increase in the log median house price index decreases the overcrowding rate of the White British by about 0.02% and that of the White Other group by around 0.06%. However, there is some evidence for overcrowding response for the Bangladeshi group towards high house prices in an area. A 1% increase in log median house price index is associated with a 0.22% increase in the group's overcrowding rate.

Ethnic group responses to increases in stocks of different tenures are also tested. For groups which have the largest presence in the social housing sector including the Black Caribbean, the Black African and the Bangladeshi and a rising presence for the Other White, a 1% rise in the social housing stocks has led to a rise in their corresponding overcrowding rate by 0.2%, 1.1%, 0.2% and 0.2%. Among these results, only the estimate for the Black Africans is statistically significant at 5% critical level. For changes in the privately rented stocks, the results are more mixed. Among the significant results, a rise in the private rental stocks is positively associated with the overcrowding rates of the Indian group (0.5%), but negatively associated with the overcrowding rates of the Other Whites (-0.3%), Caribbeans (-0.6%) and Africans (-1.4%).

Table 4. Average Marginal Effects of Local Housing Attributes (Price and Tenure) on Overcrowding Rates across Ethnic Groups

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Dependent Variable: Occupancy Rating										
Log Median House Price Index	-0.024***	0.011	-0.063***	0.021	-0.029	0.215**	0.048	0.069	0.053	0.045
	(0.005)	(0.016)	(0.022)	(0.037)	(0.075)	(0.103)	(0.063)	(0.046)	(0.053)	(0.059)
% Social Housing Stocks	0.033	-0.123	0.186	-0.019	-0.263	0.176	-0.251	-0.224	0.192	1.108***
	(0.028)	(0.096)	(0.135)	(0.201)	(0.432)	(0.491)	(0.372)	(0.260)	(0.244)	(0.417)
% Privately Rented Stocks	-0.028	0.107	-0.306**	0.521**	0.387	-0.200	0.185	-0.142	-0.564**	-1.431***
	(0.026)	(0.089)	(0.129)	(0.223)	(0.451)	(0.511)	(0.411)	(0.237)	(0.235)	(0.499)
Observations	652	652	652	650	644	626	650	650	651	650

To examine the tenure specific stock size effects on overcrowding rates for different ethnic groups, the percentage of housing stocks in each size and in each type of tenure are also included in the model. For owner-occupied housing, building an additional 1% small-size stocks raises the rate of overcrowding for most groups. Statistically significant effects are found for White British (0.3%,), White Other (1.4%), Indian (1.6%), Other Asian (1.1%) and Chinese (2.8%). Building additional medium-sized and large-sized owner-occupied properties do not have much of a significant effect on overcrowding across most ethnic groups; however, most of the associations remain positive. Lastly, reductions in overcrowding rate is found by building additional extra-large-sized owner-occupied stocks (more than 8 rooms). However, statistically significant evidence is not found for all groups; for those results that are significant, a 1% increase in the extra-large sized properties would lead to a 0.03% decrease in overcrowding for White British, a 0.26% decrease in overcrowding or White Other and a 0.41% decrease in overcrowding for Indians. For other Asians, this is -0.47% and for Chinese, this is -0.29%.

The effects of changing the level of privately rented stocks on overcrowding are overall limited but an increase in the growth rate of the small-sized privately rented stocks almost always increases the local overcrowding rates. Groups affected include White British (0.6%), White Other (2.0%), Indian (2.0%), Other Asian (3.8%), Chinese (2.4%), Caribbean (1.4%) and African (2.8%). Building an additional 1% increase in stocks of medium, large or extra-large-sizes does not have much of an effect on overcrowding but it is worth noting that even additional extra-large sized stocks are built, Pakistani households remain experiencing overcrowding with the coefficient increase of 17.4%; this is likely to be a result of a feedback: those who actively search unusually large sized housing stocks, could potentially expand their household size further as part of their cultural practice. This could explain most of the positive coincidences between housing sizes and overcrowding for many ethnic groups, especially Asian and African groups.

With respect to social housing, building additional small-sized stocks increases the overcrowding rates for majority of the ethnic groups as usual. Evidence has found that the White British, White Other, Indian, Pakistani, other Asians, Chinese and Caribbean are all affected. Their corresponding marginal effects are 0.3%, 1.1%, 3.1%, 3.2%, 2.0%, 1.8% and 2.5% respectively. Building additional medium-sized property stocks has led to fewer significant effects however the associations remain mostly positive. The affected groups include Indian (2.0%), Pakistani (2.5%), Other Asian (3.2%) and Chinese (1.6%). The effect of additional large sized housing stocks remains positive for most groups but few is statistically significant. On the other hand, additional extra-large sized social housing stocks reduce overcrowding for almost all groups but only the estimate for White British is statistically significant. In particular, a 1% increase in the extra-large sized housing stock reduced overcrowding for the White British by about 2.4%.

Overall, ethnic group specific responses to local housing options are limited, however, it should be noted that building small (1-3 rooms) always raises overcrowding and this is valid for most of the groups. The effect of building larger stocks in the private rented sector on reducing overcrowding is limited. There is strong evidence such that building extra-large owner-occupied stocks would reduce overcrowding for most of the ethnic groups and there is weak evidence that building additional extra-large sized social housing stocks would reduce overcrowding for most groups. The strength of evidence is assessed by the statistical significance of the model's corresponding estimates.

Table 5. Average Marginal Effects of Local Housing Attributes (Size by Tenure) on Overcrowding Rates across Ethnic Groups Continued.

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Dependent Variable: Occupancy Rating										
% Small Size Owner Occupied Stocks	0.272**	-0.101	1.400***	1.604**	2.203	-1.243	2.983***	2.816***	1.299	1.461
	(0.116)	(0.310)	(0.399)	(0.794)	(1.461)	(1.840)	(1.140)	(0.799)	(0.849)	(1.040)
% Medium Size Owner Occupied Stocks	0.101	-0.640***	0.462	1.983***	1.512	0.264	0.707	0.845	1.038	-0.480
	(0.065)	(0.242)	(0.328)	(0.636)	(1.137)	(1.633)	(0.977)	(0.618)	(0.726)	(0.833)
% Large Size Owner Occupied Stocks	0.054	-0.504*	0.655*	2.812***	2.077	0.759	2.239*	1.391*	0.513	0.407
	(0.076)	(0.291)	(0.393)	(0.818)	(1.573)	(2.067)	(1.321)	(0.755)	(0.979)	(1.092)
% Extra Large Size Owner Occupied Stocks	-0.028**	-0.019	-0.262***	-0.411***	-0.085	-0.093	-0.465**	-0.287**	-0.007	-0.208
	(0.014)	(0.052)	(0.082)	(0.139)	(0.263)	(0.342)	(0.217)	(0.138)	(0.178)	(0.188)
% Small Size Privately Rented Stocks	0.575***	0.031	2.033***	2.012***	1.829	2.516	3.820***	2.390***	1.427*	2.816***
	(0.083)	(0.295)	(0.368)	(0.664)	(1.401)	(1.586)	(1.047)	(0.685)	(0.818)	(0.987)
% Medium Size Privately Rented Stocks	-0.016	-0.968***	0.044	1.253	2.022	-1.078	-1.748	0.505	1.645*	0.515
	(0.097)	(0.337)	(0.434)	(0.823)	(1.546)	(2.068)	(1.449)	(0.832)	(0.977)	(1.341)
% Large Size Privately Rented Stocks	-0.004	-1.122	0.157	0.132	-5.616*	2.072	3.341	2.155	-0.339	2.851
	(0.185)	(0.770)	(0.846)	(1.580)	(3.192)	(3.894)	(2.384)	(1.598)	(2.116)	(2.258)
% Extra Large Size Privately Rented Stocks	-0.130	0.338	3.636**	-0.403	17.440***	0.486	-5.099	3.587	3.633	5.837
	(0.318)	(1.354)	(1.756)	(4.475)	(6.064)	(7.428)	(4.887)	(3.298)	(3.731)	(5.084)
% Small Size Social Housing Stocks	0.270***	-0.393	1.099***	3.096***	3.187**	0.671	1.959*	1.782**	2.454***	-0.468
	(0.090)	(0.267)	(0.401)	(0.775)	(1.390)	(1.923)	(1.170)	(0.809)	(0.880)	(1.167)
% Medium Size Social Housing Stocks	0.138	0.020	0.412	1.966**	2.522*	1.046	3.201**	1.580*	-0.582	-1.505
	(0.095)	(0.323)	(0.449)	(0.793)	(1.488)	(2.043)	(1.253)	(0.810)	(0.942)	(1.080)
% Large Size Social Housing Stocks	0.175	-0.748	0.640	3.266***	1.288	0.439	2.789	2.033	2.550	3.013
	(0.162)	(0.546)	(0.763)	(1.267)	(2.344)	(3.084)	(2.036)	(1.312)	(1.859)	(1.886)
% Extra Large Size Social Housing Stocks	-2.373***	-1.774	-5.370	6.878	-5.069	-13.840	-0.856	-10.20	6.559	-2.883
	(0.854)	(3.230)	(3.941)	(7.596)	(13.91)	(20.730)	(11.51)	(7.176)	(9.830)	(9.953)
Observations	652	652	652	650	644	626	650	650	651	650

5.7 Conclusion

The chapter firstly attempts to examine the lengths of settlement on housing deprivation outcomes including dwelling sharing practices and overcrowding; it subsequently investigates some ethnicity specific factors and area level housing attributes that could potentially explain ethnic group level differences in overcrowding rate. Although there are different views held towards overcrowding: some perceive that overcrowding is a result of the household's cultural practice therefore should not be subject to intervention while others consider to be a severe deprivation problem that imposes detrimental effects on household's well-being and family relationships. The chapter considers both views to be valid to some extent that people's financial circumstances and cultural backgrounds that interact with the local housing market will result in very different effects on their potential housing deprivation experiences. Specifically, 10 ethnic groups are considered ranging from White British, White Irish, Other White, Indian, Pakistani, Chinese, Other Asian, Black Caribbean and Black African. Using mostly the census aggregated data, a set of fractional logit models are used to examine the effects of lengths of settlement, ethnic group specific factors and local housing attributes on overcrowding rates of these ethnic groups.

In general, one would expect that as immigrants settle for longer in the destination country, they are more likely to improve on their financial circumstances as well as resembling the indigenous households in terms of housing practices. Over time, households should be able to find suitable housing to accommodate their family members therefore their overcrowding experiences should be mitigated.

To test this across ethnic groups, I regressed each population inflow by different periods of arrival on their corresponding overcrowding rate and insight was gained into how the housing experience of each ethnic group develops over time. Longer term settlers tend to reduce the group's overcrowding rate while overcrowding tends to be concentrated in the most recent arrival cohorts. This is valid for many ethnic groups. Slightly more persistent experience in overcrowding are found for the other White and Chinese groups. Bangladeshi shows the most persistent experience of overcrowding as households from all periods of arrival show positive contribution to overcrowding. The implication is that, while it is reassuring that majority of the ethnic groups tend to reduce overcrowding over time, some experience more persistent overcrowding than others. It would be interesting to question whether this persistency is a result of one's cultural practice or persistent deprivation. For this reason, this had led me to investigate further using dwelling sharing as a deprivation outcome variable which puts more emphasis on short term compromise in housing situation.

After using the percentage share of households in shared dwelling units, the results show the White Other group tends to practise dwelling sharing across cohorts from multiple periods of arrival and some Pakistani households also tend to have persistent practice in dwelling sharing. Otherwise, the rest of the groups tend to have dwelling sharing in their most recent arrival cohort and their earliest arrival cohorts tend to reduce the level of this practice.

Subsequently, I investigated individual ethnic group specific factors on overcrowding rate. The list of factors includes: age, gender, marital status, household size, occupational ranking, mobility and residential clustering. While different age groups, % share of married couples and % share of female are included as control variables, the rest are some key adjustment mechanisms that ethnic groups, especially minority groups undergo to adapt to the housing market condition in the UK. From the results, there is no significant stratified age group effect on overcrowding across ethnic groups. While an increase in the share of married couples tends to reduce overcrowding perhaps due to a more devoted effort towards better housing stock, gender composition of the ethnic groups has no significant effect on their group level overcrowding rate but an extra person in the household almost always raises the level of overcrowding for most of the ethnic groups. Turning to occupational ranking of each ethnic group, there is in general a negative relationship found between one's occupational status and their chance of overcrowding. The mobility factor of ethnic groups is also explored. I used the percentage share of population that has moved out of their local authority around census years as an indicator for how internally mobile a group is. It was only found that for Chinese, Caribbean and the Other White groups, a higher percentage share of movers is negatively associated with their group level overcrowding rates. Lastly, only for the ethnic minority groups, the effect of residential clustering also works both ways. While a larger Pakistani, Other White or African concentration is negatively associated with overcrowding, which potentially reflects these groups' ability to benefit from extensive networks in terms of improving their housing conditions, the degree of clustered-ness is positively associated with overcrowding for the White Irish group. This suggests that a larger concentration might also be an indication of a more severe group deprivation.

Within the same model, I also looked at how each ethnic group would interact with changes in local housing options ranging from house prices, property size mixes across tenures and tenure compositions of the areas. With respect to changes in house prices, the White British and White Other groups tend to have lower share of overcrowded households in response to increases in house prices. Statistically significant overcrowding response towards high house prices has only been found for the Bangladeshi group. In addition, places with a higher share of extra-large size properties tend to see a lower rate of overcrowding in the owner-occupied housing sector, the corresponding evidence is weak for the social housing sector. Building small tends to increase overcrowding regardless of tenure sectors or which ethnic group resides in. Positive associations between overcrowding and larger sized housing stocks are likely to arise because of potential feedback effects: households which have larger family sizes (low compromise on fertility) tend to search larger stocks in the first place.

In this chapter, each ethnic group's situation in housing is treated independently and their individual self-adjustments and interactions with the local housing market are examined separately. The study could be of use to a range of stakeholders who are interested in learning UK ethnic group difference in housing practices as well as their distinct housing aspirations according to their own socioeconomic and cultural backgrounds. Another point worth noting is that while each ethnic group is treated independently, the actual weight for each is heavily skewed with the White British still representing the largest share (85%, source: census 2011) of the overall population. The geographical concentration of ethnic minority groups also matters such that certain regions with high concentration and diversity of immigrants would find the results more important than those places with low concentration and diversity of immigrants. Additionally, one should not forget that migration activities and geographical connections of ethnic ties adopted by households as a way to self-correct their deprived situation.

