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Immigration and Displacement across Local Labour Markets

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ABSTRACT

This paper investigates the impact of contemporary flows of immigrants on internal movements of natives and earlier immigrants across the local authorities of England and Wales. To analyse the impact of immigration, a theoretical framework where natives and immigrants are imperfect substitutes is adopted. The econometric analysis, based on the instrumental variable approach proposed by Card (2001), shows that immigration does not displace native working-age population; instead, flows of natives are complementary with those of new immigrants. There is evidence of displacement for earlier immigrants, with a substantial impact for those with no or low qualifications. Robustness tests are provided to corroborate the results.

KEYWORDS

Census; displacement; England and Wales; migration; local authority.

EDITORIAL NOTE

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‘NEW’ POLISH MIGRATION TO THE UK:
A SYNTHESIS OF EXISTING EVIDENCE

TABLE OF CONTENTS

Introduction

The impact of immigration is at the centre of public debate in all developed and developing countries. Mainstream studies about the consequences of immigration focus on the impacts on labour market outcomes of the host country such as wages, employment and participation. However, as observed by several authors (e.g. Filer, 1992; Borjas, 2003), even if immigration flows do not have adverse effects on wages or employment, they could exert pressures on the labour market that induce out-migration of previous residents towards areas with lower immigrant concentrations. The question of immigration to the UK induces displacement in local labour markets has received the attention of scholars only recently (e.g. Hatton and Tani, 2005; **?**). The aim of this paper is to contribute to this literature by exploring some methodological and empirical issues that have not been addressed before. This is done by proposing a framework with the following features: 1) labour markets are identified by local authority districts (LAD)[1]; 2) each LAD is segmented into qualification/age groups; 3) the impact of immigration is studied separately for natives and earlier immigrants.

Most UK studies are based on regional data, since widely used sources of migration data such as the Labour Force Survey (LFS) and the General Household Survey (GHS) are published on this geographical scale. However, a great deal of labour-based migration occurs between more finely delineated areas than regions: data from the 2001 Census of England and Wales show that among the fraction of migrants that changed LAD between 2000 and 2001, only 45 per cent moved across Governmental Office Regions (GOR). One of the advantages of using LADs is that they can better identify differences across local economies (such as pushing and pulling determinants for migration) that are usually ignored on a regional scale. A region such as the North West, for example, includes thriving LADs, with favourable employment prospects, along with more depressed areas, characterised by high unemployment rates. A finer definition of local labour market is also important for measuring immigrants' concentration: as an example, Greater London - which is the main region of destination for international migrants - includes LADs with high immigration rates such as Kensington & Chelsea and peripheral LADs with relatively low concentrations, such as Bexley. A potential drawback is that movements between neighbouring LADs could mask changes of residence rather than migrations to different labour markets. This problem is addressed by testing the sensitivity of the results with a geography formed by travel to work areas (TTWA).

A key issue about the study of the displacement effect is the analysis of different types of labour. In order to acknowledge the fact that workers are heterogeneous in their skill levels, LADs are segmented into qualification and age cells. Workers with different skill levels face different competition pressures on their labour market outcomes: other things

[1] A map of the LAD of England and Wales is reported in the Appendix.

being equal, young and poorly educated workers are more exposed to the risk of wage and employment declines than a skilled labour force. As a consequence, the potential reaction triggered by immigration is likely to be dissimilar for these two groups. An advantage of analysing different skill groups is to better account for the particular composition of international migration. Similarly to the case of other countries, new immigrants to the UK are relatively young: the Census table commissioned for the analysis shows that nearly 93 per cent of the flows of foreign-born immigrants that arrived in England and Wales between 2000 and 2001 are younger than 45 years. Perhaps differently from many other countries, however, the large majority of these new immigrants are relatively highly educated: more than 70 per cent of the new foreign-born immigrants hold at least an A-level (or its UK equivalent). This contrasts with less than 30 per cent of the total resident population in 2000 holding such qualifications.

