Immigration and Local House Prices in UK

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Abstract

Recent evidence from Sa (2014) suggests that immigration reduces local house prices at the UK local authority level. Therefore, at this geographical scale at least, immigration seems to impose a negative impact on neighbourhood values as reflected by decreasing housing prices. And, what's often used to explain this local economic effect in the literature is the concept of "native flight": if natives, who respond by moving out, tend to be at the top of the income distribution, their departure will lead to a reduction in overall neighbourhood income, which in turn will reduce housing demand and lead to a reduction in house price. Using several different spatial econometric models, this paper attempts to provide some empirical evidence on the extent of immigration effect on local housing values at a very small spatial scale, which then was broken down further into various UK regions to examine regional effects. A small but statistically significant negative impact was found for England and Wales as a whole; this effect also exhibits distinct regional patterns with areas closer to the Greater London tending to have little effect but for those are further away from it, it becomes larger. Secondly, we also challenge the assumption of a single housing market and explore which submarket, are most potently affected particularly in terms of housing tenure and type.

Keywords: House Prices, Immigration, Spatial Modelling, Housing Sub-markets

Introduction

In a wide range of literature across Economics, Sociology and Human Geography, the topic of immigration has long been subject to extensive studies. Much of the research has focused on its impact on labour market outcomes (Card, 2001 for US; Dustmann et al, 2013 for UK). However, this

paper would like to put its focus on the housing market. What would be the mechanism between immigration and house price? At the aggregate level, one would expect that immigration would increase the overall population hence contribute to the housing demand and push up house prices. However, the dynamics at a local level may reduce house prices. At a local level, residential sorting and segregation could lead to a reduction in house prices as a result of an overall decrease in demand (Card, 2001; Saiz, 2007; Sa, 2014).

Robust empirical estimation of the impact on the housing market has only come in the last decade. (Saiz, 2007; Akbari & Aydede, 2012; Gonzalez & Otega, 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 Maré 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 (Sa, 2014). Overall, immigration in the UK as a fraction of the working population has risen from 8% in the mid-1990s to 13% in 2010, while seasonally adjusted average house prices have increased from £60,000 in 1995 to £180,000 in 2007 (Sa, 2014), raising concerns about the impact of immigration on housing affordability, such as the claim by the 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

Most of the empirical studies using a spatial variation approach have mainly focused on the local authority level (Sa, 2014; Brakkmann, 2016). In order to understand the house price effect at a very local level, this article will use a smaller spatial unit, i.e. lower layer super output area (LSOA). It attempts to capture the local interaction between natives and immigrants, although the size of this area unit is not comparable to that of a neighbourhood, which potentially leads itself to another piece of research. The paper will also look at this effect across different regions as well as across different

housing sub-markets. From the results, one may potentially infer any differences in terms of dynamics of each local economy. In Section II we briefly discuss the existing literature with regards to how immigration affects local house prices. In Section III, we set out the methodology for dealing with them. In section IV we describe the data and provide summary statistics. We then present the results of findings in section V. We conclude in section VI.

Section II: Literature Review

Much of the literature examining immigration impact on the housing market comes from the US, where the depreciation in housing value is used to reflect native preference towards segregation (Borjas, Freeman and Katz, 1997; Card 2001; Borjas 2003; Saiz, 2007; Saiz and Wachter, 2011). The intuition is like this: if an inflow of immigrants into an area triggers native people especially those at the top of the income distribution to move out; even with an overall increase in population, if the total income in the area were to drop, the overall housing demand would decrease hence the corresponding house price would reduce through an income effect. Empirically, Saiz (2007) found that immigration inflows would increase the population hence the housing demand at the level of Metropolitan Statistical Area, but he went to the census tract level (Saiz and Wachter, 2011), he captured the native sorting effect which eventually led to a reduction in house price. However, would the area level dynamics with respect to immigration and housing in the US be similar to those in the UK? At the local authority level, Sa (2014) discovered a negative house price effect between 2003 and 2010 using labour force survey data. Similarly, Braakmann (2016) also found a negative relationship between immigration and house prices for the same period being studied in this paper. Both of them have provided evidence on substantial and significant native displacement by immigrants. In addition, Hatton and Tani (2005) pointed to a smaller native out-migration at government office region level. Therefore, it was suggested that displacement effect of immigration is numerically larger as the geographical area under analysis becomes smaller (Sa, 2014; Borjas, 2006).