Appendix

C1. Measuring Residential Segregation among Ethnic Groups

Table C1. Dissimilarity Index by Ethnic Group Combinations

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Chinese	Black Caribbean	Black African
White British	0.0000	0.3402	0.4118	0.5740	0.6503	0.6458	0.4121	0.6612	0.6289
White Irish		0.0000	0.2020	0.4027	0.5536	0.5256	0.2282	0.4209	0.3513
White Other			0.0000	0.4455	0.5939	0.5295	0.2495	0.4008	0.3465
Indian				0.0000	0.4716	0.5135	0.4479	0.4176	0.4214
Pakistani					0.0000	0.5061	0.5441	0.4917	0.5319
Bangladeshi						0.0000	0.4929	0.5006	0.5009
Chinese							0.0000	0.4480	0.3640
Black Caribbean								0.0000	0.2246
Black African									0.0000

The dissimilarity index is calculated among all ethnic group pairs. The expression used is $D = \frac{1}{2}\sum_{i=1}^{N} \frac{g_{is}}{G_s} - \frac{g_{it}}{G_t}$ for all pairs of *s* and *t*. Ethnic groups considered include the White British, White Irish, Other White, Indian, Pakistani, Bangladeshi, Chinese, Black Caribbean and Black African. For each combination of two ethnic groups, the index is calculated to measure the degree of residential segregation based on local authority level population counts. The higher the value of the index, the more segregated one group is from the other residentially. The interpretation is as follows, an index of x% between ethnic group A and ethnic group B would suggest that the x% of ethnic group A population needs to move to other local authorities to make group As and group Bs to distribute evenly across all local authorities. From Table C1, one can see there is a less degree of segregation among the broader racial categories, i.e. the subgroups within the White group show less residential segregation towards each other but more towards Other Asian groups and Black groups; the dissimilarity index is calculated to be 0.34 between White British and White Irish, and 0.41 between White British and White Other. The trend is similar for the Black population in which the Africans show more integration to the Caribbean groups when compared to all other ethnic groups. The measure of segregation is around 0.22 towards Black Africans and the level towards other groups is much higher ranging from 0.35 to 0.63. The South Asian groups show more or less similar degree of integration towards any other groups, but the Chinese exhibit substantially low level of residential segregation towards the White Irish and the other White groups, and this is followed by the Black African groups.

C2. Summary Statistics for Model Variables

Table C2. Overall Overcrowding Rates

Measurement - Year	Observations	Mean	Std. Dev.	Min.	Max.	Measurement - Year	Observations	Mean	Std. Dev.	Min.
Occupancy Rating - 2001	348	0.065	0.060	0.011	0.591	Occupancy Rating - 2011	348	0.079	0.066	0.021
Number of Persons per Room - 2001	348	0.005	0.008	0.001	0.072	Number of Persons per Room - 2011	348	0.004	0.007	0.001

Table C3. Overcrowded-ness Measured using Occupancy Rating

Ethnic Group (2001)	Observations	Mean	Stan.Dev.	Min.	Max.	Ethnic Group (2011)	Observations	Mean	Stan.Dev.	Min.
White British	348	0.062	0.036	0.023	0.282	White British	348	0.058	0.038	0.018
White Irish	348	0.076	0.047	0.000	0.392	White Irish	348	0.083	0.043	0.000
White Other	348	0.103	0.073	0.015	0.436	White Other	348	0.168	0.076	0.034
Indian	348	0.145	0.079	0.000	0.498	Indian	348	0.129	0.069	0.000
Pakistani	348	0.196	0.133	0.000	0.549	Pakistani	348	0.165	0.103	0.000
Bangladeshi	348	0.334	0.185	0.000	1.000	Bangladeshi	348	0.232	0.129	0.000
Other Asian	348	0.173	0.120	0.000	0.750	Other Asian	348	0.185	0.080	0.000
Chinese	348	0.186	0.076	0.000	0.488	Chinese	348	0.157	0.078	0.000
Caribbean	348	0.112	0.091	0.000	0.727	Caribbean	348	0.100	0.071	0.000
African	348	0.201	0.143	0.000	0.667	African	348	0.191	0.102	0.000

Table C4. Overcrowded-ness Measured by Persons per Room

Ethnic Group (2001)	Observations	Mean	Stan.Dev.	Min.	Max.	Ethnic Group (2011)	Observations	Mean	Stan.Dev.	Min.
White British	348	0.002	0.002	0.001	0.014	White British	348	0.007	0.018	0.001
White Irish	348	0.003	0.004	0.000	0.024	White Irish	348	0.136	0.078	0.000
White Other	348	0.009	0.011	0.000	0.067	White Other	348	0.003	0.004	0.000
Indian	348	0.016	0.019	0.000	0.146	Indian	348	0.074	0.088	0.000
Pakistani	348	0.028	0.039	0.000	0.214	Pakistani	348	0.064	0.098	0.000
Bangladeshi	348	0.064	0.086	0.000	0.750	Bangladeshi	348	0.076	0.146	0.000
Other Asian	348	0.031	0.043	0.000	0.250	Other Asian	348	0.022	0.062	0.000

Chinese	348	0.007	0.018	0.000	0.176	Chinese	348	0.009	0.009	0.000
Caribbean	348	0.007	0.018	0.000	0.176	Caribbean	348	0.060	0.086	0.000
African	348	0.023	0.036	0.000	0.333	African	348	0.003	0.005	0.000

Table C5. Length of Settlement across Ethnic Groups (2011)

White British	Observations	Mean	Stan.Dev.	Min.	Max.	Indian	Observations	Mean	Stan.Dev.	Min.
Born in the UK	348	0.977	0.017	0.858	0.994	Born in the UK	348	0.369	0.104	0.000
Arrived before Year 1981	348	0.012	0.007	0.003	0.052	Arrived before Year 1981	348	0.196	0.069	0.000
Arrived between Year 1981 and 2000	348	0.006	0.006	0.001	0.045	Arrived between Year 1981 and 2000	348	0.104	0.033	0.000
Arrived between Year 2001 and 2006	348	0.003	0.003	0.001	0.020	Arrived between Year 2001 and 2006	348	0.181	0.086	0.000
Arrived between Year 2007 and 2011	348	0.002	0.003	0.000	0.027	Arrived between Year 2007 and 2011	348	0.147	0.083	0.000
White Irish	Observations	Mean	Stan.Dev.	Min.	Max.	Pakistani	Observations	Mean	Stan.Dev.	Min.
Born in the UK	348	0.326	0.053	0.165	0.577	Born in the UK	348	0.486	0.126	0.000
Arrived before Year 1981	348	0.433	0.083	0.156	0.636	Arrived before Year 1981	348	0.132	0.070	0.000
Arrived between Year 1981 and 2000	348	0.146	0.040	0.048	0.260	Arrived between Year 1981 and 2000	348	0.128	0.053	0.000
Arrived between Year 2001 and 2006	348	0.047	0.025	0.012	0.300	Arrived between Year 2001 and 2006	348	0.136	0.085	0.000
Arrived between Year 2007 and 2011	348	0.049	0.035	0.000	0.225	Arrived between Year 2007 and 2011	348	0.115	0.084	0.000
White Other	Observations	Mean	Stan.Dev.	Min.	Max.	Bangladeshi	Observations	Mean	Stan.Dev.	Min.
Born in the UK	348	0.174	0.045	0.080	0.366	Born in the UK	348	0.482	0.113	0.000
Arrived before Year 1981	348	0.104	0.043	0.013	0.245	Arrived before Year 1981	348	0.108	0.071	0.000
Arrived between Year 1981 and 2000	348	0.144	0.050	0.023	0.242	Arrived between Year 1981 and 2000	348	0.205	0.065	0.000
Arrived between Year 2001 and 2006	348	0.283	0.050	0.155	0.437	Arrived between Year 2001 and 2006	348	0.107	0.057	0.000
Arrived between Year 2007 and 2011	348	0.295	0.078	0.120	0.637	Arrived between Year 2007 and 2011	348	0.089	0.070	0.000
Black Caribbean	Observations	Mean	Stan.Dev.	Min.	Max.	Other Asian	Observations	Mean	Stan.Dev.	Min.
Born in the UK	348	0.553	0.109	0.0	0.861	Born in the UK	348	0.201	0.085	0.000
Arrived before Year 1981	348	0.233	0.073	0.0	0.489	Arrived before Year 1981	348	0.097	0.041	0.000
Arrived between Year 1981 and 2000	348	0.080	0.037	0.0	0.244	Arrived between Year 1981 and 2000	348	0.184	0.065	0.058
Arrived between Year 2001 and 2006	348	0.085	0.081	0.0	1.000	Arrived between Year 2001 and 2006	348	0.276	0.076	0.000

Arrived between Year 2007 and 2011	348	0.050	0.062	0.0	0.667	Arrived between Year 2007 and 2011	348	0.242	0.088	0.000
Black African	Observations	Mean	Stan.Dev.	Min.	Max.	Chinese	Observations	Mean	Stan.Dev.	Min.
Born in the UK	348	0.305	0.099	0.0	0.535	Born in the UK	348	0.261	0.076	0.000
Arrived before Year 1981	348	0.042	0.025	0.0	0.146	Arrived before Year 1981	348	0.168	0.060	0.000
Arrived between Year 1981 and 2000	348	0.177	0.058	0.0	0.333	Arrived between Year 1981 and 2000	348	0.194	0.053	0.000
Arrived between Year 2001 and 2006	348	0.298	0.091	0.1	1.000	Arrived between Year 2001 and 2006	348	0.157	0.041	0.000
Arrived between Year 2007 and 2011	348	0.179	0.092	0.0	0.683	Arrived between Year 2007 and 2011	348	0.217	0.148	0.000

Table C6. Occupational Score across Ethnic Groups

Ethnic Group (2001)	Observations	Mean	Stan.Dev.	Min.	Max	Ethnic Group (2011)	Observations	Mean	Std. Dev.	Min.
White British	348	5.390	0.485	4.248	7.248	White British	348	5.452	0.463	4.452
White Irish	348	5.665	0.509	3.333	7.233	White Irish	348	5.850	0.468	4.341
White Other	348	5.896	0.457	3.787	7.277	White Other	348	4.770	0.862	2.462
Indian	348	6.391	0.883	0.000	8.333	Indian	348	6.226	0.645	0.000
Pakistani	348	5.654	1.459	0.000	9.000	Pakistani	348	5.740	1.027	0.000
Bangladeshi	348	4.715	1.642	0.000	9.000	Bangladeshi	348	4.747	0.928	0.000
Other Asian	348	6.042	0.964	0.000	8.500	Other Asian	348	5.109	0.527	3.143
Chinese	348	5.545	0.501	0.000	6.727	Chinese	348	5.676	0.582	0.000
Black African	348	5.479	0.919	0.000	8.333	Black African	348	5.391	0.545	3.835
Black Caribbean	348	5.443	0.913	0.000	9.000	Black Caribbean	348	5.432	0.572	2.000

Table C7. Average Hourly Wage across Ethnic Groups

Ethnic Group (2001)	Observations	Mean	Stan.Dev.	Min.	Max.	Ethnic Group (2011)	Observations	Mean	Stan.Dev.	Min.
White British	348	4.6	1.175	2.0	8.4	White British	348	5.3	1.322	2.3
White Irish	348	5.1	4.255	0.3	22.9	White Irish	348	6.8	5.725	0.8
Other White	348	4.9	2.618	0.3	30.6	Other White	348	5.4	1.995	0.6
Indian	348	5.0	4.191	0.6	27.9	Indian	348	6.1	4.116	1.0
Pakistani	348	2.6	3.302	0.2	28.0	Pakistani	348	3.1	3.550	0.3

Bangladeshi	348	1.5	2.177	0.1	23.5	Bangladeshi	348	2.1	3.118	0.3
Other Asian	348	3.4	2.845	0.2	21.8	Other Asian	348	4.1	2.876	0.2
Chinese	348	3.5	3.493	0.2	24.0	Chinese	348	4.4	4.664	0.3
Black African	348	3.7	3.028	0.6	17.7	Black African	348	4.8	3.708	0.4
Black Caribbean	348	5.2	3.942	0.3	20.7	Black Caribbean	348	5.5	4.372	0.3

Table C8. Mean Household Size across Ethnic Groups

Ethnic Group	Observations	Mean	Stan.Dev.	Min.	Max.	Ethnic Group	Observations	Mean	Stan.Dev.	Min.
White British	348	2.3	0.100	1.6	2.5	White British	348	2.3	0.116	1.5
White Irish	348	1.8	0.156	1.4	3.3	White Irish	348	2.2	0.140	1.6
Other White	348	2.6	0.211	1.7	3.9	Other White	348	2.4	0.166	1.7
Indian	348	2.9	0.375	0.0	4.2	Indian	348	3.0	0.534	0.0
Pakistani	348	3.6	1.437	0.0	19.0	Pakistani	348	3.2	0.970	0.0
Bangladeshi	348	3.9	1.025	0.0	12.0	Bangladeshi	348	3.7	1.455	0.0
Other Asian	348	3.1	0.680	0.0	7.0	Other Asian	348	3.0	0.933	0.0
Chinese	348	3.3	0.438	0.0	4.8	Chinese	348	2.8	0.347	0.0
Black African	348	2.9	0.774	0.0	11.0	Black African	348	2.0	0.614	0.0
Black Caribbean	348	2.1	0.774	0.0	9.0	Black Caribbean	348	2.4	0.547	0.0

Table C9. % Share Movers across Ethnic Groups (Census)

Ethnic Group (2001)	Observations	Mean	Std. Dev.	Min.	Max.	Ethnic Group (2011)	Observations	Mean	Std. Dev.	Min.
White British	326	0.056	0.029	0.021	0.198	White British	326	0.047	0.018	0.020
White Irish	326	0.043	0.021	0.011	0.170	White Irish	326	0.047	0.018	0.020
White Other	326	0.119	0.058	0.035	0.413	White Other	326	0.076	0.021	0.038
Indian	326	0.141	0.093	0.000	0.552	Indian	326	0.090	0.038	0.002
Pakistani	326	0.079	0.066	0.018	0.431	Pakistani	326	0.073	0.048	0.000
Bangladeshi	326	0.066	0.040	0.000	0.293	Bangladeshi	326	0.045	0.031	0.000
Chinese	326	0.117	0.085	0.028	0.932	Chinese	326	0.105	0.043	0.018

Other Asian	326	0.147	0.072	0.030	0.455	Other Asian	326	0.076	0.028	0.011
Black Caribbean	326	0.153	0.078	0.054	0.542	Black Caribbean	326	0.058	0.033	0.000
Black African	326	0.081	0.062	0.017	0.418	Black African	326	0.098	0.038	0.011