An important feature of this work is the distinction between the impact of immigration on natives and on earlier immigrants (defined as those immigrants who arrived before the year 2000). Newly arrived immigrants are more likely to have characteristics that are similar to earlier immigrants than to natives. In particular, they are likely to have analogous skill profiles and choose similar occupations. This fact is embodied in the analysis by allowing for imperfect substitutability between immigrants and natives. Immigrants are also likely to choose similar destinations due to the existence of social networks shared by new and previous immigrants. As an example, Census data show that eight out of the ten top destinations are the same for new and earlier immigrants, as well as six out of the bottom ten. Hence the analysis of substitution effects between new immigrants and resident population requires us to account for the different effect on natives and earlier cohorts of foreign-born persons. To date, no study has addressed in such detail the displacement effect question for the case of England and Wales. Works such as Hatton and Tani (2005) exploit time series variation of migration data, but only consider regionally based flows; on the other hand, **?**, use data at LAD level, but only for aggregated flows, without distinguishing between skill level or country of birth.

The analysis of displacement is carried out by firstly proposing a theoretical framework that models the mechanism through which wages and employment of previous residents adjust in response to immigrant inflows. The empirical analysis is implemented by the aid of an econometric model where internal movements are related with immigration flows, which measure the penetration of recently arrived foreign-born persons into the local labour market. The issue of potential endogeneity arising from the correlation between unobserved LAD/skill-specific factors and migration flows is addressed by introducing fixed effects and by instrumenting the current immigration flows with historical settlements of foreign-born persons. The paper uses a dataset that combines information from Census migration tables and Census microdata. Two features render this dataset unique: first, migration rates are derived using 100 per cent of the observed working-age population flows instead of using small samples such as those from the LFS or the International Passenger Survey (IPS). Second, data have been obtained from the Office for National Statistics (ONS), under special conditions, without the application of the small cell counts confidentiality routine, which could otherwise affect estimations that involve small areas[2].

The results of the analysis show that international migration does not displace native working-age population; instead, both natives and new immigrants move to the same local labour markets. However, there is evidence of displacement for earlier immigrants, particularly for workers with no or low qualifications. These findings corroborate the conjecture that immigrants and natives are imperfect substitutes in production.

The next Section contains a brief review of the literature on displacement. A theoretical model which explains the mechanism through which an increase of immigration affects wages and employment rates in the local labour market is outlined in Section 3. This is used in Section 4 to derive the econometric specification which is the base for the estimation. Section 5 contains a description of the data, along with summary statistics. Analysis is carried out in Section 6, where different OLS and IV specifications are estimated and results are contrasted. The subsequent section contains the sensitivity analysis, which is performed by removing the student population, using TTWA as definition for local labour markets, analysing origin-destination specific flows and implementing predicted occupation groups. Section 8 summarises the results and proposes potential avenues for future research.

Reviewing the literature on displacement

The literature on the consequences of immigration in the labour market is well established, especially for the case of the USA. A seminal approach has involved the use of the spatial correlation method, which consists of studying the correlations between wages and employment and some measure of immigration in the local labour market. On the basis of this methodology, the majority of studies have concluded that immigration has no or negligible adverse effects on wages or employment of natives.

Filer (1992) criticises the spatial correlation approach claiming that it ignores the fact that, by exerting downward pressure on wages and reducing employment opportunities in the local labour market, immigration induces previous residents to move towards areas

[2]ONS applies a confidentiality routine to all tables from 2001 Census, consisting of an adjustment to small cell counts. Details on disclosure protection measures can be found at http://www.statistics.gov.uk/census2001/discloseprotect.asp. At Local Authority District Level, this procedure is likely to affect most of the migration indices, such as the net migration rates considered in this paper. A thorough discussion of the effects of small cell adjustment on migration interaction data is in Duke-Williams and Stillwell (2007).

with lower immigration concentration. The study of the spatial correlations will then fail to capture the true impact of migration simply because its effects are diluted country-wide. Using data from the 1980 USA Census for the standard metropolitan statistical areas (SMSA), Filer analyses the correlations between immigration and net migration by ethnic group, qualification attainment and occupation, and estimates models which include several control variables. The regression results suggest that a 10 per cent increase in the SMSA labour supply induced by immigration leads to an average net out-migration of natives of about 12 per cent, with effects that are larger among poorly-educated workers.