In this paper, I challenge this perception. At LSOA level, I do not find any evidence of native flight. This directly counters the hypothesis that such effect would increase uniformly as the size of the area gets larger. One factor that may explain this feature could be that households or individuals do not trade off settlement location at the LSOA level. However, they could move out of a local authority in response to immigration, and they could also move out of a neighbourhood (smaller than LSOA). This would explain why native displacement does not occur at all geographical scale.

Apart from native outmigration response, there are several other channels documented in the literature that could also be at work.

Firstly, immigrants are perceived to increase the level of crime in an area; through the stigmatisation effect, the quality of the neighbourhood decreases, which is reflected in reduction in house prices. With regards to this particular causal 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.

Secondly, there could be difference between immigrants and natives in terms of usage in existing housing space (Saiz, 2007; Carter, 2005; Braakmann, 2016). It was suggested that immigrants may be more willing to accept more crowded living condition, and more people can live in the same housing stock. Saiz in his 2007 paper 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: not only he found that the number of persons per room rises with the share of immigrants, there is also a rise in the share of owner-occupiers but a decrease in the share of private renting. One explanation for this could be that owners split up larger properties such as houses to offer them on the rental market. 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 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 the population increase; therefore house price would not be increased by much.

The third channel through which immigrants could influence local house prices is that there may be potentially different level of willingness to pay for housing for a certain quality. If immigrants in general tend to care less about the standard of property they live in, then there is not much of an incentive for them to spend on housing maintenance, refurbishments and renovations. Even in those cases which they rent, their landlords would be less willing to pay to maintain the quality of the houses compared to say when they live in it themselves. Therefore, if an inflow of immigrants led to a structural decline in housing quality, the house price in an area would fall. However, from the empirical literature, Sa (2014) did not find any evidence on the immigration-house price link through this channel, at the local authority level.

Lastly, "Neighbourhood Stability" could be another explanation for risk-neutral and risk-averse house buyers to forgo properties in areas where the ethnic mix is constantly changing. To them, 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.

Although the paper does not test all of the channels that might be at work, the house price effect and native displacement effect will be examined in detail. It contributes to the existing literature in three ways: (1) it attempts to capture the very localised interaction between immigrants and natives by using a much smaller geographical unit, i.e. the lower super output area (LSOA), instead of using

local authorities which has been commonly found in recent empirical studies in the UK (Sa, 2014; Braakmann, 2016). (2) It breaks down the house price effect of immigration by the 11 Government Office Regions in hope of identifying where the house price reduction is most salient and provides some explanations for such regional difference. (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 sub-markets by tenure and type. Then it explains how it could be used to support the evidence in the existing empirical studies.

Section III: Methodology

When analysing the effects of immigration on various economic outcomes, the existing methodology has often used a fixed effect model with quasi-instruments constructed based on some theoretical explanation: the shift-share IV in Card (1991, 2001), Saiz (2007), Sa (2014) and Braakmann (2016) ; the spatial diffusion IV in Saiz and Wachter (2011) and the "Gateway" IV in Gonzalez and Ortega (2013).This article attempts to use the spatial diffusion instrument initially developed in Saiz and Wachter (2011) to identify the house price effect of immigration.

Endogeneity Issues in Modelling

Ideally, if all regions are identical and immigrants are randomly allocated across regions, then we 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 in reality. 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, in order 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 we 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 is 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 US 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 enclaves 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 paper, I use immigrants' geographical distribution in 2001 to predict the decadal change of immigration level in each neighbourhood, i.e. from 2001 to 2011.

Model Set Up

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:

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

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

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 additional regional trends such as the effect of the local planning system, regional policies and so on.

