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Measuring the impact of immigration on neighbourhood house prices

Evidence from England and Wales

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Abstract: With immigration rates on the rise, it is critical for policy makers to understand the impact of immigrant inflows on a range of domains. The paper examines the impact of immigration on local housing values at neighbourhood scale, using a first differenced model with spatial diffusion instrumental variables (IVs). A small but statistically significant negative impact was found for England and Wales (E&W) using census data 2001–2011. The reductions mainly come from flat prices and prices of attached properties. When searching for potential explanations for this phenomenon to happen, native out-migration response towards immigration was tested. Affluent natives may be displaced by inflowing immi grants leading to an overall reduction in area level income hence house price drops (Sá, 2015). Weak evidence was found for native displacement at this lower level of geography. Alternative causal channels include housing supply response towards immigrant inflows. This paper provides some evidence supporting that immigrants indeed induce a small increase in housing stocks.

Keywords: House prices · Immigration · Causal inference · Spatial diffusion instrument · Housing supply · Housing submarkets

1 Introduction

This paper studies the impact of immigration on the housing market. While at the macro level, immigrants are expected to boost the overall population, which would cause an out ward shift in housing demand and push up house prices. But, how does immigration impact locally? The mainstream literature has explored the economic asymmetries associated with 'native flight' dynamics. Residential sorting and segregation could lead to a reduction in house prices as a result of falling average income as well-healed natives are displaced by less affluent migrants, reducing local housing demand (Card, 2001, Saiz, 2007, Sà, 2015). While this might be true, other channels might exist through which immigrant inflows could depress local house prices and this could potentially add additional evidence to understand UK immigration.

Through empirical tests, we examine the magnitudes of various housing market effects in order to decide the policy relevance of the issue. This paper contributes to the literature in three ways. (1) We attempt to examine the immigration effect on the housing market using smaller geographies than used in previous UK research, i.e., the lower layer super output areas (LSOA) as a proxy for neighbourhood. (2) We use innovative econometric models to estimate housing market response towards immigration through both the demand and sup ply side analysis. (3) We forgo the assumption of a single housing market in the UK and examine the house price effect across different housing submarkets by type. This may help indicate which sector of housing is more responsive to immigration shocks.

The structure of the paper is as follows: in Section 2 we briefly discuss the existing literature with regards to how immigrant inflows affect local house prices. In Section 3, we set out the methodology for testing different empirical relationships. In section 4 we describe the data and provide descriptive statistics. We then present the results of findings in section 5. We conclude in section 6.

2 Literature review

Empirical estimation of the impact of immigration on housing market has only come rela tively recently (Saiz, 2007; Akbari & Aydede, 2012; González & Ortega, 2013; Braakmann & McDonald, 2020, Sanchis-Guarner, 2023), compared with the more longstanding stream

of work focusing on labour market effects of immigrants (Dustmann et al., 2013; Dustmann & Frattini, 2014; Edo, 2019; Fasani et al., 2020, Sargent, 2023). Different studies tackle immigration impact on the housing market through different perspectives. In the UK, housing is an important sector in its own right, generating significant employment and trade through construction (Akbari & Aydede, 2012) and transactions-related industries (estate agency, surveying, conveyancing, and mortgage finance). So, the impact of immigration on housing demand could be potentially an important area to examine. Different countries can have different housing market impacts of immigration. For example, small economies such as New Zealand tend to observe large fluctuations in the inflow of migrants, which raises concerns about increased volatility of demand for residential housing (Stillman & Maré, 2008). Some U.S. literature tended to focus on the degree of residential segregation, housing value growth and occupational densities that immigrants would bring, concerning its substantial collective influence in certain regions as well as in particular housing submarkets (Munshi, 2003; Saiz, 2007). 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 been done to examine housing space change and rearrangement to accommodate immigrant settlement (Braakmann, 2019), native displacement and local housing value growth (Sá, 2015).

The strands of literature treat the immigrant population as a homogenous group. However, another strand of literature tends to explore immigrant heterogeneity, focusing on migrants' distinct economic and cultural characteristics that could potentially lead to varying settlement patterns/effects at the local level. Key patterns studied in this strand of literature typically focus on the spatial concentration of migration (Munshi, 2003; Saiz, 2007), different rates of spatial clustering across migrant groups (Meen et al., 2016), and migrants' different characteristics that could lead to different dynamics of local economies.