A series of studies have followed since Filer's pioneering work, with mixed findings. Card (2001) proposes a theoretical model where each SMSA is a single output producer with labour inputs consisting of CES-type aggregated occupations. He derives a reduced form that correlates the effect of immigration on internal migration, wages and employment rates of natives and earlier cohorts of immigrants. Data used in the study come from the 1991 US Census. To test if immigration displaces previous residents, Card estimates several models where total population growth and migration measures (i.e. net migration, out-migration and in-migration) are expressed as a function of the immigration rate in each SMSA/occupation cell. To control for potential unobserved demand factors that might be correlated with both internal and international movements, he uses an instrumental variable approach where historical settlements of immigrants - arguably exogenous with respect to present demand shocks - are a predictor for current immigration flows. The results show no evidence of displacement effects, with internal movements of natives and earlier immigrants almost insensitive or somewhat complementary to immigration flows. This also corresponds to moderate effects on the labour market outcomes of the two groups: Card's findings are consistent with a negative, but very modest, impact of immigration. In cities with a high immigrant concentration, the negative impact on wages and employment of low-skilled workers is about 3 per cent.

Along these lines, Borjas (2003) develops a CES-type structural model where the national labour market is segmented into nested education and experience cells. The advantage of his framework is that it allows for imperfect substitutability between and within education groups. Using data from four Censuses from 1960 to 1990, Borjas first estimates the elasticities of substitutions for each skill group and then simulates the effects of immigration on wages. His results imply that an immigration inflow that induces a 10 per cent increase in the labour supply reduces wages by 4 per cent on average and by 9 per cent for high school dropouts. Using Census data from 1960 to 2000 and a framework similar to the previous one, Borjas (2006) finds analogous wage impacts of immigration. He estimates a series of models that correlate the migration rates of natives with immigration within each region/skill group. As in his earlier work, skills are broken down by nested education and experience groups, while geographies correspond to Metropolitan

Areas, States and Census Divisions. Borjas finds evidence of a substantial displacement effect: the estimates of the model for internal migration show that, for any 100 additional immigrants in each region/skill cell, between 20 and 60 natives migrate towards areas with lower immigration concentration, with effects increasing with the size of the labour market under consideration.

Borjas' results have been criticised by Sparber and Peri (2007) on the grounds that, in the set of equations estimated, there exists a mechanical negative correlation between the response variable (expressed by log employment) and the main migration explanatory variable (expressed by the immigration rate). They prove their claim by simulating results using arbitrary values of such correlation. They also estimate alternative types of regression with the same data used by Borjas (2006) and find no evidence of displacement; instead, they found that an increase of 100 immigrants in each region/skill cell will be accompanied by an increase of 30 to 40 natives.

There are only a few studies that explore the displacement effect of immigration outside the USA context. Stillman and Maré (2007) consider this hypothesis for the case of New Zealand: using data from 1996 and 2001 Census at local labour market area (LMA) level and an econometric framework similar to Borjas (2006), they estimate the impact of immigration on internal movements of natives and earlier immigrants. They use two different definitions of skill groups: one based on age/qualification and one based on occupations. Endogeneity issues are mitigated by using the instrumental variable approach proposed by Card (2001). Their results indicate that there is no evidence of displacement for natives or earlier immigrants; in each LMA/skill group, population grows at a rate higher than international immigration, implying that both previous residents and new immigrants move to the same areas. Their results are robust across different types of labour market definition.

To date, only a few studies have investigated the displacement effect in the UK. Hatton and Tani (2005) build a model where net internal flows between regions are a function of the net international migration. They use data from the IPS and from the National Health Service Central Register (NHSCR) for the period 1982-2000. One advantage of their dataset is that it is possible to exploit time series variation, which allows a better control for persistent demand shocks; another benefit is that emigration rates can be included in the analysis. These data, however, also have some issues. IPS are only available at regional level, with no breakdowns by skill, and they are constructed using a sample of 0.2 per cent of all travellers into and out of the UK[3]. NHSCR are high-frequency data, but they only contain information about age and sex of migrants, with some issues of undercounting of young males[4]. With these caveats, they estimate a series of models, with

[3]This corresponds to roughly 250,000 interviews annually, see ONS website http://www.statistics.gov.uk

[4]The undercounting of young males creates potentially biased estimates if the age and/or sex distribution of migrants varies by areas. Tabulations at regional level from SAR reveal that age profiles are

and without control variables such as house prices and job vacancies, and they found that net internal migration is negatively correlated with the net immigration to the region. However, this effect is significant only when restricted to the Southern Regions (which are high immigration areas); according to their estimates, for an additional 100 (net) immigrants, more than 50 previous residents will move to another region.