Specific 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):

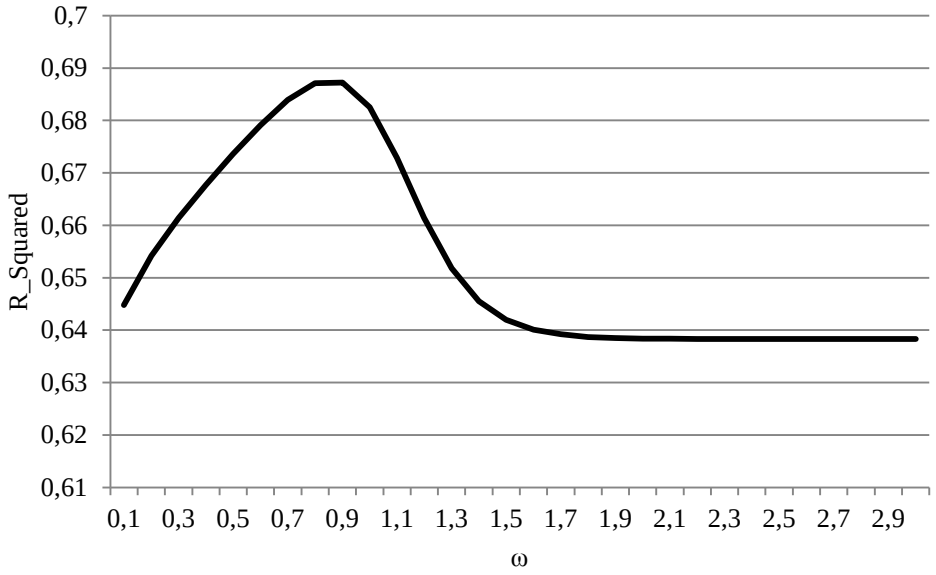
$$Pull_{ij,T} = \sum_{\substack{s \neq i \\ s \in j}} \frac{\left(\frac{I}{Pop}\right)_{s,T-10} {}^{*Area_s}}{(d_{is})^{\omega}},\ where\ i\ \in \{LSOAs\}, j \in \{LADs\}, T = 2011 \qquad (2)$$

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 for the one that gives the largest R^2. As one can see from the plot below, the value of 0.9 is chosen in this case.

Fig. 1: R^2 Evaluation of Distance Decay Parameter ω



One problem for using this gravity pull measure as an instrument is that we are 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 we are not sure whether we 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 we fail 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 enclaves. 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, we would expect that the former would be less affected by surrounding LSOAs but B to be more affected. We need to assume 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:

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

We should expect a negative sign for 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 enclave is full so new immigrants are somehow "forced" to settle in peripheral LSOAs. The difference is captured by using the interaction term:

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

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

Overall, we 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.

Section IV: Data

Table 1: Descriptive Statistics

Variables	Observations	Mean	S.D.	Min.	Max.	Data Source
House Price Information						
Change in Log Median House Prices (Land Registry) 2001-2011	34290	0.656	0.24	-1.017	3.289	Land Registry
Population Information						
Change in the Share of Foreign Born 2001-2011	34290	0.055	0.09	-0.272	3.258	Census
Change in the Share of Native Born 2001-2011	34290	0.078	0.21	-0.822	9.698	Census
Instrument/Gravity Pull Measure	34290	3.011	2.01	0.1835	56.55	Census
Socioeconomic Characteristics						
% Population Below 16 (2001)	34290	0.201	0.05	0.0084	0.437	Census
% Population Above 64 (2001)	34290	0.16	0.06	0.0037	0.661	Census
% Non-Family Households (2001)	34290	0.359	0.11	0.0312	0.915	Census
% Households with No Kids (2001)	34290	0.178	0.05	0.0247	0.444	Census
% Population with below-GCSEs qualifications (2001)	34290	0.531	0.14	0.0255	0.869	Census
% Population with at least a First Degree (2001)	34290	0.195	0.11	0.0087	0.73	Census
Unemployment Rate (2001)	34290	0.054	0.04	0.0043	0.351	Census
% White Population (2001)	34290	0.914	0.15	0.0464	1	Census
Log 2001 Population	34290	7.314	0.12	6.9058	8.785	Census
Housing Supply						
Share of Dwelling/Population (2001)	34290	0.433	0.06	0.1018	1.085	Department for Communities and Local Government
Physical Geographies						
Log km to CBD/Urban Centre (2005)	34290	0.332	0.87	-4.204	2.488	Ordinance Survey (Strategi)
Log km to nearest A-Road (2005)	34290	-0.90	1.24	-10.31	2.757	Ordinance Survey (Strategi)
Log km to nearest B-Road (2005)	34290	-0.37	1.22	-8.786	2.769	Ordinance Survey (Strategi)
% Area covered by Woodlands (2005)	34290	0.014	0.06	0	0.873	Ordinance Survey (Strategi)
% Area covered by Lake (2005)	34290	0.002	0.02	0	0.712	Ordinance Survey (Strategi)
Housing Attributes						