How do immigrant inflows affect neighbourhood house prices? The past literature (Sà, 2015) has indicated that the main mechanism behind often involves a change in the local income distribution. When immigrants enter an area, they contribute to overall income and demand more housing, as a result, house prices go up. However, if this inflow of immigrants triggers native residents to move out, especially those at the top of the income distribution, even with an overall increase in the population, the total income in the area could potentially

drop, and the overall housing demand would decrease hence the corresponding house price would reduce through an income effect.

The native out-migration response to incoming immigrants has been termed “native flight”, or “white flight” following the literature examining residential sorting and segregation in the U.S. (Borjas et al., 1997; Borjas, 2003; Saiz, 2007; Saiz & Wachter, 2011). It is considered as a primary reason for housing values to drop especially when examining neighbourhood effects. Saiz (2003) study of 306 US Metropolitan Statistical Areas between 1983 and 1997, for example, 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, 2003, p23). However, when adopting a smaller spatial geography in his later paper, Saiz and Wachter (2011) 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. For UK immigration studies, Sà (2015) and Braakmann (2019) also found evidence for native flight and subsequent house price reduction at local authority level – a spatial geography commonly used in empirical studies in the UK.

This raises the question of whether these effects intensify if even smaller spatial geographies are considered. UK census and land registry data contain the necessary demographic and house price information needed to explore this at the lower layer super output area level (LSOA). LSOAs, with a mean population of 1500, equivalent to an average number of households of 400 (ONS Administrative Data Statistics), are administrative boundaries 80 times as small as the local authority units (LADs) used by Sà (2015) and Zhu et al. (2018). The geographical 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. The area unit is selected primarily as a way of capturing local effects. If the native out-migration response is the key driver for depreciating housing values at neighbourhood level, one would expect a stronger native-immigrant interaction, therefore a larger native displacement at the neighbourhood level than at the local authority level. Following the above mechanism, the larger native displacement effect may potentially lead to a bigger decrease in local house prices through a significant reduction in area level income.

Other channels through which immigration could impact the local house price include the housing supply response. The current narrative is positive on UK immigrants and their arrivals and settlements are generally welcomed (Fernández-Reino & Cuibus,

2024). To be specific, new immigrants consistently indicate desire to work (Craig et al., 2004). They also provide much needed labour and skills. For example, migrant workers from EU countries are reported to be filling important skill shortages in certain industries (CAB, 2004). Furthermore, they help balance demographic profiles in areas with shrinking population because of outward migration and declining birth rates (CAB, 2004; Wren, 2004). These are considered positive economic features (Johnston et al., 2002). Under benign immigrant climate, coupled with a flexible housing market, landlords are more active in providing accommodation; housing development projects are more likely to be granted due to higher expected value adding opportunities in the sector. From the literature, Braakmann (2019) has found evidence that the number of available stocks in the market increases in response to rising immigrant inflows. This could potentially point to a direction that explains the negative house price effect of immigration, the reason being relatively faster housing supply growth.

3 Methodology

To analyse the effects of immigration on housing market outcomes, the paper uses the stan dard spatial correlation technique between immigration and housing outcomes. However, this method is susceptible to endogeneity problems arising from common fixed influences that attract both immigrants to settle and house prices to rise. Reverse causality may also exist such that immigrants may actively avoid areas where house prices are rising and select places that are relatively inexpensive. To resolve these endogeneity problems, the regression model is first differenced and area level socioeconomic characteristics and physical attri butes of dwellings are added as controls to mitigate omitted variable bias. We continue to use the spatial diffusion instruments (IV), developed by Saiz and Wachter (2011) to identify the house price effect of immigration.