Table C10. Index of Absolute Clustering across Ethnicities

Ethnic Group	Observations	Mean	Stan.Dev.	Min.	Max.	Ethnic Group	Observations	Mean	Stan.Dev.	Min.
White British	346	-0.753	8.168	-134.4323	20.1741	White British	348	-0.5785	4.057	-50.2605
White Irish	346	0.002	0.002	-0.0013	0.0098	White Irish	348	0.0012	0.001	-0.0015
White Other	346	0.004	0.008	-0.0078	0.1120	Other White	348	0.0146	0.017	-0.0127
Indian	346	0.010	0.026	-0.0019	0.2575	Indian	348	0.0117	0.026	-0.0017
Pakistani	346	0.014	0.036	-0.0001	0.2951	Pakistani	348	0.0167	0.042	-0.0003
Bangladeshi	346	0.013	0.093	0.0000	1.0000	Bangladeshi	348	0.0057	0.014	0.0000
Other Asian	346	0.003	0.007	-0.0001	0.0863	Other Asian	348	0.0055	0.007	-0.0014
Chinese	346	0.003	0.004	-0.0024	0.0337	Chinese	348	0.0038	0.006	-0.0020
Black African	346	-0.001	0.008	-0.0834	0.0157	Black African	348	0.0067	0.010	-0.0016
Black Caribbean	346	0.004	0.007	-0.0013	0.0700	Black Caribbean	348	0.0030	0.006	-0.0019

Table C11. Summary Statistics for Local Housing Markets Attributes

Variable (2001)	Observations	Mean	Std. Dev.	Min.	Max.	Variable (2011)	Observations	Mean	Std. Dev.	Min.
Log Median House Prices	348	3.806	0.093	3.384	4.079	Log Median House Prices	348	4.472	0.097	4.079
% Share of Small Stocks (1-3 Rooms)	348	0.105	0.062	0.033	0.593	% Share of Small Stocks (1-3 Rooms)	348	0.124	0.071	0.041
% Share of Medium Stocks (4-5 Rooms)	348	0.428	0.056	0.311	0.626	% Share of Medium Stocks (4-5 Rooms)	348	0.428	0.052	0.315
% Share of Large Stocks (6-7 Rooms)	348	0.284	0.047	0.067	0.423	% Share of Large Stocks (6-7 Rooms)	348	0.305	0.050	0.060
% Share of Extra Large Stocks (8 More Rooms)	348	0.110	0.049	0.013	0.260	% Share of Extra Large Stocks (8 More Rooms)	348	0.142	0.060	0.016
% Share of Social Housing Stocks	348	0.192	0.087	0.036	0.656	% Share of Social Housing Stocks	348	0.174	0.070	0.055
% Share of Privately Rented Stocks	348	0.093	0.046	0.021	0.418	% Share of Privately Rented Stocks	348	0.170	0.061	0.078

Table C12. Summary Statistics for Local Authority Level Stocks by Size and Tenure (Percentage of Total Stocks)

Variable (2001)	Observations	Mean	Std. Dev.	Min.	Max.	Variable (2011)	Observations	Mean	Std. Dev.	Min.
% Owner Occupied Properties in Small Size	348	0.032	0.023	0.011	0.277	% Owner Occupied Properties in Small Size	348	0.030	0.019	0.009
% Owner Occupied Properties in Medium Size	348	0.309	0.054	0.139	0.445	% Owner Occupied Properties in Medium Size	348	0.255	0.043	0.115
% Owner Occupied Properties in Large Size	348	0.258	0.050	0.034	0.357	% Owner Occupied Properties in Large Size	348	0.253	0.051	0.028
% Owner Occupied Properties in Extra Large Size	348	0.110	0.052	0.006	0.262	% Owner Occupied Properties in Extra Large Size	348	0.189	0.070	0.019
% Privately Rented Properties in Small Size	348	0.057	0.017	0.025	0.161	% Privately Rented Properties in Small Size	348	0.085	0.021	0.050
% Privately Rented Properties in Medium Size	348	0.030	0.024	0.006	0.187	% Privately Rented Properties in Medium Size	348	0.044	0.035	0.011
% Privately Rented Properties in Large Size	348	0.024	0.010	0.007	0.117	% Privately Rented Properties in Large Size	348	0.063	0.016	0.033
% Privately Rented Properties in Extra Large Size	348	0.007	0.005	0.001	0.045	% Privately Rented Properties in Extra Large Size	348	0.010	0.004	0.003
% Socially Rented Properties in Small Size	348	0.051	0.031	0.016	0.230	% Socially Rented Properties in Small Size	348	0.050	0.025	0.015
% Socially Rented Properties in Medium Size	348	0.095	0.043	0.029	0.267	% Socially Rented Properties in Medium Size	348	0.088	0.035	0.028
% Socially Rented Properties in Large Size	348	0.025	0.012	0.006	0.067	% Socially Rented Properties in Large Size	348	0.020	0.009	0.005
% Socially Rented Properties in Extra Large Size	348	0.002	0.001	0.000	0.007	% Socially Rented Properties in Extra Large Size	348	0.002	0.001	0.001

C3. Coefficients Tables for both Lengths of Settlement Model and Factor Model

Table C13. The Coefficient Effects of Lengths of Settlement across Ethnic Groups

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Black Caribbean	Black African
Overcrowding Measure: Occupancy Rating										
% Share Arrived before 1981	-34.391**	-0.393	-2.303**	-1.641**	-2.289*	2.099*	-4.737***	-2.199**	-0.722	-4.713***
	(16.687)	(0.549)	(1.071)	(0.688)	(1.309)	(1.270)	(0.755)	(1.092)	(0.644)	(1.377)
% Share Arrived between 1981 and 2000	86.970***	-1.697*	-1.806**	-1.369*	-0.385	1.354	-3.057***	-1.004	1.636	-1.317*
	(17.982)	(0.963)	(0.828)	(0.827)	(1.272)	(0.984)	(0.544)	(0.963)	(1.112)	(0.725)
% Share Arrived between 2001 and 2006	-50.911	-0.463	2.072***	-0.756*	-0.526	1.809**	-1.068***	2.581***	-0.979	-0.453
	(37.323)	(2.302)	(0.762)	(0.425)	(0.671)	(0.906)	(0.384)	(0.937)	(0.736)	(0.543)
% Share Arrived between 2007 and 2011	1.370	4.289***	1.775***	3.361***	0.227	0.741	-0.120	1.136*	-0.269	-0.342
	(14.476)	(1.192)	(0.577)	(0.483)	(0.780)	(0.879)	(0.296)	(0.583)	(0.699)	(0.513)
Regional Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	348	346	346	346	346	346	346	346	346	346

Table C14. Coefficient Effects of Lengths of Settlement on % Households in Shared Dwelling

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Dependent Variable: % Household Sharing a Dwelling										
% Arrived before 1981	-51.624***	0.321	1.151	-3.187	-1.429	-8.478	-9.055**	-2.305	0.236	-12.565***
	(14.768)	(1.804)	(4.447)	(2.549)	(2.247)	(5.573)	(4.079)	(3.287)	(1.587)	(3.889)
% Arrived between 1981 and 200	244.460***	-10.133***	5.238**	-0.949	3.143*	-0.795	-4.125*	0.989	4.935	-1.212
	(44.084)	(3.094)	(2.662)	(3.931)	(1.683)	(2.653)	(2.248)	(3.744)	(4.153)	(2.450)
% Arrived between 2001 and 2006	-151.364**	-3.492	4.414*	0.371	1.107	11.631***	-2.565	5.121	2.105	-0.102
	(68.910)	(4.709)	(2.448)	(1.605)	(1.388)	(2.329)	(1.619)	(3.411)	(1.646)	(1.132)
% Arrived between 2007 and 2011	-84.439**	9.400***	6.576***	4.521***	3.992***	2.321	0.345	4.431**	2.314	0.524
	(42.833)	(2.823)	(1.901)	(1.713)	(1.532)	(2.567)	(1.592)	(1.763)	(1.513)	(1.111)
Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	348	346	346	346	346	346	346	346	346	346

Table C15. The Coefficient Effects of Socioeconomic and Cultural Factors on Overcrowding Rates across Ethnic Groups

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Dependent Variable: Occupancy Rating										
% Share of Population Aged 0-15	2.532*	5.687***	0.511	10.244***	-0.723	-2.128	-0.550	2.381	-0.395	-0.634
	(1.410)	(0.764)	(0.925)	(1.375)	(1.392)	(1.374)	(1.185)	(1.954)	(1.169)	(2.094)
% Share of Population Aged 16-49	0.350	1.023	1.873***	7.508***	0.170	-0.845	-0.008	3.218**	-0.767	-2.096
	(1.072)	(0.732)	(0.628)	(1.397)	(1.417)	(1.414)	(1.102)	(1.461)	(0.918)	(1.953)
% Share of Population Aged 50-64	1.222	1.217	-1.656***	6.008***	-1.156	-0.420	-2.307	0.736	-1.852	-1.244
	(1.486)	(1.049)	(0.563)	(1.704)	(2.375)	(1.591)	(1.504)	(2.201)	(1.230)	(2.087)
% Share of Married Population	-2.528***	-1.509**	-1.149*	-2.511***	0.615	0.064	-0.167	-0.333	-0.519	0.525
	(0.923)	(0.699)	(0.620)	(0.505)	(0.557)	(0.435)	(0.399)	(0.503)	(0.425)	(0.598)
% Share of Female Population	-3.247	1.258	1.286	-1.214	0.642	0.130	-1.232	0.408	0.920	0.952
	(2.131)	(0.929)	(1.098)	(0.822)	(0.877)	(0.908)	(0.809)	(0.523)	(0.661)	(0.968)
Household Size	1.047***	0.262	0.250	0.415***	0.147***	0.148**	0.046	-0.008	0.282***	-0.145
	(0.236)	(0.180)	(0.179)	(0.065)	(0.052)	(0.065)	(0.063)	(0.045)	(0.100)	(0.129)
Log Occupational Score	-0.712	-1.299***	-1.546***	0.100	0.405	-0.528*	-1.769***	-1.031***	0.104	1.078**
	(0.647)	(0.436)	(0.256)	(0.455)	(0.567)	(0.294)	(0.429)	(0.370)	(0.455)	(0.534)
Hourly Wage	0.003	-0.001	-0.011	0.001	-0.000	0.001	0.005	0.004	0.004	0.011
	(0.010)	(0.003)	(0.008)	(0.006)	(0.010)	(0.009)	(0.010)	(0.004)	(0.009)	(0.011)
% Share of Movers	1.436	-0.579	-0.993*	0.479	0.784	0.597	0.644	-1.014**	0.729	-2.073**
	(0.995)	(1.244)	(0.603)	(0.634)	(0.911)	(1.294)	(0.516)	(0.394)	(0.526)	(0.917)
Residential Clustering Index	-	40.922**	-2.138*	-1.333	-9.658***	-10.556	-4.917	2.602	-5.568**	5.176
	-	(19.834)	(1.167)	(3.003)	(3.412)	(7.154)	(6.108)	(5.528)	(2.285)	(10.051)
Observations	652	652	652	650	644	626	650	650	651	650

Table C16. The Coefficient Effects of Local Housing Attributes (Price and Tenure) on Overcrowding Rates across Ethnic Groups

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Dependent Variable: Occupancy Rating										
Log Median House Price Index	-0.426***	0.155	-0.561***	0.186	-0.208	1.155**	0.344	0.505	0.307	0.577
	(0.086)	(0.225)	(0.199)	(0.323)	(0.543)	(0.550)	(0.450)	(0.333)	(0.407)	(0.581)
% Social Housing Stocks	0.586	-1.731	1.666	-0.170	-1.900	0.944	-1.788	-1.637	7.629***	2.112
	(0.510)	(1.348)	(1.209)	(1.765)	(3.117)	(2.630)	(2.654)	(1.899)	(2.871)	(2.675)
% Privately Rented Stocks	-0.499	1.506	-2.737**	4.580**	2.790	-1.072	1.317	-1.038	-9.850***	-6.194**
	(0.459)	(1.252)	(1.157)	(1.966)	(3.254)	(2.737)	(2.932)	(1.735)	(3.440)	(2.588)
Observations	652	652	652	650	644	626	650	650	651	650

Table C17. The Coefficient Effects of Local Housing Attributes (Size by Tenure) on Overcrowding Rates across Ethnic Groups

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Dependent Variable: Occupancy Rating										
% Small Size Owner Occupied Stocks	4.898**	-1.417	12.520***	14.114**	15.897	-6.660	21.274***	20.590***	10.057	14.257
	(2.092)	(4.368)	(3.570)	(6.987)	(10.546)	(9.862)	(8.137)	(5.843)	(7.163)	(9.317)
% Medium Size Owner Occupied Stocks	1.827	-9.014***	4.129	17.451***	10.912	1.416	5.043	6.181	-3.306	11.390
	(1.169)	(3.412)	(2.938)	(5.602)	(8.205)	(8.750)	(6.966)	(4.516)	(5.737)	(7.965)
% Large Size Owner Occupied Stocks	0.981	-7.089*	5.864*	24.743***	14.986	4.069	15.965*	10.171*	2.802	5.634
	(1.366)	(4.091)	(3.516)	(7.204)	(11.351)	(11.079)	(9.425)	(5.523)	(7.519)	(10.747)
% Extra Large Size Owner Occupied Stocks	-0.499**	-0.271	-2.346***	-3.615***	-0.610	-0.497	-3.314**	-2.096**	-1.433	-0.076
	(0.247)	(0.731)	(0.730)	(1.225)	(1.895)	(1.833)	(1.551)	(1.007)	(1.297)	(1.956)
% Small Size Privately Rented Stocks	10.370***	0.437	18.186***	17.706***	13.194	13.481	27.239***	17.480***	19.389***	15.662*
	(1.503)	(4.159)	(3.295)	(5.841)	(10.111)	(8.503)	(7.472)	(5.009)	(6.804)	(8.974)
% Medium Size Privately Rented Stocks	-0.283	-13.629***	0.389	11.029	14.588	-5.779	-12.463	3.695	3.547	18.056*
	(1.740)	(4.748)	(3.884)	(7.243)	(11.160)	(11.083)	(10.335)	(6.083)	(9.234)	(10.728)
% Large Size Privately Rented Stocks	-0.064	-15.798	1.403	1.161	-40.519*	11.103	23.823	15.757	19.629	-3.724
	(3.329)	(10.843)	(7.573)	(13.901)	(23.048)	(20.871)	(17.007)	(11.689)	(15.543)	(23.230)
% Extra Large Size Privately Rented Stocks	-2.351	4.751	32.533**	-3.542	125.800***	2.605	-36.358	26.230	40.186	39.870
	(5.734)	(19.060)	(15.718)	(39.378)	(43.822)	(39.805)	(34.846)	(24.116)	(35.008)	(40.973)
% Small Size Social Housing Stocks	4.876***	-5.529	9.831***	27.238***	22.997**	3.593	13.966*	13.031**	-3.221	26.929***
	(1.632)	(3.762)	(3.585)	(6.828)	(10.028)	(10.302)	(8.344)	(5.915)	(8.033)	(9.658)
% Medium Size Social Housing Stocks	2.497	0.278	3.682	17.300**	18.194*	5.603	22.826**	11.556*	-10.360	-6.391
	(1.719)	(4.545)	(4.018)	(6.984)	(10.741)	(10.950)	(8.946)	(5.924)	(7.437)	(10.346)
% Large Size Social Housing Stocks	3.158	-10.528	5.723	28.741***	9.290	2.355	19.885	14.869	20.740	27.987
	(2.928)	(7.685)	(6.823)	(11.154)	(16.909)	(16.525)	(14.523)	(9.598)	(12.987)	(20.400)
% Extra Large Size Social Housing Stocks	-42.770***	-24.978	-48.043	60.522	-36.575	-74.147	-6.106	-74.622	-19.849	71.983
	(15.391)	(45.446)	(35.264)	(66.844)	(100.396)	(111.093)	(82.059)	(52.480)	(68.515)	(107.885)
Observations	652	652	652	650	644	626	650	650	651	650