1. Housing Type						
Δ % Detached Properties	34290	-0	0.13	-1	1	Land Registry
Δ % Attached Properties	34290	-0.01	0.17	-1	1	Land Registry
Δ % Flats	34290	0.008	0.12	-1	1	Land Registry
% Detached Properties (2001)	34290	0.225	0.242	0	1	Land Registry
% Attached Properties (2001)	34290	0.637	0.267	0	1	Land Registry
% Flats (2001)	34290	0.138	0.220	0	1	Land Registry
2. Age of Dwelling						
Δ % New Builds (2001-2011)	34290	-0.01	0.18	-1	1	Land Registry
% New Builds (2001)	34290	0.154	0.129	0	1	Land Registry
Δ % Dwellings Built 10 Years Ago or Less (2000-2010)	34290	0.002	0.12	-1	0.882	Consumer Data Research Centre Data
Δ % Dwellings Built 20 Years Ago or Less (2000-2010)	34290	-0.03	0.14	-1	0.884	Consumer Data Research Centre Data
Δ % Dwellings Built 30 Years Ago or Less (2000-2010)	34290	-0.06	0.17	-1	0.884	Consumer Data Research Centre Data
% Dwellings Built 10 Years Ago or Less (2000)	34290	0.063	0.115	0	1	Consumer Data Research Centre Data
% Dwellings Built 20 Years Ago or Less (2000)	34290	0.148	0.183	0	1	Consumer Data Research Centre Data
% Dwellings Built 30 Years Ago or Less (2000)	34290	0.258	0.244	0	1	Consumer Data Research Centre Data
3. Housing Tenure						
Δ % in Freeholds (2001-2011)	34290	0.001	0.14	-1	1	Land Registry
% in Freeholds (2001)	34290	0.801	0.256	0	1	Land Registry
4. Inner Facilities						
Δ % Dwellings with Central Heating (2001-2011)	34290	0.058	0.07	-0.122	0.775	Census
% Dwellings with Central Heating (2001)	34290	0.916	0.08	0.1735	1.004	Census
% Dwellings with Bath/Toilet/Shower (2001)	34290	0.995	0.01	0.5895	1.004	Census
5. Size						
Δ % Dwellings with 1 room	34290	-0.00	0.01	-0.359	0.253	Census
Δ % Dwellings with 2 rooms	34290	0.002	0.02	-0.224	0.26	Census
Δ % Dwellings with 3 rooms	34290	0.007	0.02	-0.328	0.251	Census
Δ % Dwellings with 4 rooms	34290	-0.01	0.03	-0.418	0.21	Census
Δ % Dwellings with 5 rooms	34290	-0.02	0.03	-0.554	0.171	Census
Δ % Dwellings with 6 rooms	34290	-0.01	0.03	-0.357	0.156	Census
Δ % Dwellings with 7 rooms	34290	0.009	0.02	-0.212	0.153	Census

% Dwellings with 1 room (2001)	34290	0.008	0.016	0	0.432	Census
% Dwellings with 2 rooms (2001)	34290	0.023	0.028	0	0.284	Census
% Dwellings with 3 rooms (2001)	34290	0.086	0.073	0	0.458	Census
% Dwellings with 4 rooms (2001)	34290	0.193	0.089	0	0.653	Census
% Dwellings with 5 rooms (2001)	34290	0.273	0.100	0.022	0.804	Census
% Dwellings with 6 rooms (2001)	34290	0.211	0.085	0.006	0.664	Census
% Dwellings with 7 rooms (2001)	34290	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 the above table; 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 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 can do to have consistent spatial data over time for this analysis. In the Appendix section, I used an alternative house price dataset from Nationwide and the data contains much more detailed housing characteristics than Land Registry data, for example, attributes such as floor area, bathroom, heating, garage availability are all recorded. 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 do 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 within 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 method 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 Sa (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 no 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.