3.1 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 (Borjas, 1995; Mobius, 2002). This 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 & Wachter, 2011):

$$Pull_{ij,T} = \sum_{\substack{s \neq i \\ s \in j}} \frac{\left(\frac{I}{Pop}\right)_{s,T-10} * Area_s}{(d_{is})^{\omega}}, i \in \{LSOAs\}, j \in \{LADs\}, T = 2011 \quad \text{(A1)}$$

The gravity pull measure $Pull_{ij,T}$ is constructed as a weighted average of the 2001 immi grant densities of surrounding LSOAs. In particular, it 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 the distance of the neighbouring LSOA, the more influence it would impose on LSOA i. The ω value is estimated from the data instead of using a prior from the literature. Specifically, we regress $Pull_{ij,T}$ on the immigration share in 2011:

$$\frac{I_{ij,\ 2011}}{Pop_{ij,\ 2001}} = \rho_j + \gamma\, Pull_{ij,2011} + \mu_{ij,2011} \quad \text{(A2)}$$

In the regression equation, we also add local authority fixed effects and the measure $Pull_{ij,2011}$ is computed on a range of ω values between 0 and 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.

One problem for using this gravity pull measure is that we are unable to test its exogeneity. This 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 would cause bias. To solve this, we follow Saiz and Wachter (2011) in generating 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, we interact the gravity pull measure with the lagged immigrant share in 2001 for each LSOA:

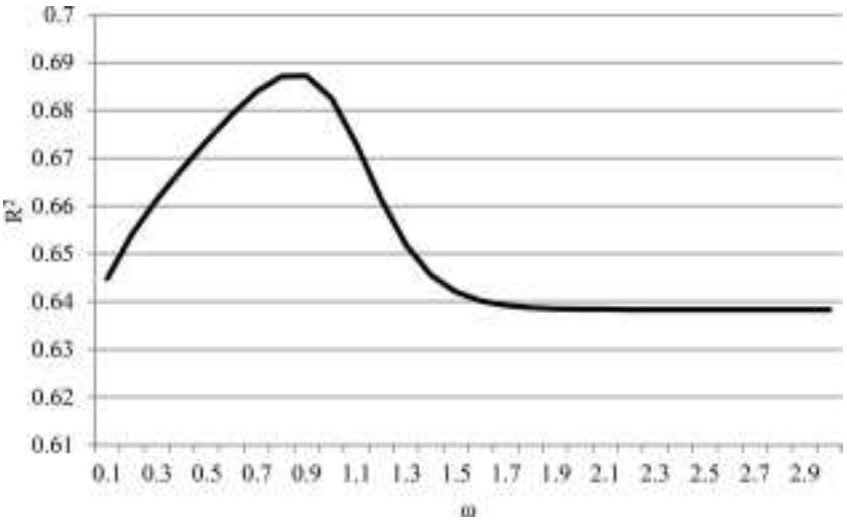

Fig. 1 R^2 Evaluation of distance decay parameter ω

$$Pull_{ij,T} \times \left(\frac{I}{Pop}\right)_{ij,\,2001} \tag{A3}$$

We 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 will not expect the neighbourhoods inside this LAD 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:

$$Pull_{ij,T} \times \left(\frac{\Delta I_{j,T}}{Pop_{j,T-10}}\right),\ j \in \{LADs\} \tag{A4}$$

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

3.2 House price model specification

The regression equation is constructed as follows:

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

$$i \in \{LSOAs\}, j \in \{LADs\},$$

Where

$\Delta \ln(HP)_{ij,T}$: decadal change in log median house price between 2001 and 2011 in LSOA i, local authority j

$\frac{\Delta I_{ij,T}}{Pop_{ij,\ T-10}}$: the change in the stock of immigrants between the same periods as a percentage of previous decade population

beta: the effect on median house prices of an increase in the stock of immigrants equal to 1% of the local population in 2001.

X: area level neighbourhood attributes vector which include demographics, socioeconomic and physical geographical characteristics (lagged).

Z: area level changes in the physical characteristics of the dwellings (first differenced).

ρ_j : local authority fixed effects used to pick up additional regional trends

4 Data

The spatial analysis is carried out at the Lower Layer Super Output Area (LSOA) level. Information was gathered on socioeconomic characteristics, geographical traits of each LSOA and physical attributes of the housing units. The descriptive statistics are tabulated in Table 1; each category of variables will be described in turn in the following sections.