C4. Coefficient Estimates using Number of Persons per Room (>=1.5) as the Overcrowding Measure

Table C18. The Coefficient Effects of Lengths of Settlement across Ethnic Groups using Persons per Room

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Black Caribbean	Black African
Overcrowding Measure: Persons per Room										
% Share Arrived before 1981	-27.855	-0.081	-18.640***	2.829*	3.640***	-0.553	-16.243***	-3.305*	-0.684	5.049
	(25.210)	(0.702)	(2.941)	(1.607)	(1.138)	(1.589)	(5.564)	(1.720)	(1.081)	(8.013)
% Share Arrived between 1981 and 2000	55.111	-2.305*	-15.821***	2.165	-0.501	-1.545	-10.615***	-2.213	4.478**	-4.066
	(50.893)	(1.205)	(2.426)	(2.214)	(1.864)	(1.810)	(3.136)	(1.921)	(1.989)	(2.715)
% Share Arrived between 2001 and 2006	201.917*	0.323	-14.073***	4.979***	-0.042	-3.137*	-8.834***	0.376	0.354	-2.182
	(117.783)	(3.031)	(2.126)	(1.055)	(1.010)	(1.669)	(2.828)	(1.794)	(1.010)	(1.981)
% Share Arrived between 2007 and 2011	-148.853***	2.031	-12.655***	4.105***	3.715***	0.097	-8.316***	-0.189	1.691	-4.104**
	(47.549)	(1.655)	(1.593)	(1.049)	(1.142)	(1.514)	(2.214)	(0.812)	(1.185)	(1.929)
Regional Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	348	346	346	346	346	346	346	346	346	346

Table C19. The Coefficient Effects of Socioeconomic and Cultural Factors on Overcrowding Rates across Ethnic Groups using Persons per Room

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Dependent Variable: Number of Persons per Room >=1.5										
% Share of Population Aged 0-15	-1.365	-1.040	-0.492	12.563***	13.368***	9.364**	-6.063	19.481**	13.194**	-0.158
	(6.432)	(2.735)	(3.806)	(4.551)	(3.295)	(4.071)	(6.134)	(7.967)	(5.770)	(1.791)
% Share of Population Aged 16-49	-13.363***	1.922	4.402	7.704*	8.543***	3.451	-5.728	13.170*	16.608***	0.121
	(3.967)	(2.927)	(2.720)	(4.297)	(3.106)	(3.327)	(5.832)	(7.029)	(5.013)	(1.764)
% Share of Population Aged 50-64	17.323***	1.909	-4.299**	9.959*	13.436***	12.110**	-10.902	12.521	9.812	0.414
	(5.608)	(3.656)	(1.885)	(5.273)	(4.053)	(5.304)	(7.147)	(8.601)	(8.138)	(1.708)
% Share of Married Population	-0.826	1.212	-0.753	-1.654	-0.479	-2.112**	-0.839	-2.276	-0.262	1.418
	(2.836)	(2.559)	(2.675)	(2.003)	(1.355)	(1.052)	(1.795)	(1.999)	(2.124)	(0.867)
% Share of Female Population	-2.668	-6.684**	10.096**	-3.107	-7.032***	-5.358**	4.976**	1.682	8.269***	-1.039
	(8.237)	(3.374)	(4.733)	(2.712)	(1.980)	(2.434)	(2.302)	(3.494)	(3.070)	(1.343)
Household Size	3.788***	1.261*	0.873	0.336	-0.008	0.307	0.079	-0.162	0.701*	0.056
	(0.781)	(0.692)	(0.593)	(0.223)	(0.198)	(0.222)	(0.230)	(0.308)	(0.416)	(0.131)
Log Occupational Score	1.449	2.228	-1.520	-1.647	-3.141*	-0.116	2.055*	-1.683	-3.725*	0.232
	(3.042)	(1.937)	(1.213)	(1.218)	(1.792)	(1.144)	(1.204)	(2.800)	(1.908)	(0.785)
Hourly Wage	-0.021	-0.023**	-0.037*	-0.022	0.010	0.035	0.039	0.042	0.063	0.005
	(0.032)	(0.011)	(0.019)	(0.017)	(0.035)	(0.027)	(0.038)	(0.032)	(0.039)	(0.017)
% Share of Movers	2.464	-6.346	-3.787	-1.568	0.317	2.099	3.537	-4.127	1.490	-1.442
	(2.756)	(5.537)	(2.355)	(2.038)	(2.143)	(3.527)	(2.428)	(2.628)	(2.029)	(1.778)
Residential Clustering Index	-	186.981**	-28.619***	-21.689	-109.567***	-66.853**	34.425*	39.327	5.279	68.367**
	-	(74.239)	(5.759)	(13.340)	(30.634)	(27.428)	(20.245)	(34.523)	(6.035)	(31.399)
Observations	652	652	652	650	644	626	650	650	651	650

Table C20. The Coefficient Effects of Local Housing Attributes (Price and Tenure) on Overcrowding Rates across Ethnic Groups using Persons per Room

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Dependent Variable: Number of Persons per Room >=1.5										
Log Median House Price Index	-1.415***	2.395**	1.272	3.167***	-3.708**	2.984*	-1.474	2.604	-1.383	1.150
	(0.409)	(0.948)	(0.944)	(1.074)	(1.527)	(1.672)	(1.557)	(1.629)	(1.607)	(1.009)
% Social Housing Stocks	12.168***	-7.512	5.770	-11.577*	0.789	26.778*	-4.106	1.756	-2.321	-21.143***
	(2.371)	(5.236)	(6.286)	(6.943)	(6.263)	(13.972)	(9.764)	(10.708)	(10.499)	(7.301)
% Privately Rented Stocks	-0.316	-0.988	-3.362	2.880	-9.653	-35.570*	6.968	5.632	-15.191	14.620*
	(3.038)	(5.225)	(6.450)	(8.009)	(6.775)	(18.507)	(11.957)	(11.732)	(12.932)	(8.014)
Observations	652	652	652	650	644	626	650	650	651	650

Table C21. The Coefficient Effects of Local Housing Attributes (Size by Tenure) on Overcrowding Rates across Ethnic Groups using Persons per Room

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Dependent Variable: Occupancy Rating										
% Small Size Owner Occupied Stocks	-4.335	26.981	13.937	53.524***	9.429	-11.526	-29.115	-12.405	-51.092*	-3.326
	(7.026)	(16.613)	(16.844)	(20.420)	(32.085)	(32.313)	(27.382)	(27.881)	(26.220)	(21.034)
% Medium Size Owner Occupied Stocks	4.407	-19.566	-29.772**	34.364***	3.909	6.905	2.856	-11.644	-24.451	23.394*
	(4.982)	(12.396)	(12.554)	(13.243)	(25.467)	(22.945)	(17.331)	(17.930)	(21.141)	(12.288)
% Large Size Owner Occupied Stocks	-4.441	-10.026	-17.749	75.536***	41.423*	-42.963	19.941	-38.210	-61.743***	21.856
	(5.451)	(15.372)	(15.664)	(17.189)	(24.302)	(30.316)	(23.099)	(27.508)	(21.804)	(16.552)
% Extra Large Size Owner Occupied Stocks	-0.501	-11.906*	8.850	29.877***	8.294	9.473	8.654	-13.631	15.228	5.324
	(2.454)	(6.160)	(6.129)	(7.753)	(8.560)	(12.623)	(9.318)	(10.899)	(10.173)	(6.659)
% Small Size Privately Rented Stocks	27.537***	-32.851**	-27.963*	58.842***	47.491**	9.469	-21.180	-64.634**	8.773	-9.361
	(7.038)	(13.364)	(15.856)	(18.610)	(22.607)	(32.329)	(29.499)	(25.817)	(21.116)	(16.702)
% Medium Size Privately Rented Stocks	13.739	-0.459	-19.784	38.235	-0.681	94.761**	7.484	-2.777	-32.970	7.016
	(9.558)	(20.636)	(23.379)	(24.927)	(41.330)	(44.875)	(30.638)	(31.430)	(33.243)	(25.478)
% Large Size Privately Rented Stocks	16.033***	-21.558*	-8.101	3.127	23.936	-4.056	23.913	-13.675	9.568	1.066
	(4.945)	(12.286)	(14.270)	(15.995)	(20.325)	(25.029)	(22.819)	(23.260)	(20.244)	(16.186)
% Extra Large Size Privately Rented Stocks	-58.094***	115.407	-160.840**	92.855	223.760*	-72.543	-343.647**	-344.145**	-26.511	-37.712
	(20.459)	(87.593)	(67.796)	(87.954)	(123.001)	(160.959)	(142.652)	(155.196)	(135.889)	(79.130)
% Small Size Social Housing Stocks	-14.492**	-3.314	-20.803	58.597***	2.851	26.600	0.385	-28.137	-39.081	67.239***
	(6.361)	(17.825)	(18.168)	(22.544)	(34.697)	(35.604)	(27.359)	(31.823)	(30.419)	(19.556)
% Medium Size Social Housing Stocks	-20.643***	9.588	-29.678*	75.992***	37.762	-52.394*	-24.688	-30.584	-36.954	51.267***
	(7.228)	(15.211)	(18.023)	(20.514)	(29.162)	(30.670)	(21.313)	(27.182)	(23.555)	(18.685)
% Large Size Social Housing Stocks	23.830*	-55.630*	28.196	59.904	-10.276	-47.653	83.312	67.151	-15.275	31.422
	(12.882)	(30.752)	(30.668)	(40.290)	(53.232)	(52.761)	(57.980)	(56.182)	(48.330)	(28.349)
% Extra Large Size Social Housing Stocks	175.633***	-96.325	-286.275*	-230.063	21.915	315.312	549.031**	119.610	-331.371	-281.112
	(67.832)	(158.660)	(153.021)	(191.967)	(289.137)	(318.189)	(254.727)	(273.659)	(272.943)	(202.577)
Observations	652	652	652	650	644	626	650	650	651	650

C5. Average Marginal Effects using Number of Persons per Room (>=1.5) as the Overcrowding Measure

Table 22. Average Marginal Effects of Lengths of Settlement on Overcrowding Rates across Ethnic Groups using Persons per Room

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Overcrowding Measure: Persons per Room										
% Share Arrived before 1981	-0.191	-0.009	-0.049***	0.190*	0.204***	-0.037	-0.336**	-0.029*	-0.037	0.014
	(0.171)	(0.081)	(0.008)	(0.110)	(0.064)	(0.107)	(0.139)	(0.015)	(0.058)	(0.022)
% Share Arrived between 1981 and 2000	0.378	-0.265*	-0.042***	0.145	-0.028	-0.104	-0.219***	-0.019	0.240**	-0.011
	(0.331)	(0.140)	(0.007)	(0.149)	(0.104)	(0.123)	(0.080)	(0.017)	(0.106)	(0.007)
% Share Arrived between 2001 and 2006	1.387	0.037	-0.037***	0.334***	-0.002	-0.211*	-0.183***	0.003	0.019	-0.006
	(0.896)	(0.349)	(0.007)	(0.075)	(0.057)	(0.115)	(0.070)	(0.016)	(0.054)	(0.005)
% Share Arrived between 2007 and 2011	-1.022***	0.234	-0.033***	0.276***	0.208***	0.007	-0.172***	-0.002	0.091	-0.011**
	(0.371)	(0.190)	(0.005)	(0.073)	(0.063)	(0.102)	(0.056)	(0.007)	(0.064)	(0.005)
Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	348	346	346	346	346	346	346	346	346	346

It should be noted when using number of persons per room, the number of overcrowded households is likely to reduce therefore ethnicity specific characteristics are likely to be associated with housing deprivation (as overcrowding is considered less severely) and responses to changes in local housing attributes are likely to be weak. As a result, factors driving overcrowding tend to have smaller effects and generate a more mixed results across ethnic groups, with some groups being more tolerant of the deprived housing conditions while others not.