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 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.

Section V: Results and Analysis

Main Results

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. We know the regression is biased due to omitted characteristics and one can see the bias is positive inflating the OLS estimate. Once we 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. The three IV estimates seem to indicate a somewhat larger negative effect on LSOA level house prices: all are around 0.25-0.45% price reductions.

In addition, the three IV specifications performed quite successfully as they pass the battery of identification tests. Firstly, although the instruments show weak correlations with the actual immigrant variables, their first stage F-statistics sit well 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 do not reject the null under which the instruments are valid, providing statistical evidence that the IVs are exogenous.

Table 2: 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	-0.099***	-0.450**	-0.305**	-0.263*
	(0.028)	(0.017)	(0.221)	(0.150)	(0.155)
LAD fixed effects	Yes	Yes	Yes	Yes	Yes
Δ Housing Characteristics	No	Yes	Yes	Yes	Yes
Lagged Housing Characteristics	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			66.72	67.45	67.59
First Stage Coefficient for:					
Gravity Pull			0.007***	0.011***	
			(0.001)	(0.003)	
Pull x Share Foreign Born in 2001				-0.027***	-0.035***
				(0.004)	(0.003)
Pull x % Δ LAD Immigration					0.158***
					(0.014)
Sargan Over-identification Test (P-Value)				0.402	0.688
Observations	3.4e+04	3.4e+04	3.4e+04	3.4e+04	3.4e+04
R_squared	0.193	0.627	0.468	0.472	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%.

Native Mobility

If the native population is substantially displaced by inflows of immigrants into an area, one would expect that the change in the share of foreign born to be negatively associated with the 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 Sa (2014). The model is laid out as follows:

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

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

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. 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 still 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 around 1 for 1 growth as well. This is in sharp contrast with the US case where Saiz (2011) used census tract level data to examine impact of decadal change in immigration share on decadal change in native population share. In his paper, there is on average 1.3 native being displaced for every 10 additional immigrants moving in a neighbourhood. From my results, I conclude at the LSOA level, there is no evidence of native displacement in England and Wales.

This is a puzzling piece of evidence. At the LSOA level, there is no native migration response from immigration inflows. However, native flight evidence is found in both Sa (2014) and Braakmann (2016). The two papers examined the same issue at the local authority level where the size of the area is larger than that of an LSOA. And Braakmann's findings are more relevant to this paper as he used the same periods in this study. Specifically, he employed the traditional shift-share IV as instrument and regressed the immigrant population change on the native population change; and what he found was a negative association between the two[1]. Intuitively, one should expect a more substantial native-immigrants interaction at a smaller spatial scale; therefore, within a lower spatial unit, the native population change should be more negatively associated with the immigrant population change.

One explanation for this is that the sorting dynamic may not take place at all of the spatial scale and happens in a more non-linear way. The average population size contained in an LSOA is around 1000-3000; and the fact that LSOAs are not able to pick up any native preference is because the size of the area does not resemble that of a typical neighbourhood (i.e. too large), in which residents may be more likely to base their settlement decisions at this level. Therefore, if a native prefers to live close to other natives, he/she does not necessarily have to move out of his/her current LSOA but simply could move down a few streets. But on the other hand, there is a substantial and significant negative native population change at much larger spatial scale, e.g. local authorities (Sa, 2014; Braakmann, 2016). It could be the case that natives who don't move out his/her LSOA may wish to move out of his local authority all together. It is worth noting that a decision to move has many contributing factors, and being part of an ethnically homogenous community is only one of them. For

majority of the population, moving is costly as the household forgoes not just jobs but also much of the social capital (e.g. relatives, friends, neighbours and local community resources) in their home city. Therefore, if native households have preference residing close to other native households, they perhaps are more likely to reside in other neighbourhoods; if they have this type of preference and as a result they look for alternative jobs, then it could be the case they will move outside the local authority all together rather than just moving out of their LSOA. If this picture fits into the reality, one would find a native out-migration response at LA level but not at the LSOA level. Again this calls into question that whether one is able to interpret native population change entirely as a response to immigration and it would be interesting to see in future research if there would be any negative native population change as one goes further down the geographical scale, e.g. census output areas.