4.1 Local House prices

House price index 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) annu ally from 1995 onwards. Each record has the address, price and some basic attributes of the property such as its type and tenure. This information was then used to derive the % share of detached/attached/flats properties as well as % share of freehold properties in each LSOA. Overall, from the above descriptive statistics, the house price index has been grow ing around 0.7% over the ten years.

4.2 Population Information

The immigrant and native population information are gathered from 2001 to 2011 Censuses. Although there is not yet an official and clear categorisation on “who counts as a migrant” (Anderson & Blinder, 2024), 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, we 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”. This is commonly seen in empirical studies which may not be perfect but only aim to capture some degree of foreignness in studying this particular type of population.

4.3 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. We follow Sá (2015) 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, the 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.

The dwelling stock data is published annually by the Department for Communities and Local Government (DCLG). The

number of dwellings in each LSOA is counted and then normalised by the 2001 population.

4.5 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 covered 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 indicates 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 pinpointing 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 the QGIS software.

4.6 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 CDRC website holds open data for LSOA level counts of dwellings in different age bands, e.g., 1990–2000, 2000–2010; this information is used 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, we use the Censuses data for heat ing 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, we were left with a panel of 34,290 cross sectional LSOA units and two periods for analysis, i.e., 2001 and 2011.

5 Results and analysis

5.1 House price effect of immigration

Initially, the models were run to measure the impact of immigration on house prices. Specification 1 shows the OLS estimates without including all the neighbourhood level characteristics and housing attributes controls. The coefficient suggests a small positive effect but it is not statistically significant. We know the regression is biased upwards due to omitted characteristics so we added the controls in specification 2. The corresponding coefficient has reversed the sign but the size of the effect is almost negligible – around 0.08% reduction in house prices led by an increase in the stock 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 specifications.

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 sit 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 the Hausman Test is not rejected when comparing the OLS specification (2) with the three IV specifications (3, 4, and 5); indicating OLS and IV are not much different from each other.

5.2 House price effect broken down by dwelling type

The housing market is never homogenous. In the UK, a property can be owner-occupied, privately rented and could also be social housing. Ignoring the public (social) housing sector, majority of the 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). Turning to the types of dwelling in the UK, the property could be detached, semi-detached, terraced or flats.

Different countries have a different housing market and immigrant portfolio. Upon arrival, immigrants interact with the existing population within the unique property market, which is the area of focus of our research. In the UK, immigrants live disproportionately in flats and privately rented sectors due to lower affordability for this group on

owner-occupied properties (Whitehead, 2011, Wessendorf, 2017, Usman et al., 2024). Therefore, we speculate that these areas tend to have the most influence from the immigrant inflows. It also has important implications for housing wealth for both native and immigrant households.

To investigate this, we relax the assumption of a homogenous housing market and test the impact of immigration on house prices across different dwelling types in the UK. This also helps to see which tenure/type is most potently affected by inflows of immigrants.

From Table 3, the OLS specifications show negative effects across all types of dwellings and the largest reduction comes from flats, while the smallest comes from attached properties including semi-detached houses and terraced properties. The effects are also 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 the initial decade population. The IV estimates remain larger given the general upward bias in the OLS estimates. From the IV specification, the largest price reduction still comes from the flats, but there is no evidence of any change in price for detached properties. There is a modest decrease in price of attached properties. Specifically, 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 (2019) 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. Additional research has also been done to test immigration effects on both leasehold and freehold properties, and it was found that most of the house price reduction comes from leasehold properties.

Given this evidence from Census data and Land Registry Price Paid Data, immigrant inflows lead to a small depression on local house prices and this is mainly found in flats. We now move on to search for the causes for such phenomenon to happen.

5.3 Causal Channel: native mobility response

A key argument in the literature that is used to explain negative house price effect of immi gration is associated with native flight (Saiz & Wachter, 2011; Sà, 2015). Immigrants in general add to the total population of a neighbourhood therefore contributing to the demand of housing; however, they could also trigger natives at the local level, especially those at the upper end of the income distribution to move

out, potentially due to native preference towards residing close to other natives. The displacement could reduce the overall demand for housing in the neighbourhood through a reduction in total income. House price reduces when housing demand reduces.