Table C23. Average Marginal Effects of Socioeconomic and Cultural Factors on Overcrowding Rates across Ethnic Groups using Persons per Room

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Dependent Variable: Persons per Room										
% Share of Population Aged 0-15	-0.006	-0.058	-0.003	0.142**	0.533***	0.565**	-0.149	0.142**	-0.006	0.161**
	(0.030)	(0.152)	(0.022)	(0.059)	(0.131)	(0.244)	(0.150)	(0.058)	(0.068)	(0.071)
% Share of Population Aged 16-49	-0.0625***	0.107	0.026	0.096*	0.340***	0.208	-0.140	0.096*	0.005	0.203***
	(0.019)	(0.163)	(0.016)	(0.051)	(0.123)	(0.201)	(0.143)	(0.051)	(0.067)	(0.061)
% Share of Population Aged 50-64	0.081***	0.106	-0.025**	0.091	0.535***	0.731**	-0.267	0.091	0.016	0.120
	(0.026)	(0.204)	(0.011)	(0.063)	(0.161)	(0.318)	(0.175)	(0.063)	(0.065)	(0.100)
% Share of Married Population	-0.004	0.068	-0.004	-0.017	-0.019	-0.127**	-0.021	-0.017	0.054	-0.003
	(0.013)	(0.143)	(0.016)	(0.015)	(0.054)	(0.063)	(0.044)	(0.015)	(0.033)	(0.026)
% Share of Female Population	-0.013	-0.372**	0.059**	0.012	-0.280***	-0.323**	0.122**	0.012	-0.040	0.101***
	(0.039)	(0.188)	(0.028)	(0.026)	(0.079)	(0.146)	(0.057)	(0.026)	(0.051)	(0.038)
Household Size	0.018***	0.070*	0.005	-0.001	-0.000	0.019	0.002	-0.001	0.002	0.009*
	(0.004)	(0.039)	(0.003)	(0.002)	(0.008)	(0.013)	(0.006)	(0.002)	(0.005)	(0.005)
Log Occupational Score	0.007	0.124	-0.009	-0.012	-0.125*	-0.007	0.050*	-0.012	0.009	-0.046*
	(0.014)	(0.108)	(0.007)	(0.020)	(0.071)	(0.069)	(0.030)	(0.020)	(0.030)	(0.023)
Hourly Wage	-0.000	-0.001**	-0.000*	0.000	0.000	0.002	0.001	0.000	0.000	0.001
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.002)	(0.001)	(0.000)	(0.001)	(0.000)
% Share of Movers	0.012	-0.354	-0.022	-0.030	0.013	0.127	0.087	-0.030	-0.055	0.018
	(0.013)	(0.308)	(0.014)	(0.019)	(0.085)	(0.213)	(0.060)	(0.019)	(0.067)	(0.025)
Residential Clustering Index	-	10.42**	-0.167***	0.287	-4.366***	-4.034**	0.844*	0.287	2.583**	0.065
	-	(4.135)	(0.034)	(0.252)	(1.217)	(1.649)	(0.496)	(0.252)	(1.186)	(0.074)
Observations	652	652	652	650	644	626	650	650	651	650

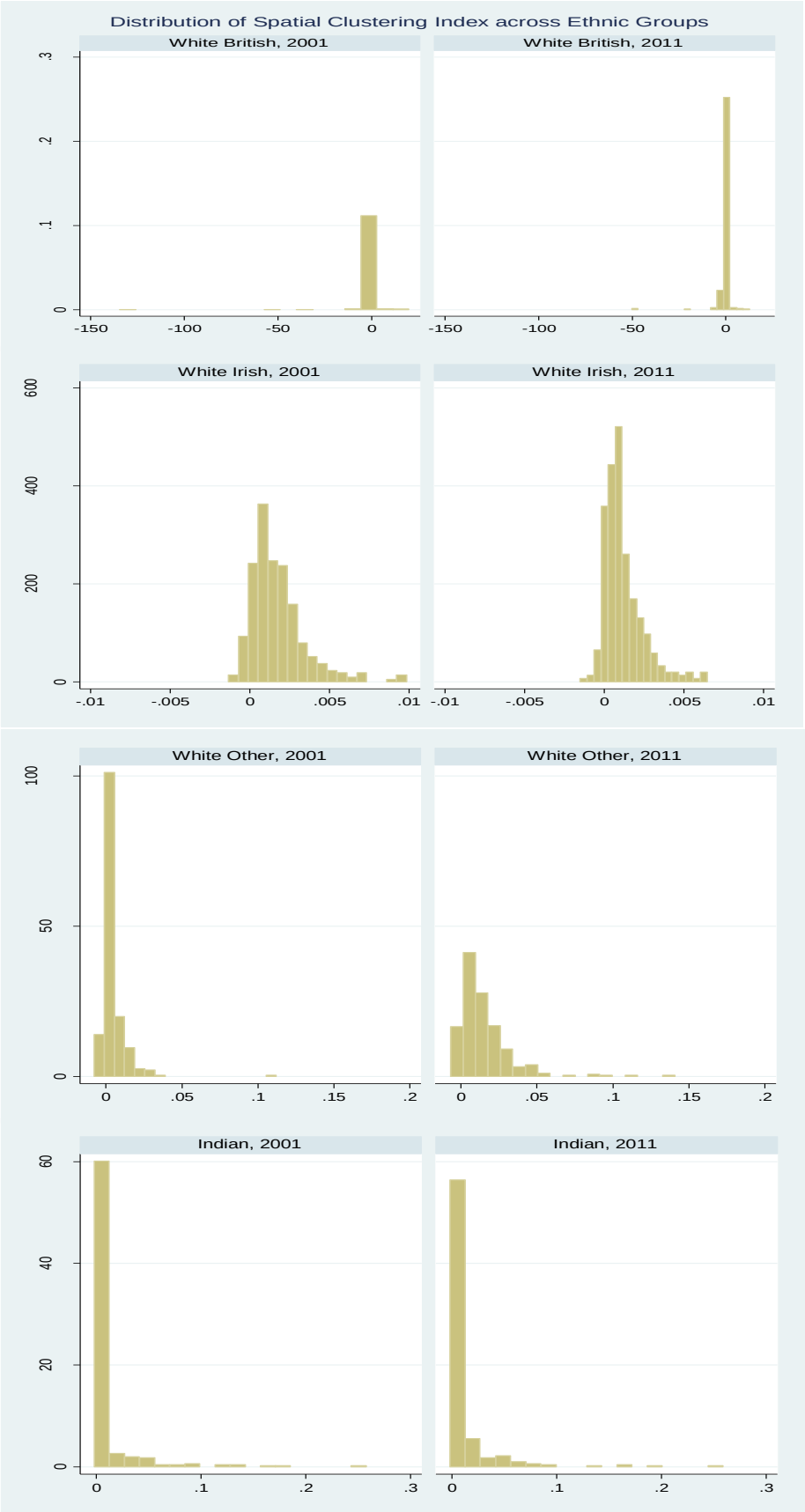
Table C24. Average Marginal Effects of Local Housing Attributes (Price and Tenure) on Overcrowding Rates across Ethnic Groups using Persons per Room

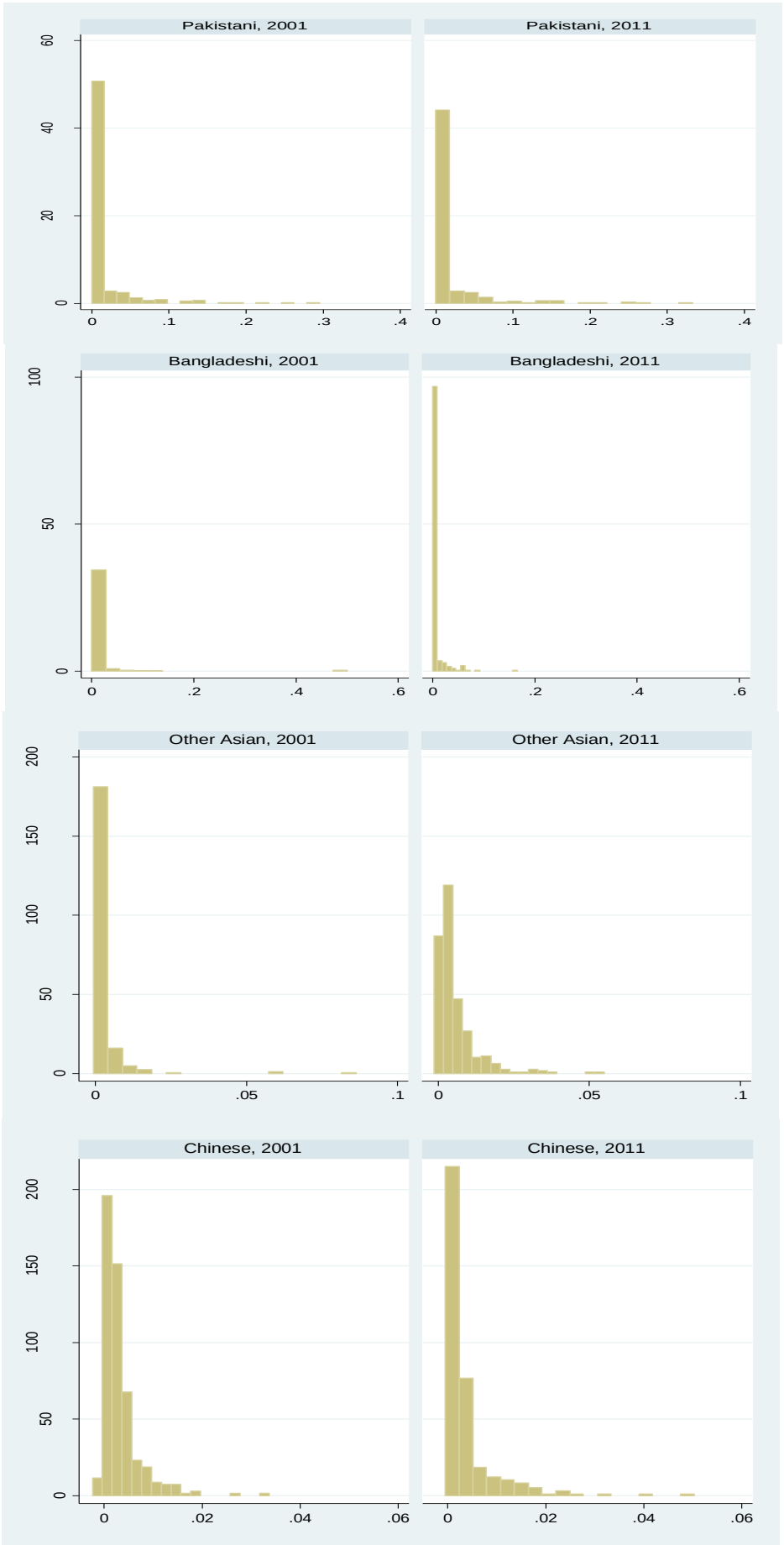
	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Dependent Variable: Number of Persons per Room >=1.5										
Log Median House Price Index	-0.007***	0.133**	0.007	0.019	-0.148**	0.180*	-0.036	0.019	0.044	-0.028
	(0.002)	(0.053)	(0.006)	(0.012)	(0.061)	(0.101)	(0.038)	(0.013)	(0.039)	(0.128)
% Social Housing Stocks	0.057***	-0.418	0.034	0.013	0.032	1.616*	-0.101	0.013	-0.799***	-0.186
	(0.011)	(0.292)	(0.037)	(0.078)	(0.250)	(0.842)	(0.239)	(0.078)	(0.275)	(0.158)
% Privately Rented Stocks	-0.001	-0.055	-0.020	0.041	-0.385	-2.146*	0.171	0.041	0.552*	-0.625*
	(0.014)	(0.291)	(0.038)	(0.086)	(0.270)	(1.114)	(0.293)	(0.086)	(0.302)	(0.321)
Observations	652	652	652	650	644	626	650	650	651	650

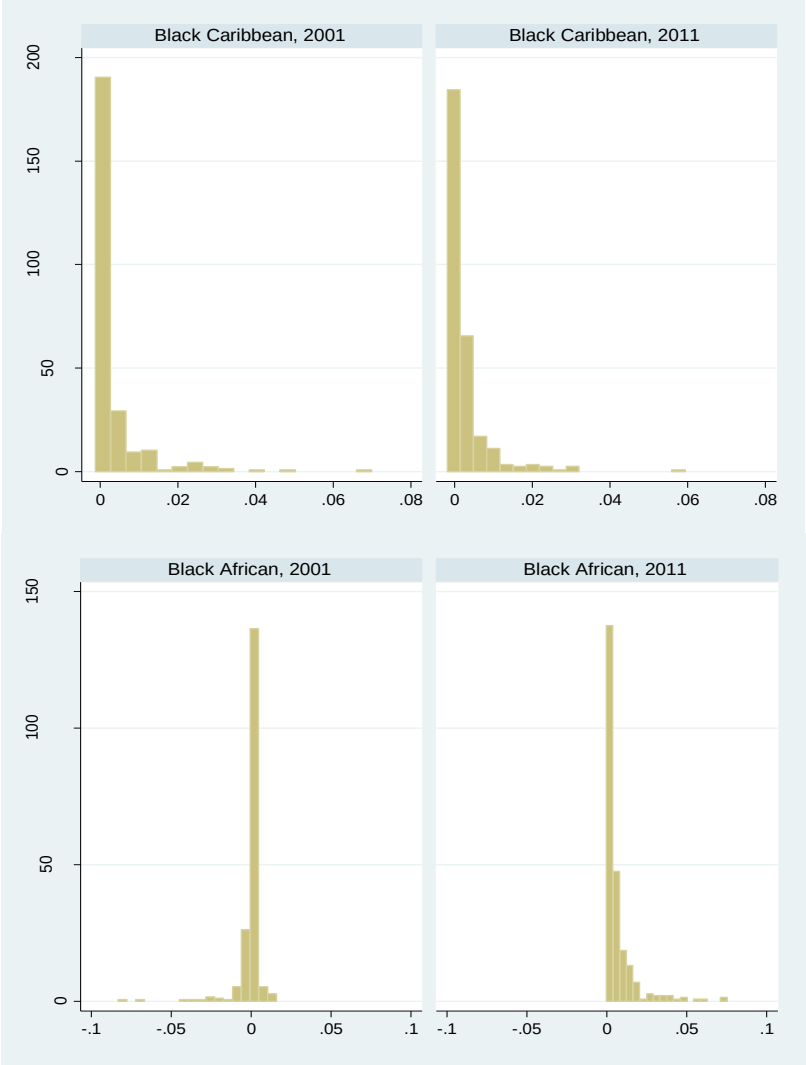
Table C25. Average Marginal Effects of Local Housing Attributes (Size by Tenure) on Overcrowding Rates across Ethnic Groups using Persons per Room