Table 3: 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	2.066***	1.444***	1.083***
	(0.073)	(0.021)	(0.069)
% Share of Foreign Born in 2001	-0.034	0.075***	0.096***
	(0.028)	(0.028)	(0.030)
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			51.42
First Stage Coefficient:			
Pull x Share Foreign Born in 2001			-0.061***
			(0.004)
Pull x % Δ LAD Immigration			0.183***
			(0.018)
Observations	3.4e+04	2.7e+04	3.4e+04
R_squared	0.561	0.431	0.380

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%.

Regional Breakdown of the House Price Effect

In order to look at any sub-regional house price effect of immigration, I divide the area of England and Wales (E&W) into the 11 Government Office Regions.

Table 4: Regional Breakdown of Immigration Impact on LSOA House Prices

	London	South East	Eastern	Merseyside	North East	
Δ Share of Foreign Born	0.015	0.004	0.003	0.068	0.175	
	(0.039)	(0.045)	(0.053)	(0.182)	(0.274)	
Observations	4737	5317	3547	899	1651	
R_squared	0.386	0.390	0.415	0.450	0.491	
	North West	South West	Yorkshire & Humberside	Wales	West Midlands	East Midlands
Δ Share of Foreign Born	0.239*	-0.050	-0.105	-0.180	-0.172*	-0.234**
	(0.135)	(0.085)	(0.065)	(0.151)	(0.091)	(0.092)
Observations	3545	3225	3284	1889	3471	2725
R_squared	0.504	0.467	0.442	0.413	0.464	0.520

Notes: Standard errors are clustered at LSOA level and are included in parentheses. Socioeconomic characteristics are included in lagged values and housing attributes are controlled in both changes and levels just as in the main results. *** indicates significance at 1%; ** indicates significance at 5%;* indicates significance at 10%.

From the results, we can see the most salient negative effects concentrate in the middle part of E&W, i.e. in the West and East Midlands regions. Regions of Yorkshire, South West and Wales have moderate negative effects but not statistically significant. Areas in the South East of E&W including the Greater London, the South East region, and Eastern side of England have almost no effect on house prices from the inflows of immigrants. Slightly larger positive effects are found in regions of Merseyside, North East and North West, but they again are not statistically significant.

Perhaps it is better to visualize this on a map. The negative effect is mostly concentrated in the middle part of the E&W, in which West Midlands and East Midlands are the most acute, and Wales and Yorkshire come the second. Regions above it (shaded in blue) show positive effects and regions below have little effects. The reason for the former could be that there are very relatively fewer immigrants in northern regions. One can see the relative low average numbers of immigrants in these regions from the table below for both years. Or it could be the mix of immigrants, perhaps certain country of origins are more likely to migrate to the north part of the country but not anywhere else, either way, the presence of these immigrants did not exhibit the feature of displacing

substantial number of natives or driving down the structural housing quality in the area too badly to push down house prices, instead, they push up local house prices by simply adding extra demand to the region.