To search for empirical evidence, we regress the % change in native population on the % change in immigrant population. If native displacement were happening, the association between the two variables would be negative. The model is specified as follows:

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

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

In this model, the lagged share of immigration and local authority fixed effects were also added to partially control the time constant neighbourhood characteristics. According to the three specifications, there is not much of evidence to support native displacement effect. However, the current immigration literature may have pointed towards a larger native outmigration response, see works in Hatton and Tani (2005), Saiz and Wachter (2011), Sà (2015) and Braakmann (2019). In Table 4, Specification 1 is an OLS specification that includes all LSOA units: 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. This is reasonable because the immigrant variable is endogenous: factors such as better job prospects, better quality housing etc. that attract immigrants would also attract natives. These common fixed influence on house prices were not controlled in the model hence positively inflating the immigrant estimate. To fix this, specification 2 tested the displacement effect only in areas without new housing developments because they often bring about large population increases, attracting both immigrants and natives alike. Specifically, this is done by removing LSOAs that have doubled the population between 2001 and 2011, which left around just under 80% of the neighbourhoods from the data. The association becomes smaller but still remains positive. In specification 3, we used the IV strategy similar to that of the main results, which gives a further lower estimate but still a positive association: it is about a 1 for 1 growth.

Using datasets from England and Wales, the native outmigration response towards immi grant inflows is not particularly salient, with the change in native population share diminish ing but not negative. The housing market is never homogenous. In the UK, a property can be owner-occupied, privately rented and could also be

social housing. Ignoring the public (social) housing sector, majority of the owner-occupied properties are freehold; privately rented accommodation is more flexible which could be offered either a freehold or a lease hold (which means owning only for a fixed period). Turning to the types of dwelling in the UK, the property could be detached, semi-detached, terraced or flats.

Different countries have a different housing market and immigrant portfolio. Upon arrival, immigrants interact with the existing population within the unique property market, which is the area of focus of our research. In the UK, immigrants live disproportionately in flats and privately rented sector due to lower affordability for this group on owner-occupied properties (Whitehead, 2011). Therefore, we speculate that these areas tend to have the most influence from the immigrant inflows. It also has important implications for housing wealth for both native and immigrant households.

5.4 Additional Channel: housing supply responses towards immigrant inflows

Alternatively, immigrants might push up housing supply. In areas with high levels of immigrant inflows, housing or building development programmes are more common and landlords may also divide up existing units to accommodate new migrants (Whitehead, 2011; Johnston et al., 2016; Braakmann, 2019). This could be due to a variety of reasons. Indigenous households may have spare housing capacity, allowing them to accommodate newly arrived migrants including refugees. Secondly, immigrants, especially highly skilled immigrants, attract foreign direct investment (FDI), which a significant proportion could flow into the construction industry, in turn leading to a rise in number of construction companies and subsequently more housing development (Burchardi et al., 2019; Lim et al., 2024). Immigrants, unlike natives, require additional capital and investment to equip them to create value in the new country (Stemn et al., 2024). In order to test the validity of this causal link, we use a similar model to that of the house price; in particular, we regress the change in share of immigration on the change in the dwelling stocks between 2001 and 2011. The specification also attempts to control the neighbourhood level characteristics by including several socioeconomic variables, the geo graphical traits of each LSOA and the physical attributes of housing units (i.e., to capture the existing residential development pattern of the area).

The model specification is as follows:

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

In this model, we assume constant price elasticity of supply, however this could vary across regions due to differences in land availability and planning restrictions in house building (Saiz, 2010; Hilber and Vermeulen, 2016).

Overall, the effect of immigration on the LSOA level housing stock change is small and positive across all specifications. The OLS estimation without any additional controls (Specification 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 actually built during the study period 2001–2011, strongly inferring an increasing land scarcity and limitation on other construction resources. However, this is not an internationally prevalent phenomenon, with different countries having differences in these local effects that can be quite subtle. For example, In Spain, immigrants are key to the revitalisation of the previously quiet, empty neighbourhoods and occupying new residential housing developments. Therefore, it could be said that immigrants lead to new or rapidly growing neighbourhoods, by moving into existing vacancies and displacing counterfactual native movers (Moraga et al., 2019). They push up overall housing demand in the area, spurring more construction activities. Although immigration also increases housing stock growth in the UK, it is largely due to landlords and/or housing developers increasing their extent to which they participate in the housing market to accommodate immigrants, by directly building more stocks (Braakmann, 2019). Immigrants don't necessarily largely arrive in empty/less populated areas and build their neighbourhoods. On the other hand, in the case of Spain, due to higher net housing demands, house prices would be weakly rising in new immigrant communities (Moraga et al., 2019).