	White British	White Irish	White Other	Indian	Pakistani	Bangladeshi	Other Asian	Chinese	Caribbean	African
Dependent Variable: Number of Persons per Room >=1.5										
% Small Size Owner Occupied Stocks	-0.020	1.503	0.081	-0.091	0.376	-0.696	-0.714	-0.091	-0.126	-0.625*
	(0.033)	(0.926)	(0.098)	(0.204)	(1.279)	(1.950)	(0.670)	(0.204)	(0.795)	(0.321)
% Medium Size Owner Occupied Stocks	0.021	-1.090	-0.174**	-0.085	0.156	0.417	0.070	-0.085	0.884*	-0.299
	(0.023)	(0.691)	(0.073)	(0.131)	(1.015)	(1.385)	(0.425)	(0.131)	(0.464)	(0.259)
% Large Size Owner Occupied Stocks	-0.021	-0.559	-0.104	-0.279	1.651*	-2.593	0.489	-0.279	0.826	-0.756***
	(0.026)	(0.856)	(0.091)	(0.201)	(0.969)	(1.827)	(0.566)	(0.201)	(0.625)	(0.267)
% Extra Large Size Owner Occupied Stocks	-0.002	-0.663*	0.052	-0.100	0.330	0.572	0.212	-0.100	0.201	0.186
	(0.012)	(0.343)	(0.036)	(0.080)	(0.341)	(0.762)	(0.229)	(0.080)	(0.252)	(0.124)
% Small Size Privately Rented Stocks	0.129***	-1.830**	-0.163*	-0.472**	1.892**	0.571	-0.519	-0.472**	-0.354	0.107
	(0.033)	(0.744)	(0.093)	(0.189)	(0.900)	(1.951)	(0.722)	(0.189)	(0.631)	(0.258)
% Medium Size Privately Rented Stocks	0.064	-0.026	-0.115	-0.020	-0.027	5.718**	0.183	-0.020	0.265	-0.403
	(0.045)	(1.150)	(0.136)	(0.230)	(1.647)	(2.700)	(0.751)	(0.230)	(0.963)	(0.407)
% Large Size Privately Rented Stocks	0.075***	-1.201*	-0.047	-0.100	0.954	-0.245	0.586	-0.100	0.040	0.117
	(0.023)	(0.684)	(0.083)	(0.170)	(0.809)	(1.510)	(0.561)	(0.170)	(0.612)	(0.248)
% Extra Large Size Privately Rented Stocks	-0.272***	6.430	-0.938**	-2.513**	8.916*	-4.378	-8.425**	-2.513**	-1.425	-0.324
	(0.096)	(4.880)	(0.395)	(1.133)	(4.894)	(9.711)	(3.491)	(1.133)	(2.989)	(1.663)
% Small Size Social Housing Stocks	-0.068**	-0.185	-0.121	-0.205	0.114	1.605	0.009	-0.205	2.541***	-0.478
	(0.023)	(0.993)	(0.106)	(0.232)	(1.383)	(2.148)	(0.671)	(0.232)	(0.736)	(0.372)
% Medium Size Social Housing Stocks	-0.097***	0.534	-0.173*	-0.223	1.505	-3.162*	-0.605	-0.223	1.937***	-0.452
	(0.034)	(0.847)	(0.105)	(0.198)	(1.162)	(1.849)	(0.522)	(0.198)	(0.705)	(0.288)
% Large Size Social Housing Stocks	0.111*	-3.099*	0.164	0.490	-0.409	-2.876	2.043	0.490	1.187	-0.187
	(0.060)	(1.713)	(0.179)	(0.410)	(2.121)	(3.182)	(1.418)	(0.410)	(1.070)	(0.591)
% Extra Large Size Social Housing Stocks	0.821***	-5.367	-1.670*	0.873	0.873	19.03	13.46**	0.873	-10.62	-4.055
	(0.317)	(8.839)	(0.893)	(1.998)	(11.52)	(19.20)	(6.212)	(1.998)	(7.644)	(3.340)
Observations	652	652	652	650	644	626	650	650	651	650

C6. Distribution of Spatial Clustering Index by Ethnic Groups (Fig. C1)




Pakistani, 2001
Pakistani, 2011
Bangladeshi, 2001
Bangladeshi, 2011
Other Asian, 2001
Other Asian, 2011
Chinese, 2001
Chinese, 2011


Black Caribbean, 2001
Black Caribbean, 2011
Black African, 2001
Black African, 2011
0
50
100
150
200
0
.02
.04
.06
.08
-.1
-.05
0
.05
.1

Chapter 6

Conclusion

In conclusion, the thesis mainly attempts to investigate two areas with respect to immigration and housing in the UK. Firstly, it analyses the local impact of foreign immigration on the housing market in England and Wales. Specific housing market outcomes include house prices, house prices across dwelling tenures and types, housing supply and overcrowding. The corresponding underlying economic mechanisms could therefore be investigated to understand in-depth the interactions between immigrant households and native households, immigrants and housing developers/landlords as well as newly arrived immigrants and their co-ethnic ties. Secondly, it looked at length the ethnic group wide differences in overcrowding experiences which are treated as a type of housing deprivation. It further went on investigating various ethnicity specific factors that drive these differences in outcomes as well as how each ethnic group responds to different local housing attributes through overcrowding. It informs us the settling experiences and housing experiences of these ethnic groups in detail.

The research project mainly draws on existing public surveys and administrative data from the UK Data Service. The data collected span a range of themes from demographics, employment, housing, social welfare, local geographies, income and migration. They are collected usually from multiple sources and some need to be applied formally if the data are considered to be disclosive of personal information. Furthermore, they are often combined into a single dataset for analysis for each chapter. Robust econometric models are applied on these datasets to estimate different effects of and mechanisms caused by immigration. These are based on spatial studies which are common in immigration literature.

In this thesis, evidence on local housing demand and supply shifts led by immigration, segregation and native flight, individual ethnic group means to reduce overcrowding and their corresponding responses to changes in different local housing attributes are provided.

Chapter 3 Summary

Chapter 3 is originally motivated by the argument put forward in Sá (2014): the immigration and house price link at the local level involves changes in the population composition of neighbourhoods. While an inflow of immigrants would add to the overall demand for housing in a local authority, potential native out-mobility response, especially those natives at the top of income distribution, would reduce the net housing demand in that local authority, leading to a fall in house prices at the local level. The article provided some evidence on housing value depreciation, native flight and downward shift in the income distribution caused by immigration between the analysis period 2003-2010. However, one automatically questions how robust the compositional change in population (therefore income) led by inflows of immigrants would be reflected in changes in local housing values over alternative periods, and would there exist other mechanisms that lead to different local house price dynamics due to newly arrived immigrants' interaction with various other local stakeholders?

The chapter firstly revisits the mechanism using an extended period from 2003 to 2015 given the availability of extra years of Quarterly Labour Force Survey data. The strength of the link is no longer that robust with the negative house price effect of immigration having disappeared and evidence of native flight process and downward shift in income remaining statistically significant. However, the reason why the income effect did not feed through the house price changes is uncertain. With 5 years of extra data, the causal link becomes less robust.

While the literature listed various ways immigrants could interact with the locals leading to different house price dynamics, the chapter puts its focus on the alternative argument of tenure transition which is more commonly observed in specific type of labour market. If a housing ladder exists, would an inflow of immigrants move down the housing ladder for an average household in a neighbourhood? In response to newly arrived immigrants, landlords are likely to split up existing owner-occupied dwelling stocks into smaller rent-able units to accommodate them; co-ethnic households might also allow new arrivals to rent freely and share accommodation with them. With these transitions might depress housing values for neighbourhoods. Firstly, free renters and free renting households are themselves less likely to participate actively in transaction-related housing market activities such as mortgage finance, directly inhibiting housing demand. This is because, free renters usually do not have sufficient income to participate in housing transactions, otherwise they would reside in alternative tenure form. The degree of participation in housing market transactions is closely linked to one's socioeconomic status and financial backgrounds; free renting (either as a result of cultural practice or income shortfall) should be associated with a lack of incentives or value perception to engage in employment for living individualistically. Also, free-renting households are usually co-ethnic members, such as families, friends or relatives from the same ethnic origin. If they

don't enter financial transactions with the free renters, they are unlikely to raise their housing demand by engaging in housing market related transactional activities. In general, there is likely to be a tendency for free renting households to keep consistencies in housing market activities. At the same time, it could also be conformism or peer pressure. In this case, both free renters and free renting households face big hurdles to participate in housing market transactions, especially if the form of tenure is long term. Secondly, a reduction in home ownership due to alternative usage of housing stocks would also reduce the overall incentives for landlords and free-renting households to maintain and invest in the physical fabric of the stocks, gardens and property exteriors. This could potentially reduce the quality and the appealing-ness of neighbourhoods, further driving down demands. Thirdly, house prices could be reduced through supply side changes, e.g. an increase in the units supplied on the market by landlords to accommodate new immigrants. From the data between 2003 and 2015, this phenomenon of tenure transition is more salient in areas with high density of employment and majority of the professions in high skills. This is not surprising because this type of area is where immigrants are most likely to concentrate. But overall, local shifts in housing demand led by immigration is not very large and is not always reflected in housing value changes.

The chapter also looks at the effect of separate country of origin groups on house prices and mobility responses. The reason to look at individual group effect is to identify any group to have a large enough collective influence on certain housing market outcomes and lives of the indigenous population. From the results, varied house price effects are found across country of origin groups but none is due to native flight. However, the results are considered inconclusive due to potentially a limitation on data. They are highly suggested to be revised in light of better datasets that contain larger country group counts (e.g. census microdata which contains full population in the UK) or adopting alternative methodology (e.g. individual level model). However, the question per se remains an interesting one that could potentially offer additional economic and social insights.

The chapter continued to use a spatial panel data model (local authority area units x year units) and a historical settlement pattern instrument that have been widely adopted in the related literature. The methodology is robust as it solves two major endogeneity problems in causal effect identification, namely, omitted variable bias and reverse causality; this has already been discussed at length in the chapter. However, the novel part of the model is the incorporation of the local space in the immigration-local housing market link, characterised by its labour market features through area level employment density and skill distributions. It enables one to identify alternative immigration led housing price dynamics which are perhaps more salient in certain types of space but not in others. The study used additional labour market statistics from NOMIS such as area level job counts and socioeconomic profiles.

Chapter 4 Summary

While foreign immigrants help address skill shortages and contribute to the economic development of UK, they also bring their own distinct set of cultural backgrounds and ethnic traditions to settle at the destination. Their interaction with the indigenous households is expected to vary in a variety of dimensions, which further leads to different housing market outcomes. The chapter mainly attempts to contribute some evidence around the claims made by the media and address gaps in the contemporaneous immigration literature.

Firstly, immigrants are alleged to dramatically raise house prices, as Former Home Secretary (Now Prime Minister) Theresa May claimed that in her 2012 speech, "without immigration, house prices would be 20% lower" If the increase is this large, the immediate concern is the affordability issue. This has prompted the study of whether immigrants are indeed the root cause for substantial house price appreciation. While for the nation as a whole, immigrants add to the overall housing demand which in turn drive up house prices. At the neighbourhood level, I used spatial diffusion model initially developed by Saiz and Wachter (2011) and found a small negative house price effect of immigration instead.

Secondly, to look at whether there are any supply shifts caused by immigration, I ran a similar model on housing supply and I found a small positive supply response towards immigration which could be partly responsible for the depreciation of the corresponding local housing values. Using occupancy rating, I also looked at overcrowding response towards increased immigrant inflows; however, the evidence shows that immigration effect on overcrowding is positively small and there is not much of a difference in overcrowding effects across different government office regions. Since immigrants reside disproportionately in attached properties and flats, negative house price effect of immigration is mainly found in these two sectors. While increased demand could push up house prices, the supply response by landlords could be an important reason for a mild house price reduction for these two types of properties.

Thirdly, house price dynamics led by immigration were initially examined in U.S. studies such as Saiz (2003, 2007) and Saiz and Wachter (2011). At larger spatial units, e.g. Metropolitan Statistical Areas, immigrants push up house prices but at smaller spatial units, e.g. census tract, immigrants drive down house prices. The crucial difference lies in the income shifts generated by native outflows in response to immigration at smaller spatial scales. Areas tend to be more impoverished in immigrant concentration as affluent indigenous households move out of their neighbourhood and the reduction in incomes is translated in lowered house prices. Similar studies in the UK include Sá (2014) and Braakmann (2016). It was mentioned in their articles native flight, i.e. the out-migration of natives in response to immigrant inflows into a neighbourhood, is mainly result

of a preference for residing close to those who share similar ethnic and socioeconomic backgrounds, especially for those natives at the top of the income distribution. However, the specific underlying motivation for relocation is vague. What exactly prompted affluent natives to move? Is this because affluent natives experience competition in the work place from high skilled immigrants that lead to their relocation? Is it because affluent natives experience discomfort from newly arrived immigrants then choose to move? Was the discomfort based on the low-income grounds or ethnic/racial grounds of an average in-moving immigrant? Based on these concerns, the phenomenon of residential segregation and native flight could take place at all levels through different kind of media of contacts. Among past relevant studies, skilled and highly educated workers tend to have more labour market concerns; e.g. Mayda (2011) found skilled natives tend to favour less skilled immigrants. Additionally, racial attitudes, crime concerns and cultural differences are found to be important determinants of attitudes towards immigration. Therefore, it is important to understand the different cases of native out-migration which potentially all lead to residential segregation of the communities in the end..

Despite of the fact that native flight is a strong argument in explaining depreciating local housing values, the role of spatial scales played in the examination of native displacement effect of immigration is less persuasive. Since many related studies are spatially focused, it was claimed in Borjas (2003) and Sá (2014) that the displacement effect becomes larger as the spatial unit used in the analysis becomes smaller. I have run local authority level, census ward level, lower layer super output area level (lsoa) and output area level (oa) displacement effect. The effect has disappeared from ward level analysis, lsoa level to oa level; instead, a net weak positive native in-migration is found in high immigration cities. Within the ward level analysis, I have found it was indeed those natives at the top of the skill distribution that tend to move out in high immigration cities but the places equally attracted more less skilled natives. Natives in general tend to move further out of their neighbourhood rather than making short moves within their original neighbourhood in response to a 1% increase in immigrant inflows. Several reasons could contribute to this. Native relocation rarely rests on the immigration factor alone. It could perhaps have more to do with the skill distribution of employment across space where one is unlikely to find many similar level jobs in one place but usually a mix of range of skillsets in a local agglomeration economy. It could also be because native's familiarity of UK geographical space goes beyond ward level (e.g. relative ties, friend ties and similar institutional knowledge in other wards) such that their migration decision is not restricted to a single ward. In this case, with limited difficulties in surviving and settling in more remote locations, the out-moving native migrant can avoid potential confrontation towards (disliked) immigrants by moving further out. And the fact that there exist inflows of less skilled natives in high immigration cities reduces the possibility of extreme opposition attitudes of this population towards immigrants; these are derived and interpreted from the statistical results in chapter 4.

Also, for this chapter, I adopted a first differenced model with a spatial diffusion instrument (IV) to analyse the effect of immigration on house price change and changes in other outcome variables. The IV is initially developed in Saiz and Wachter (2011) and it is particularly suited in neighbourhood scale immigration studies; however, for large area units, the IV has a very weak predictive power; in the context of UK, the instrument fails to predict future streams of immigrants at the local authority level. The IV is first adopted in the UK immigration literature to examine the effect of immigration on economic outcomes.