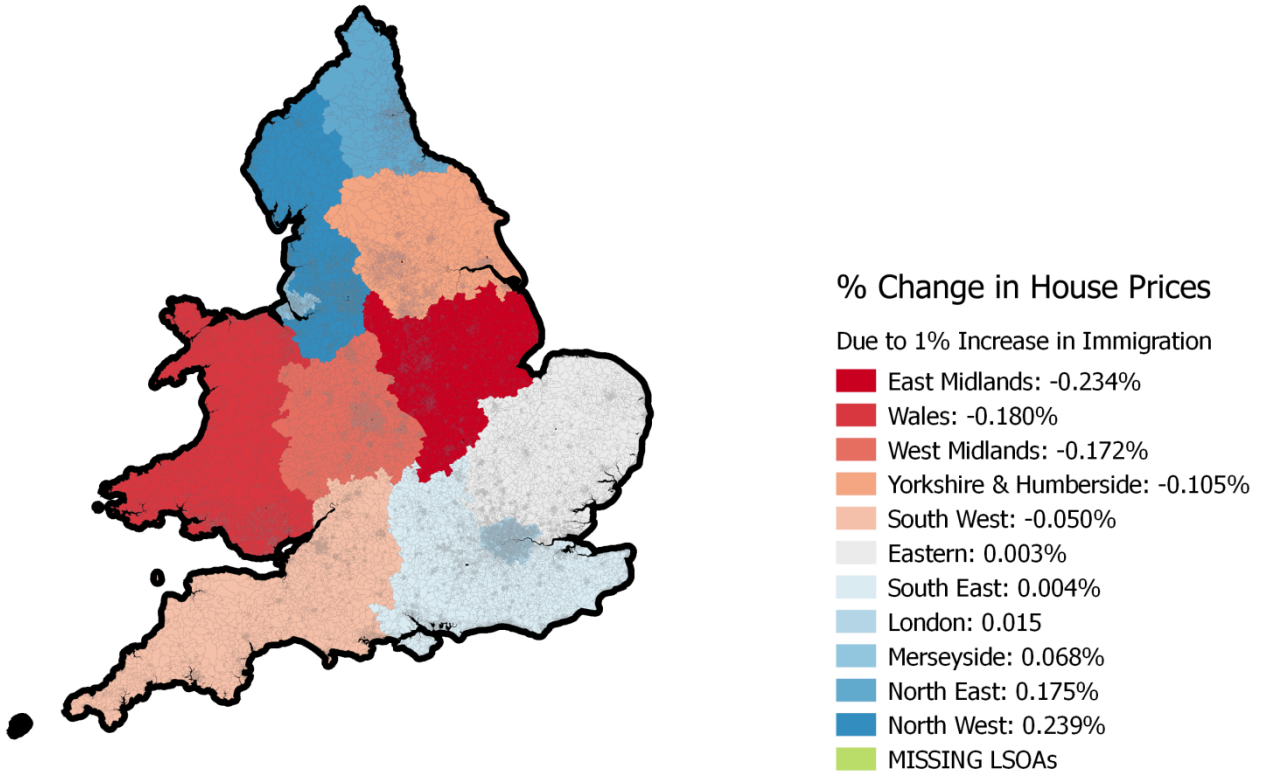
The region on the south east side of E&W also exhibits a quite different dynamics. The combination of regions is known to be the centre of economic activities in E&W, where Greater London contains one of the most prominent financial centres in the world, Cambridgeshire contains the world-class university and is also the base of many R&D and technology companies, and the outer south east region has the highest concentration of commuting middle class in the country. It seems immigration has little overall effect over house prices in these regions. Channels described in the Hypotheses Section are perhaps not particularly salient here. Also, the immigrants did not manage to push up the relative housing demand comparable to that in the North, despite of their higher absolute average numbers. I could think of two reasons to explain why this might be the case: (1) large share of immigrants tend to rent in these areas and rents, although higher than those in the rest of the areas, are more regulated than house prices, so a large number of them do not actually influence housing demands directly; (2) property transactions are more likely to be in the form of investments in these regions, although the aggregate investment demands cannot be completely separated from the aggregate consumption demands, i.e. people can purchase properties (investment) and allow others to live in (consumption). Frequent transactions could push house prices up while actual consumption demands do not necessarily need to rise in line, it is not uncommon to hear in the news that properties bought unoccupied by investors. However, one could say foreigners could also have investment demand, however, foreign investors can demand housing for investment purposes without their physical presence in the UK, and these people are not included and are also unable to be included in the data for the analysis here. Unfortunately, these are just some speculations that are not tested empirically in this paper.

For future research, it is worth looking into further the different dynamics going on in different sub-regions.