6 Conclusion

This 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) in England and Wales between 2001 and 2021. A first differenced model with spatial diffusion instruments (Saiz & Wachter, 2011) is adopted to account for the endogeneity problem which then allows us to infer causal relationships. Over the two decades, the immigration effects on key housing market variables at the local level are very small, all below 1%. Immigrant inflows may push down local house prices and the largest reduction comes from flats/leasehold properties. This is mainly explained through native net out-migration responses towards immigration in the literature. However, housing stock increases may also be a contributor for a slow house price appreciation/house price depreciation. This will have implications on overcrowding, high density development and slow housing value growth, particularly in major urban areas of the UK, where there are a large share of both natives and immigrants.

In the past, most studies focused on measuring the immigration impact on labour market indicators; it may also be important to study how they impact on other areas such as housing, transport, school quality and other local amenities, all of which are mediums of interaction between immigrants and the existing population. Observing how immigrants interact with the native population can help us better shape future housing and integration policies.

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Data availability The data that support the findings of this study can be derived from the following resources available in the public domain: The Office for National Statistics UK [https://www.ons.gov.uk/], HM Land Registry Open Data [https://landregistry.data.gov.uk/app/ppd/], NOMIS [www.nomisweb.co.uk] and Consu mer Data Research Centre [https://www.cdrc.ac.uk/].

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Table 1 Descriptive statistics

Variables	Observations	Mean	S.D.	Min.	Max.	Data Source
House Price Information						
Change in Log Median House Prices 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	0.32	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	0.2	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	-0.9	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	1.6	0.97	-4.17	3.8	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	3.7	Wikipedia/Google Maps
Log km to nearest Golf Club	34,290	1	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	− 0.0214	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

Δ % Dwellings Built 20 Years Ago or Less (2000–2010)	34,290	-0.03	0.14	-1	0.884	Consumer Data Research Centre
Δ % Dwellings Built 30 Years Ago or Less (2000–2010)	34,290	-0.06	0.17	-1	0.884	Consumer Data Research Centre
% Dwellings Built 10 Years Ago or Less (2000)	34,290	0.063	0.115	0	1	Consumer Data Research Centre
% Dwellings Built 20 Years Ago or Less (2000)	34,290	0.148	0.183	0	1	Consumer Data Research Centre
% Dwellings Built 30 Years Ago or Less (2000)	34,290	0.258	0.244	0	1	Consumer Data Research Centre
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	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	0.1	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

Notes. LN variables are derived from Land Registry and CN variables are derived from Census

Table 2 Immigration Impact on 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 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^2	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%

Table 3 House Price Effect broken down by Dwelling Type

	OLS	IV
Detached	-0.112**	0.029
	(0.049)	(0.307)
Observations	26,543	26,543
R^2	0.101	0.101
Attached	-0.077***	-0.401***
	(0.028)	(0.003)
Observations	34,290	34,290
R^2	0.399	0.389
Flats	-0.186***	-0.993***
	(0.033)	(0.325)
Observations	20,535	20,535
R^2	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 house price model despite that the prices of detached, attached and flats are the dependent variables: neighbourhood level controls are kept; however, housing attributes are adjusted to only include those from land registry data as dwelling characteristics from censuses are not broken down by housing 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 we pool 2000, 2001 and 2002 together as a single year; similarly, we pool 2010, 2011 and 2012 data together to increase the number of transactions for each LSOA for each period

Table 4 Immigration Impact on 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	34,290	27,049	34,290
R2	0.559	0.43	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%

Table 5 Immigration Impact on 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
1st 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	34,290	34,290	34,290	34,290	34,290
R2	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 and the lagged house price in 2001. The controls 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.