There is a rich use of external data sources for this chapter which range from Land Registry, Census publicly open data, Department of Communities and Local Government (DCLG), Consumer Data Research Centre (CDRC), Ordinance Survey and Google Map Spatial Data. Specifically, Land Registry data contain housing transaction prices and other basic stock attributes such as tenure, newbuild and etc.. The Census contains the demographic and socioeconomic characteristics of the full population in the UK. DCLG has stock supply records by fine geographies. More detailed housing attributes are gathered from CDRC and Census. Additionally, both Ordinance Survey and Google Maps have spatial coordinate data on various local physical geographies and amenities. Their presence could potentially influence local housing developments therefore it is a novel part included in the housing supply model. By pinpointing the centroids of each lsoa area unit and the centroids of the amenity locations in QGIS, I was able to calculate the distance between the two in order to measure how easy it is to access these amenities. From the Ordinance Survey, log km to the nearest urban centre, nearest A-Road and B-Road, percentage area covered by woodlands and lake are derived; from Google Maps, log km to the nearest bus station, coastline, rail station, golf club and shopping centre are also calculated. The inclusion of both local housing characteristics and physical amenities greatly improves the fit of the supply model.

Chapter 5 Summary

The dimensions affected by overcrowded home are multi-faceted. Dense urban life raises the level of crime and violence and unmet housing needs could raise social problems. Additionally, overcrowding could cause a series of health issues including mental health, physical health, life satisfaction and general well-being. Past studies in health economics and epidemiological research have found that coughs, colds, asthmas, influenza and diarrhoea are associated with household size. Black and minority ethnic households in the UK are more likely to reside in high density dwelling than their White British counterparts. Their chance of experiencing illness is also higher. Apart from detrimental health consequences, serious effects on education and family relationships are also huge, especially for vulnerable groups. For example, children living in crowded condition are more likely to experience social deficits, impairments in wellbeing and deterioration in school performance. Mothers in overcrowded homes are also found to be more stressed, leading to mental health issues.

Generally speaking, overcrowding represents at least a short-term socioeconomic deprivation of households and is likely to develop into a prolonged state of housing and economic deprivation if the household in question cannot escape the crowded living condition due to either their personal circumstances or the effects of their external environments.

Specifically, the chapter perceives the overcrowding problem with respect to ethnic group differences. 10 groups considered are White British, White Irish, White Other, Indian, Pakistani, Bangladeshi, Other Asian, Chinese, Black African and Black Caribbean. While the ethnic minority groups have higher proportions of overcrowded households than the White majority group however the latter has much larger absolute number of these households, indicating that drivers behind overcrowding are likely to be multi-faceted and the problem is a widely spread phenomenon requiring attention.

Chapter 5 firstly attempts to identify whether there exists any persistency in housing overcrowding outcomes experienced by any particular group. By disaggregating each ethnic group population into several periods of arrival categories, I can distinguish the established households from newly arrived households. It was found that overcrowding tends to be concentrated in the most recent arrival cohorts while long term settlers tend to reduce a group's overcrowding rate. Slightly more persistent experience in overcrowding is found for Chinese and the White Other groups; Bangladeshi show the most persistent experience of overcrowding as households from all periods of arrival show positive contribution to overcrowding although not all coefficients are statistically significant.

The chapter then investigates what factors drive these differences across ethnic groups. A range of ethnicity specific characteristics were examined first. Apart from age, gender and marital

status, income, occupational status, household size, internal mobility and co-ethnic spatial clustering were analysed in turn to understand their effect on the local overcrowding rate for each group. Based on the findings, a better financial circumstance (e.g. a rise in income or occupational ranking) always reduces overcrowding. Having a larger average household size always reduces overcrowding.

Whether being internally more mobile would reduce overcrowding depends on the historical evolution and cultural contexts of the ethnic group in question. For groups using migration as a means to escape socioeconomic deprivation and unemployment, being internally more mobile would help them reduce overcrowding. Evidence shows that the White Other, Chinese and Caribbean experience reduced overcrowding rate as a result of increased mobility. No effect is found for the rest of the groups.

Additionally, ethnic minority groups tend to spatially cluster in space due to shared culture, language and life style. A higher degree of residential clustering could help some minority groups to reduce overcrowding through mutual support if the group is considered to be more collectivistic, i.e. being more altruistic and focus on group interest rather than individual interest. The opposite effect is likely to happen if the group is perceived to be more individualistic, i.e. focusing on individual achievement. The White Irish group, being a very individualistic ethnic minority group, does not see the group level overcrowding rate to reduce in stronger Irish communities. On the other hand, Africans, Other White and Pakistani show lower overcrowding rate in stronger co-ethnic communities as demonstrated by their more collectivistic nature. Most of the rest of the groups tend to have insignificant negative relationships indicating the potential benefits for co-ethnic communities to exist, but not being statistically salient.

Turning to results of overcrowding responses towards changes in different local housing attributes, house price effect on overcrowding generally depends on the sector the ethnic group has the most presence in. Generally, those with a more presence in owner-occupied sector is more sensitive to house price changes. A drop in house prices usually means a reduction in housing wealth which reduce the number of opportunities for owners to manoeuvre around to mitigate overcrowding. White British and White Other groups tend to have larger presence in the owner-occupied sector therefore a rise in house prices would see the share of their corresponding level overcrowding rate to fall. Among the rest, only Bangladeshi shows overcrowding response (or lack of response in mitigating overcrowding) towards high house prices.

How would different ethnic groups respond to changes in the property size mixes across different tenures of the neighbourhood? With a rise in higher share of extra-large size owner-occupied properties tend to see a lower rate of overcrowding across most groups; the corresponding evidence

for the social housing sector is weak and building large in the private rented sector has little effect in bringing down overcrowding. However, a rise in the share of small sized properties is positively associated with overcrowding regardless of tenure sectors and ethnic groups.

Fractional outcomes regression models are chosen to examine the effects of these different factors. Since the outcome variable is the percentage overcrowded households in each local authority, it is continuous and bounded between 0 and 1. The model allows non-linear relationship between independent variables and the outcome variable where the latter could be interpreted as a probability. Previously, Alba and Logan (1992) examined ethnic group wide differences in home attainment by applying a logistic regression on the U.S. data, but the range of variables investigated is rather limited: age, gender and length of settlement were claimed to be crucial to explain ethnic group wide differences in home attainment at the time. However, it was not explained what exactly was driving improvements in home attainment rates over that longer period of settlement. In this chapter, factors were further broken down to incorporate both financial and cultural elements, allowing us to distinguish different means adopted by households to mitigate overcrowding problems over time.

However, the methodology also comes with its limitation. Firstly, while it allows analysis at the ethnic group level, it does not include individual level variables which potentially important factors could be omitted. Secondly, causal interpretation of the findings is weak as there is limited correction of the endogeneity issues in the model apart from including several local authority level fixed effects.

The chapter mostly used census publicly open data which contains a rich range of information on demographics, labour markets, housing markets and migration etc.. It demonstrates this type of data could also be used to conduct complex social science analysis, not just privately held or disclosive data. The study also used data derived from previous projects (i.e. migration data) and specially constructed ones from Data depositors in exchange for a fee (i.e. period of arrival data), also demonstrating the viability of these two sources of conducting research.

Implication of Findings

Implication of House Price Effect

The implication of examining the effect of immigration on housing market dynamics is multifaceted. From the thesis, there are four broad categories of findings obtained from the analysis: firstly, immigrants cause local housing demand and supply shifts which lead to a depreciation of housing values, but the effect is not large with below 1% negative effect; secondly, tenure transition response to immigration could be one of the primary reasons for reduction in house prices and takes place mostly in economically active and high skilled areas. This is likely to come from two sources: landlords divide up existing owner-occupied units into private rental units to accommodate new arrivals; households tend to allow family members, relatives and co-ethnic members to free rent their owner-occupied properties before they can find work; thirdly, residential segregation is a subtle concept that requires more scrutiny. It was found at neighbourhood scales, there is a weak net increase in native population in high immigration cities, mostly contributed by inflows of less skilled natives. High skilled natives tend to move out of their neighbourhoods in response to immigration and natives in general are more likely to move to more remote places rather than down a few streets within the same neighbourhood; fourthly, apart from socioeconomic and financial progress, co-ethnic support and internal migration are also effective means for some ethnic groups to escape housing deprivation, but not for others. The Bangladeshi group experiences severe housing deprivation demonstrated by its persistence in overcrowding situation as well as its vulnerability towards high house prices. Additionally, there is evidence that building small raises overcrowding rate, building medium and large properties have limited effects; building extra-large sized properties only reduce overcrowding in the owner-occupied and social housing sectors. I will discuss the implications of these sets of results in turn.

Former Home Secretary (Now Prime Minister) Theresa May has claimed that in 2012, "without immigration, UK house prices could be 20% lower." The message is clear, UK house price has been rising steadily over the years and immigrants play an important part in contributing to this. Not only they increase the actual demand by physically being here, but also bring substantial level of investment to the housing sector. The narrative is in favour of immigrants as they could potentially bring benefits to the indigenous households, especially property owners.

If one breaks down the UK population by ethnic origins that dwell in different housing tenures, majority of the White British, White Irish, Indian and Pakistani reside in owner-occupied dwellings, all are around 70% of their corresponding total population (census 2011), with only a few staying in the privately rented and social housing sector. On the contrary, other immigrant households, e.g. Chinese, Caribbean and African, tend to have larger presence in the latter two sectors. Given that

the White British being the ethnic majority group taking up over 80% of the population, the figure shows that over half of the population in the UK is owner-occupiers. The claim that immigrants positively contributing to house prices shows immigration generally represents a good force in the housing sector as the extra population adds to the economic growth and productivity of the UK and most owner-occupiers are likely to benefit through capital gains. However, rising **local** house prices could potentially lead to affordability issues for some first time home buyers and low-income households. Some private renters and social housing dwellers are also likely to see their cost of living rise.

Immigration-led increase in national housing prices could be considered a positive populist view among indigenous households potentially because it meant an increase in the overall wealth of the locals. However, negative views towards this link usually arise from affordability issues. For example, the London house price bubble was for a while claimed to be caused by immigrants and foreign investors investing in housing stocks, which have led to affordability issues for local London residents. Empty houses were invested and built but no one could afford to dwell in those units due to high house prices (Wilson and Barton, 2017) which demonstrates an alternative negative view on immigrants and foreign investors pushing up house prices. For the period of analysis between 2003 and 2015, the author analysed the local authority level house price impact of immigrants in England and Wales and did not find any reduction in house prices; in her subsequent chapter, she found a small negative effect of immigrants on house prices using LSOA neighbourhood level scale. This provides an alternative perspective that immigrants overall do not have much (if any, weak negative) local effect on house prices (i.e. the micro effect). This suggests that immigrants either do not depress or depress a very little amount of the local housing wealth.

Implication of Tenure Transition

What would be the implication of increased private rental and free rental stocks in high immigration cities? The phenomenon involves turning some of the existing stocks into small units to accommodate new arrivals, co-ethnic members, family members and relatives (Shelter, 2012; Braakmann, 2016). If the trend continues, the places are likely to result in a rapid growth of the private rental sector and a more and more overcrowded owner-occupied and/or social housing sector.

An increased reliance on the private rented sector is likely to have several negative implications: firstly, high rents in central cities would erode the real purchasing power of consumers through a reduction in their real wage after housing payments. Secondly, it reduces tenant welfare through lowered quality of housing, insecurity of the tenure, potential rises in unresolved disputes between landlord and tenants due to limited regulations or third-party coordination. This is because,

privately rented stocks are less likely to be kept at good quality as landlords do not dwell in the property themselves and potentially manage multiple properties, directly reducing their overall incentives to maintain and renovate properties; tenants who do not plan to stay long term are also less likely to maintain properties. This also opens up questions about how to protect and keep track of a certain level of standards of these stock increases through appropriate institutions and regulations (Shelter, 2012).

An increased rate of free renting is also likely to inhibit demand for both free renters and free renting households, resulting in less participation of housing market related transactions and activities. Their overall financial abilities and incentives to maintain and renovate properties are also likely to be reduced, leading to a potential fall in housing quality.

Additionally, transaction level is going to reduce in the owner-occupied sector with rapid population inflows, buy-to-let is likely to be popular and one may need alternative ways of financing to accommodate alternative forms of ownership, liabilities and flexibility. Neighbourhood stability issues in the peripheral areas could be another concern which potentially lead to social tension and segregation (Kmibro, 2009; Taylor et al., 2009; Platts-Fowler and Robinson, 2015).

Implications of Segregation and Residential Sorting in the UK Context

Furthermore, results around segregation and native flight are different from that was typically found in the U.S. literature. In the U.S., positive house price effect of immigration is found at the metropolitan statistical area (MSA) level demonstrating an increase in housing demand led by immigrants. At U.S. census tract (a smaller spatial unit than MSA) level, a negative house price effect of immigration is found due to native flight response towards inflows of immigrants. For Chapter 4, I found a weak net in-migration of natives into the local wards using census data between year 2001 and year 2011. From the UK immigration literature, native out-migration responses towards immigrant inflows tend to be found at larger spatial units such as local authorities and government office regions.

However, I do not believe the UK results change the fundamentals of the segregation pattern that was found in the U.S. Saiz and Wachter (2011) has found that residential sorting tends to be more of an outcome of socioeconomic divide between natives and immigrants than a racial divide. Using the UK census data, I also found that displacement is more of an adjustment of the indigenous households at the top of the income distribution rather than those at the bottom of the distribution in response to immigration, although it is not clear whether the opposition attitudes are targeted at highly-skilled or less-skilled immigrants.

At the UK census ward level, white natives move out in response to immigrant inflows but there is also a slightly bigger proportion of natives moving in. This could suggest opposition attitudes towards immigration are short lived and potentially targeted towards specific groups in certain locations, not targeted at immigration as a whole. Literature has a substantial body of evidence concerning the lower socioeconomic position of the in-migrants which might explain the out-migration response of native households (Easton and Pryce, 2011). These native residents tend to fear socioeconomic decline in the local neighbourhood (Crowder et al., 2011). Additionally, a lot of external contextual factors could be driving the out-migration flows along the immigration factor; and it is unlikely that immigration factor is the only factor that plays in a native's relocation decision. For instance, Baum-Snow (2007) notes that the building of interstate highway directly reduces commuting costs in turn reduces urban population; Margo (1992) and Boustan and Margo (2009) found that rising income is also one of the primary reasons for natives to move out into suburban areas. Meanwhile other groups moving in were attracted by the fall in local property prices (Depro et al., 2015).