? analyse the impact that immigration from the Eastern European countries that recently joined the European Union has on the UK labour market. They use data from the Worker Registration Scheme and the National Insurance Number (NINO) Registrations database. These datasets have the advantage of being published at LAD level, allowing a detailed study of local labour markets. They first estimate the impact of immigration on wages and unemployment, finding no significant adverse effect even for the low-skilled or young labour force. They then investigate whether immigration leads to a displacement of the native labour force. The results of their preferred specification confirm the findings of Hatton and Tani (2005), although the magnitude of displacement effect is substantially smaller (between 4 and 9 per cent, for LADs and region, respectively). These results are vulnerable to criticism for two reasons: first of all, the displacement hypothesis is tested without skill or occupation breakdown of the population. Second, as pointed out also by the authors, the issue of endogeneity has not been addressed, and hence local demand shocks are likely to bias the true effect.

Set aside from the studies of displacement effect is the work of Manacorda et al. (2008). This study is relevant as it offers an alternative explanation for the absence of immigration effects: the imperfect substitutability between immigrants and natives. Following Ottaviano and Peri (2006), the authors develop a framework where immigrants and natives are imperfect substitutes. Using data from the GHS and the LFS for the period 1973 to 2005, they first estimate the elasticity of substitution between immigrants and natives and then simulate the impact of immigration on the wages of both natives and the previous cohorts of immigrants. They conclude that, in the period under examination, immigration increases the wage differential between native and earlier immigrants by about 5.5 per cent. An important corollary of imperfect substitutability is that, since competition between new and earlier immigrants is stronger than between new immigrants and natives, the displacement effects should be larger among previous cohorts of foreign-born persons.

different from the average profile (i.e., at country level), particularly in the case of London. Since this region has a large proportion of immigrants and internal migrants, migration rates will be measured with error.

Theoretical framework

The model combines those of Card (2001), Card and Lemieux (2001) and Borjas (2003). Each LAD j produces a single output by the means of the following technology:

$$Y_j = F(K_j, L_j),$$

where K and L represent capital and labour, respectively. In each LAD, labour is a CES-type aggregate of inputs represented by schooling qualification groups s:

$$L_j = \left(\sum_s \nu_{js} L_{js}^{\frac{\rho-1}{\rho}} \right)^{\frac{\rho}{\rho-1}},$$

where ν_{js} represent LAD/qualification relative efficiency, with $\sum_s \nu_{js} = 1$ and ρ is the elasticity of substitution between qualifications. Each of these inputs is an aggregate of imperfect substitutable types of labour, represented by age intervals a:

$$L_{js} = \left(\sum_a \lambda_{sa} L_{jsa}^{\frac{\delta-1}{\delta}} \right)^{\frac{\delta}{\delta-1}},$$

where λ_{sa} corresponds to qualification/age relative efficiency, $\sum_a \lambda_{sa} = 1$ and δ is the elasticity of substitution across age groups. Within each qualification/age cell, natives (N) and migrants (M) are imperfect substitutes:

$$L_{jsa} = \left(\sum_k \psi_{jsak} L_{jsak}^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}},$$

where $k \in \{N, M\}$, ψ_{jsak} and η are the relative efficiency and the elasticity of substitution between immigrants and natives, respectively, with $\sum_k \psi_{jsak} = 1$. This feature follows the works of Ottaviano and Peri (2006) and Manacorda et al. (2008). Cultural diversity, ethnic segregation, language gap and other factors could determine different productivity and occupational choices for immigrants, hence resulting in their imperfect substitutability with natives. Profit maximisation yields the following equation for the marginal product of natives' and migrants' labour inputs (see Appendix):

$$\ln w_{jsak} = \ln\left(q_j \frac{\partial Y_j}{\partial L_j} \right) + \frac{1}{\rho} \ln L_j + \left(\frac{1}{\delta} - \frac{1}{\rho} \right) \ln L_{js} + \left(\frac{1}{\eta} - \frac{1}{\delta} \right) \ln L_{jsa} - \frac{1}{\eta} \ln L_{jsak} + \kappa, \quad (1)$$

where $\kappa = \ln \nu_{js} + \ln \lambda_{sa} + \ln \psi_{jsak}$ and q_j is the price of the output in each LAD. The labour participation function is expressed as follows:

$$\ln L_{jsak} = \epsilon \ln w_{jsak} + \ln P_{jsak}, \quad (2)$$

where P represents the working-age population in each LAD/qualification/age cell for both natives and migrants, and ϵ is the elasticity of labour supply which, for simplicity, is assumed to be constant across groups. By combining equations 1 and 2, the following expressions for wage and employment are obtained:

$$\ln w_{jsak} = \frac{\eta}{\epsilon+\eta}\left\{ \ln\left(q_j \frac{\partial Y_j}{\partial L_j} \right) + \frac{1}{\rho}\ln L_j + \left(\frac{1}{\delta}-\frac{1}{\rho}\right)\ln L_{js} + \left(\frac{1}{\eta}-\frac{1}{\delta}\right)\ln L_{jsa} + \kappa \right\} - \frac{1}{\epsilon+\eta}\ln P_{jsak} \quad (3)$$

$$\ln \frac{L_{jsak}}{P_{jsak}} = \frac{\epsilon\eta}{\epsilon+\eta}\left\{ \ln\left(q_j \frac{\partial Y_j}{\partial L_j} \right) + \frac{1}{\rho}\ln L_j + \left(\frac{1}{\delta}-\frac{1}{\rho}\right)\ln L_{js} + \left(\frac{1}{\eta}-\frac{1}{\delta}\right)\ln L_{jsa} + \kappa \right\} - \frac{\epsilon}{\epsilon+\eta}\ln P_{jsak} \quad (4)$$

Notice that these expressions are very similar to Card (2001) and Borjas (2003) when $\eta \to 0$. A percentage increase in the working-age population of migrants ($d\ln P_{jsaM}$) affects the equilibrium wage and employment of migrants and natives in the same qualification/age group, but also of migrants and natives in other qualification/age groups. The total effect for a city is found by considering the impact on different education and age cells. Following Ottaviano and Peri (2006), it is possible to express the effects of immigration on a given qualification and age group in each LAD as follows:

$$\frac{d\ln w_{jsaN}}{d\ln P_{jsaM}} = \frac{\eta}{\epsilon+\eta}\left\{ \frac{1}{\rho}\sum_{\tilde{s}\neq s}\sum_{\tilde{a}\neq a} \underbrace{\frac{\partial \ln L_j}{\partial \ln P_{j\tilde{s}\tilde{a}M}}}_{+} - \pi \sum_{\tilde{a}\neq a} \underbrace{\frac{\partial \ln L_{js}}{\partial \ln P_{js\tilde{a}M}}}_{+} - \mu \underbrace{\frac{\partial \ln L_{jsa}}{\partial \ln P_{jsaM}}}_{+} \right\} \quad (5)$$

$$\frac{d\ln(\frac{L_{jsaN}}{P_{jsaN}})}{d\ln P_{jsaM}} = \frac{\epsilon\eta}{\epsilon+\eta}\left\{ \frac{1}{\rho}\sum_{\tilde{s}\neq s}\sum_{\tilde{a}\neq a} \underbrace{\frac{\partial \ln L_j}{\partial \ln P_{j\tilde{s}\tilde{a}M}}}_{+} - \pi \sum_{\tilde{a}\neq a} \underbrace{\frac{\partial \ln L_{js}}{\partial \ln P_{js\tilde{a}M}}}_{+} - \mu \underbrace{\frac{\partial \ln L_{jsa}}{\partial \ln P_{jsaM}}}_{+} \right\} \quad (6)$$

The terms $\pi = \frac{1}{\delta} - \frac{1}{\rho}$ and $\mu = \frac{1}{\eta} - \frac{1}{\delta}$ are both negative as long as the elasticity within group is larger than the elasticity between groups, i.e. $\eta > \delta > \rho$, which is a standard assumption in similar models. The Appendix shows that the components $\frac{\partial \ln L_j}{\partial \ln P_{jsak}}$, $\frac{\partial \ln L_{js}}{\partial \ln P_{jsak}}$ and $\frac{\partial \ln L_{jsa}}{\partial \ln P_{jsak}}$ are all positive. The corresponding effects for earlier immigrants are:

$$\frac{d\ln w_{jsaM}}{d\ln P_{jsaM}} = \frac{\eta}{\epsilon+\eta}\left\{ \frac{1}{\rho}\sum_{\tilde{s}\neq s}\sum_{\tilde{a}\neq a} \underbrace{\frac{\partial \ln L_j}{\partial \ln P_{j\tilde{s}\tilde{a}M}}}_{+} - \pi \sum_{\tilde{a}\neq a} \underbrace{\frac{\partial \ln L_{js}}{\partial \ln P_{js\tilde{a}M}}}_{+} - \mu \underbrace{\frac{\partial \ln L_{jsa}}{\partial \ln P_{jsaM}}}_{+} - \frac{1}{\eta} \right\} \quad (7)$$

$$\frac{d\ln(\frac{L_{jsaM}}{P_{jsaM}})}{d\ln P_{jsaM}} = \frac{\epsilon\eta}{\epsilon+\eta}\left\{ \frac{1}{\rho}\sum_{\tilde{s}\neq s}\sum_{\tilde{a}\neq a} \underbrace{\frac{\partial \ln L_j}{\partial \ln P_{j\tilde{s}\tilde{a}M}}}_{+} - \pi \sum_{\tilde{a}\neq a} \underbrace{\frac{\partial \ln L_{js}}{\partial \ln P_{js\tilde{a}M}}}_{+} - \mu \underbrace{\frac{\partial \ln L_{jsa}}{\partial \ln P_{jsaM}}}_{+} - \frac{1}{\eta} \right\} \quad (8)$$

Equations 5 to 8 summarise the important aspect that immigration in a given qualification/age group also affects other qualification and age groups. Some observations are necessary:

1. other things being equal and as long as there is no perfect substitution between immigrants and natives (i.e. $\eta < \infty$), then $\frac{d\ln w_{jsaN}}{d\ln P_{jsaM}} > \frac{d\ln w_{jsaM}}{d\ln P_{jsaM}}$ and $\frac{d\ln(\frac{L_{jsaN}}{P_{jsaN}})}{d\ln P_{jsaM}} > \frac{d\ln(\frac{L_{jsaM}}{P_{jsaM}})}{d\ln P_{jsaM}}$, i.e. the adverse effect of immigration is worse for immigrants because they are perfect substitutes with newcomers;

2. the sign of both expressions is ambiguous, as there are positive and negative terms. As noted by Ottaviano and Peri (2006), the expression might be positive when the components $\frac{\partial \ln L_j}{\partial \ln P_{jsaM}}$ are particularly large, i.e. there is a large spillover to the total labour force caused by imperfect substitutability. In all other cases the effect will be negative due to the crowding out of similar workers. A corollary to equations 5 to 8 is that the impact of immigration on wages and employment depends on how the skills distribution of new immigrants compares to that of previous residents. If previous residents have skills similar to immigrants, the negative effects will be relatively large.

3. a plausible assumption is that previous residents respond to the total effect of immigration. Natives and earlier immigrants of a given qualification/age group will migrate to (out of) a LAD if the total effect of immigration on their wage and employment outcomes is positive (negative). Hence the correlation between internal migration and immigration of a given qualification/age group captures the combined effects across and within groups.

The empirical analysis of the paper will assess the effect of an increase in the supply of immigrants on the mobility of natives and earlier migrants in the same LAD/qualification/age group.

Econometric model

The econometric framework is based on Card (2001), with the distinction of considering that the labour market is segmented in qualification and age groups rather than occupations. The starting point is the definition of population growth between 2000 and 2001. In each qualification/age group, natives and migrant working-age populations grow according to the following equation:

$$P_{jN}^{2001} = P_{jN}^{2000} + P_{jN}^{L} - P_{jN}^{O},$$

$$P_{jM}^{2001} = P_{jM}^{2000} + P_{jM}^{L} - P_{jM}^{O},$$

where L and O are indices for in-migration and out-migration across LADs, respectively. By indicating with R_j the immigration flows, total population growth is represented by:

$$\begin{aligned} \frac{P_j^{2001}}{P_j^{2000}} &= 1 + \frac{P_{jN}^{L} - P_{jN}^{O}}{P_{jN}^{2000} + P_{jM}^{2000}} + \frac{P_{jM}^{L} - P_{jM}^{O}}{P_{jN}^{2000} + P_{jM}^{2000}} + \frac{R_j}{P_{jN}^{2000} + P_{jM}^{2000}} \\ &= 1 + n_j e_j + m_j(1 - e_j) + rj \end{aligned} \tag{9}$$