Table 5: LSOA Average Number of Immigrants in 2001 and 2011

Region	2001	2011
East Midlands	92.08	163.30
Eastern	105.42	180.45
London	406.85	629.51
Merseyside	49.52	86.41
North East	44.52	77.49
North West	82.87	138.93
South East	122.60	196.14
South West	77.30	125.43
Wales	48.73	88.59
West Midlands	114.15	179.76
Yorkshire & Humberside	79.11	140.55

LSOA House Price Effect of Immigration by Region 2001-2011



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 dwelling types and tenure. 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 6: House Price Effect Broken Down by Dwelling Type

Dependent Variable: Δ Log Median House Prices 2001-2011		
	OLS	IV
Attached	-0.033	-0.066
	(0.024)	(0.138)
Observations	3.4e+04	3.4e+04
R_squared	0.457	0.457
Detached	-0.128***	-0.156
	(0.047)	(0.380)
Observations	2.7e+04	2.7e+04
R_squared	0.154	0.154
Flats	-0.057**	-1.081***
	(0.027)	(0.340)
Observations	2.1e+04	2.1e+04
R_squared	0.253	0.198

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 my transactions for each LSOA.

As for the results, I tend to trust more in the IV estimation as the OLS is subject to omitted variable bias, even though the Hausmann Test statistics indicates there is not much of a difference between the two models. From Table 6, it seems that the largest effect comes from the reduction in flat prices. This is much larger than the effect on both detached and attached properties. Specifically, an increase in the stocks of immigrants equal to 1% of the 2001 local population is associated with around 1.1% reduction in flat prices. 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 decreases house prices at the lower end of the distribution where there could be a large concentration of flats.

Table 7: House Price Effect Broken Down by Dwelling Tenure

Dependent Variable: Δ Log Median House Prices 2001-2011		
	OLS	IV
Freehold Properties	-0.015	-0.169
	(0.025)	(0.139)
Observations	3.4e+04	3.4e+04
R_squared	0.520	0.517
Leasehold Properties	-0.063**	-0.773**
	(0.027)	(0.308)
Observations	2.4e+04	2.4e+04

R_squared	0.268	0.244

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 my transactions for each LSOA.

The beakdown by housing tenure also depicts a similar story, with the majority of the negative effect coming from the leasehold properties. As one can see from the Table 8 below, the majority of the detached and semi-detached dwellings are freehold and the majority of the flats are leasehold.

Table 8: % 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

One explanation for not finding any negative effect for detached/semi-detached houses or freehold properties could be that immigrants do not have a direct influence on them, as they are more likely to live in leasehold properties or flats.

Much of the literature has documented that the immigrant population tends to be more mobile compared to the indigenous population, at least in early years of arrival; they are less likely to form households, but tend to live disproportionately in private renting (Whitehead, 2011) and to live at higher densities (Johnson et al., 2016). 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.

In addition, the lack of evidence on falling house prices in detached/owner-occupied properties may to some extent infer that native out-migration response is not particularly salient at this level of geography. This is because, if affluent natives move out of an area, the demand for these types of properties would fall, hence their prices would fall. However, this is not to say that native displacement does not occur at all, perhaps other factors such a structural decline in housing quality could explain better the house price reduction at the LSOA level. Unfortunately, housing quality data

at LSOA level is not available; otherwise one could test this empirically using the same model specification.

Section VI: Conclusion

The paper uses census data and land registry price paid data to examine the impact of immigration on local house prices at the level of lower layer super output area (LSOA) between 2001 and 2011. A first differenced model with the proximity instruments (Saiz and Wachter, 2011) is adopted to account for the endogeneity problem which then allows us to infer causal relationships. Over the decade, there is a negative but almost negligible house price effect driven by immigration inflows. In addition, there is no evidence of native out-migration response at this level of geography but literature seems to point to a substantial native out-mobility at much larger spatial scale, e.g. local authorities (Sa, 2014; Braakmann, 2016). The seemingly paradoxical result may suggest that native displacement does not necessarily occur at all levels of geography but happens more non-uniformly. Regional breakdown of this house price effect shows the negative association mainly concentrates in the middle part of the country, i.e. East Midlands and West Midlands, while the north part shows positive effect and the south and the south eastern parts of E&W have almost no effect. One perhaps needs to look further into each individual region to understand their dynamics in order to explain this difference. 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. This may suggest the reduction is likely to reflect not native preference but mainly other features such as a structural decline in housing quality.

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