While native outflows tend to take place at the top of the income distribution, one should not exclude the possibility that particular cases of segregation and native flight problem at the lower end of the native income distribution, although potential quantitative evidence is not provided in the thesis. It is reasonable to expect that some locally deprived areas would be particularly hostile to immigration as the pressures they add to the services and local amenities, neighbourhood stability could cause strains and social tensions due to income and racial inequalities. For this reason, policy initiatives perhaps need to take place at a more microscale, i.e. from individual neighbourhood to neighbourhood. One should pay particular attention to the restricted mobility of low-income (less-skilled) native households. However, the relevance of these empirical findings to current housing policies is limited which mainly revolve around spatially targeted regeneration programmes, tenure diversification and the focus has been shifted away from incentivising "desired" population movements. The findings partially support that, given a particular type of economic and political structure creating unique geographical landscape for its labour market, migrant characteristics and migration patterns are likely to be stable over time. Policies concentrating on arranging housing market factors around migration tend to be effective and widely adopted in the UK and other European countries.

Also, the displaced natives tend to move further out to more remote location rather than an alternative location within the same neighbourhood (i.e. a census ward). This could arise from a number of reasons, high skilled natives tend to possess more income, knowledge and institutional support to migrate; therefore out-movers have the capability to move longer distance; out-movers are less inclined to move to alternative location within the same neighbourhood in order to avoid confrontation of disliked immigrants; moving further out is "safer".

Alternatively, positive phenomenon is observed as private rental stocks have gone up in high immigration cities. Existing landlords provide extra units on the market to accommodate new comers. This has positive consequences not only because appropriate levels of housing resources are devoted to immigrants moving into a new area but also it helps integrate the community through providing more opportunities of immigrants to interact with the locals through shared accommodation or a greater tenant mix.

Two recent papers on community integration include the "Integrated Community Strategy Green Paper (2018) and the Casey Review (2018) – A Review on Opportunity and Integration written by Dame Louise Casey. In the Casey Review, Ms. Casey has outlined several important aspects over how communities are segregated and the potential economic and social costs that could arise from the ignorance of these problems. "Few interactions between people from different backgrounds [would help foster] mistrust, prejudice and anxiety" (Casey, 2018, p.8) while promoting integration would help build resilience of people when encountering others with different values and behaviours. Specific policy actions include promoting British laws, regulations and histories within the core curriculum in all schools, giving support to those likely to settle permanently in the UK upon first arrival, and tackling school segregation and English deficiency. In the author's opinion, these measures have taken immigrant settlement into account and approached the problem by helping and supporting new settlers to solve difficulties when first arrived in the UK. Migrants arrived in the UK for different reasons and the type of problems they have come across are varied and hidden usually from the mainstream society. Most often, immigrant children and adults possess a high degree of tolerance and resilience towards differences and have developed mature understanding in their positions, goals and aspirations within the society at an early stage. However, the degree of tolerance and understanding should be mutual and support should be reciprocal in order to have integration to take place. The report has taken substantial consideration in recognising differences in immigrant groups and giving support for them to overcome barriers during their settling experiences; the author thinks of it to be a good initiative because it helps avoid imposing stereotypes and coercion in behaviours and practices, allowing immigrants to develop and grow in an absence of limited social networks and economic resources. It would allow further interactions, integration and cooperation among different groups rather than restricting their horizon within their own communities. The preventative stance taken by the report would allow us to see fewer violent cases arisen from social tensions and ethnic group conflicts in the future which are generally considered as negative. Promoting interactions in one's daily life could build resilience of both natives and immigrants, which is better than not interacting at all. Given the thesis has found substantial native flight from those in the top income distribution, one should find the route cause for the phenomenon and confront the situation before it accumulates to a degree with detrimental implications. To integrate, building tolerance and resilience are key.

On the other hand, the Integrated Community Strategy Green Paper (2018) has outlined measures to promote integration. The paper again took considerate perspectives over the settling and integrating experiences of the ethnic minority groups. There are three strategies worth highlighting: (1) improving the English language skills of migrants; (2) encouraging meaningful social mixing; (3) supporting newly arrived migrants to integrate and improving communities' ability to adapt to the migration. The author believes that these demonstrate the accepting stance of immigrants to work and settle in the UK and should be greatly encouraged. It also demonstrates the country's willingness to achieve economic growth and trades through a more collaborative stance and also taking into account the global context in which we all face today. Promoting English skills of the migrant groups would help integrate members and subgroups within a wider society, allowing them to engage in a variety of activities such as cultural exchanges, trades and commerce and promoting understanding of different administration and institutions; encouraging adequate social mixing could avoid segregation and clear misunderstanding as a result of lack of contacts across segregated groups while promoting mutual learning processes. External support that help migrants to adapt would give them chances to familiarise existing institutions and market environments, allowing them to achieve progress in a range of dimensions such as socioeconomic status, housing and education.

Implication of Overcrowding Experiences across Ethnic Groups

Previous literature (Alba and Logan, 1992; Akresh, 2008) that examine ethnic minority group settling experiences tend to focus on modelling the life trajectories of immigrant households, in dimensions such as occupational progress, socioeconomic achievements, education participation and performance and home attainment. However, there are very limited number of studies that explore factors that drive different rates of progress across ethnic groups, including both characteristics that pertain to the specific group's cultures and traditions as well as their responses towards changes in external environments. Instead of modelling factors that are potentially vague such as age, gender, minority group perception on marital, family and social relationships, the chapter focused more on actions taken by household members themselves as well as what supporting institutions such as local governments, public sector organisations or charities can do to mitigate overall deprivation. Individual household actions such as relocating to alternative areas, improving financial circumstances, shrinking household size and obtaining support from co-ethnic networks are effective means to alleviate housing deprivation for some ethnic groups, while being less effective for other ethnic groups.

The findings derived from the model have at least three positive implications: firstly, they help raise awareness for the general public about behaviours and practices of each other; secondly, they would also encourage house building and development activities to represent the interest of the full population, i.e. being more inclusive and comprehensive; thirdly, they would inform the supporting institutions to help them devise appropriate level of interventions in case of extremely

deprived situations. For example, the social housing sector tends to have severe overcrowding problems, and also has a highest level of concentration of ethnic minority groups. Building larger stocks for them would reduce the financial strain for these households as well as mitigating the overcrowding problem.

The Implications of Evidence on Government, Local Councils and Housing Developers' Actions

Additionally, what role could the Government, local councils do to reduce the level of overcrowding at the aggregate level? In the 2011 report generated on behalf of the Planning and Housing Committee (Boff, 2011), the overcrowding issue in London has been brought forward to the public attention around housing. It was proposed that building larger family sized stocks would help reduce the overcrowded living situation in London social housing sector where the problem is most prevalent.

London, being the centre for international business and commerce, as well as histories and cultures, accommodates a broad range of population across ethnic backgrounds, lengths of settlement, different occupational spectrums and constitutes a wide range of income distribution. The housing needs and aspirations of London's population are complex and constantly changing. The attempt to raising overcrowding as London's housing priorities, in addition to rough sleeping and homelessness is based on the reason that the public costs of overcrowding are currently increasingly borne by the education, social services and health budgets instead of housing budgets.

Advocates had claimed that building bigger would help reduce overcrowding in London's social housing sector because building large properties in the sector would allow households with large family size to accommodate themselves while vacating their old homes for other families of appropriate sizes to move in. The resulting chain effect would resolve the housing needs of multiple households. The strategy works because in the social housing sector, stock allocation is primarily based on self-reports of the housing needs of tenant households, not on their financial circumstances, whereas in the private sector, bigger sizes are potentially just an indication of the household's wealth.

Traditionally, 3+ beds family sized houses are bought as investments to cater sharers of the stock, be it professionals or low-income families (Boff, 2011). The rise of small sized units is partly due to past planning policies that promote high density housing. This type of housing strategy generates more economic values (e.g. reduced land costs, more relaxed planning obligations) but is not suited for family size house building and could potentially lead to a series of anti-social behaviour problems. The proposed number of bedrooms is 4+, challenging what's been proposed by the current Mayor's most recent London Housing Strategy report (Kahn, 2018) and the current building capacity of 3+ beds family sized homes. The focus of the latter tends to be put on generating a more mixed and

balanced community for London, therefore the concern is more on how the division of different housing types and sizes would further segregate London's population, and how the right blend of housing developments across locations would be reached to promote the vision of the mixed community.

The last chapter of thesis has provided some empirical evidence regarding how effective building large sized stocks would mitigate overcrowding. Although there is not a generally reduced overcrowding response across various ethnic groups towards rises in medium sized (4-5 rooms) and large sized (5-7 rooms) stocks, overcrowding is effectively reduced in areas with high share of extra-large sized properties (>= 8 rooms) mainly in the social housing sector and owner-occupied sector, providing evidence in line with the measures proposed in Boff (2011).

When looking at the overcrowding responses towards property size mixes across different sectors, the differences are not huge and are generally consistent. Property size matters less for the privately rented sector towards the end of the larger size. However, building small (1-3 rooms) almost always raises the overcrowding rate regardless of tenure sector and in which ethnic group dwells. The evidence is in support of proposing more large size family house building to reduce overcrowding in the social housing sector.

To increase the number of large size stocks, measures have been proposed in several policy documents. Firstly, to improve the current operation of the public subsidy system, since the level of grant rates in London does not vary by property size, building large is not as cost effective as to building small. The grant rate should be raised for constructing larger sized properties and reduced for constructing smaller sized properties, therefore to incentivise the provision of larger size family homes. Secondly, introducing flexible rents and giving boroughs a degree of flexibility to vary rent levels according to property size would also encourage developers to build large. Additionally, setting appropriate targets in housing policies would also help, for example, increasing the share of 4+ beds instead of 3+ beds in the social housing sector, targeting to maximise the number of bedrooms rather than number of units, or allocating grant not per unit basis, but per person basis and so on.

Although building small would incur lower cost of acquiring land initially, but it creates difficulties to expand the development site at a later stage, where other competing development sites could sit very closely to yours; on the other hand, building large (not just in terms of units, but also in terms of floor space), while incurring a substantial upfront cost in land acquisition and potentially more stringent planning obligations, would create opportunities to split up the units at later stage to serve alternative forms of aspirations of residents and accommodate alternative forms of living arrangements, which could in turn promote a series of additional renovations and upgrades. From the

perspective of housing developers, building large perhaps is more sustainable and profitable in the long term, but this should also be subject to further economic assessment.

Housing Market Neutrality

Overall, the thesis does depict a fairly neutral housing market impact and this can be seen through:

1. local supplies positively respond to immigrant inflows, which potentially suggests market mechanism works such that landlords are seeing additional immigrant housing demand as a source of economic opportunities; however, only growth in private rental and free rental stocks are found in high immigration cities;

2. the presence of segregation and residential sorting being small and native out-migration tend to take place at the top of the income distribution (on net), and despite outflows, there are still inflows, demonstrate either homophily (if any) has not yet contributed to a dynamic which constitutes an extremely segregated spatial pattern or the experience of opposition attitudes is short lived, i.e. non-persistent negative impression and avoidance. This suggests market failures arising from housing market discrimination and segregation are likely to be limited;

3. the emphasis on the positive side of co-ethnic ties and migration in alleviating minority group member deprivation. Therefore, immigrants possess a certain level of ability to self-correct housing market disadvantage and meet their housing demands.

However, discrimination and stereotypes could still exist. In fact, there exists a body of literature providing evidence on the local housing market working in a biased way against immigrants (Clark 1993; Galster, 1987; Streitwieser, 1983; Krysan, 2008; Perry, 2008). Tomlins (1999) also addressed that the housing inequality could take place in a range of dimensions: e.g. at individual level – landlords refuse to let to minority group members and estate agents practice discrimination against immigrants during housing search; at institutional level – the racist attitudes and behaviours are institutionalised within organisations such that subjective allocation of housing resources always works against the ethnic minority group communities. With that said, discriminatory practices in the housing market often leads to a counter discriminatory response by disadvantaged groups such as migrating to another area or seeking support from co-ethnic members; however, this does not mean discriminatory practices do not exist.

Although the thesis emphasises minority groups' ability to self-correct disadvantaged situation, working around or through the support of the housing market system, disadvantages and discriminations are more subtly revealed through several pieces of evidence, for example:

1. The minority's substantial presence in the social housing sector, especially for Bangladeshi, Black African and Black Caribbean groups, even when they are long established in the UK;
2. All minority groups experience overcrowding at least during their initial settlement;
3. Ethnic minority groups remain much higher overcrowding rates in private rented and social housing sectors compared to the White majority group.
4. Immigrant inflows increase occupational density and the rate of growth in private and free rental stocks, but do not increase growth of owner-occupied stocks, demonstrating their relative income disadvantage.

Overall, the thesis assessed the economic impact of immigration in England and Wales and their experiences of housing deprivation in terms of overcrowding. It provides evidence on several topical issues regarding housing price growth, segregation, native flight problem, the UK housing construction activities and so on. With respect to segregation, future work could be directed towards looking at more deeply the underlying drivers behind segregation and residential sorting within the spatial framework. Provided that segregation is an economics based argument, it would be also worthwhile tackling native-immigrant migration across stratified skill groups. For example, does the native at the top of the income distribution respond more to the highly skilled immigrants than the less skilled immigrants. Even if less skilled natives have limited relocations, does it mean opposition attitudes is non-existent? Investigating further the displacement effect of immigrants on natives across stratified skill groups would allow us to understand the underlying motivations of native flight and potential sources of social tensions.

In terms of ethnic minority group settlement experiences, it is worth further investigating both the positive and negative impact of minority group areas on the group members' well-being, settlement experiences and economic conditions. Another area worth exploring is the immigrant households' participation in the local housing market, from housing search, access to finance to housing investments; the quality of housing and the neighbourhood environments they dwell in etc., in order to assess any potential housing market discriminatory practices as well as migrants' disadvantages in the housing sector. How does online housing search in the privately rented sector provide meaningful social interactions and mixing between natives and immigrants? There are many important questions to address in this area.

Additionally, it is important to improve the model specification to take into account the endogeneity problem or developing individual level models when examining the concentration and migration effects of ethnic minority households to tackle their deprived situations; from there, to assess what local governments and institutions should do to look into supporting counter-discriminatory practices for ethnic minority households rather than interfering with them.

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