where $n_j = \frac{P_{jN}^{L} - P_{jN}^{O}}{P_{jN}^{2000}}$; $m_j = \frac{P_{jM}^{L} - P_{jM}^{O}}{P_{jM}^{2000}}$; $e_j = \frac{P_{jN}^{2000}}{P_{jN}^{2000} + P_{jM}^{2000}}$. The growth rate is expressed as a linear combination of net internal migration rates of natives and earlier immigrants (n_j and m_j, respectively) where the weights correspond to the relative shares (e_j and $1-ej$) of the two groups. Equation 9 assumes that the working-age population of previous residents is constant between 2000 and 2001. If natives and migrants of a given qualification/age group are insensitive to immigration flows, then $n_j e_j + m_j(1 - e_j) + r_j = r_j$, i.e. the local population grows only because of immigration.

The estimation of this equation involves potential endogenous issues arising from the presence of unobserved LAD- and/or qualification/age-specific shocks that are correlated with the immigration rate. A strategy to control for group-specific shocks is to pool observations over all qualification and age groups and introduce fixed effects; however, LAD/qualification/age-specific demand shocks might still be correlated with r_{jsa}. Endogeneity bias can be mitigated by the means of an instrument that is orthogonal to local demand shocks. As discussed in Card (2001), a robust instrument is constituted by country of birth-specific historical settlement of immigrants. This can be used to predict the part of current immigration flows that is exogenous to contemporaneous demand conditions. The instrument is represented by the following expression:

$$R_{jsa} = \hat{R}_{jsa} + \zeta_{jsa} = \sum_b \gamma_{jb}\theta_{sab}R_b + \xi_{jsa} \tag{10}$$

where θ_{jb} is the fraction of historical flows from country b that settled in local authority j, θ_{sab} represents the countrywide share of current migrants belonging to qualification s and age a, and R_b represents the current flows from country b. The term $\hat{R}_{jsa}$ predicts how current immigration flows would be redistributed across LADs and qualification and age groups in the absence of local demand shocks, represented by ξ_{jsa}. Hence the key identifying assumptions are:

$$E\{\gamma_{jb}, \theta_{sab}, R_b|\xi_{jsa}\} = 0 \tag{11}$$

The instrumental variable approach just described has been extensively used in the migration literature. Here, Card's approach is adapted by proposing an instrument constructed with ethnic-specific historical settlement of immigrants in addition to the one based on country of birth. This is thought to be more appropriate for the UK case given the tendency of immigrants to cluster in ethnic enclaves and due to the fact that different ethnic groups may originate from the same country of birth. As will be discussed in the Section 3.6, both instruments yield very similar results. Using equation 9 it is possible to express the components of population growth (i.e. in-migration rate, out-migration rate and net migration) as functions of r_j for both natives and earlier immigrants; by implementing the instrumental variables approach described above and adding LAD/qualification/age-specific covariates, the following reduced form regression can be estimated:

$$g_{jsa} = \beta r_{jsa} + \mathbf{Z}_{jsa}\boldsymbol{\chi} + \tau_j + \tau_s + \tau_a + \tau_{sa} + \upsilon_{jsa} \tag{12}$$

where g_{jsa} is a component of population growth (inflow, outflow, net migration rates) for natives and earlier immigrants; τ_j, τ_s and τ_a represent LAD, qualification and age effects; the interaction τ_{sa} is used to control for the fact that age is only a proxy of potential experience, which can vary substantially within each qualification cell; $\mathbf{Z}$ is a set of variables to control for local demand shocks. The parameter of interest is β, which captures the effect of immigration on the various components of population growth.[5].

Data description

Data used in the analysis come from several sources. The main source is the Census Table C0949, which has been commissioned from the Office for National Statistics (ONS). This table contains counts of migrants between LADs of England and Wales cross-tabulated by highest level of schooling qualification, age and foreign-born status, i.e. individuals born inside or outside the UK[6]. This table is used to construct in-migration, out-migration, net migration, and immigrant flows in England and Wales. Table C0949 has the important feature of not being especially contaminated by random small cell adjustment, which is usually implemented by ONS in all tabular outputs to prevent the release of confidential information.

Another important source of data is the Controlled Access Microdata Sample (CAMS).

[5] Equation 13 is the baseline for estimation. The overall analysis has been carried out also using the model $g_{jsa} = \beta r_{jsa} + \mathbf{Z}_{jsa}\boldsymbol{\chi} + \tau_j + \tau_s + \tau_a + \tau_{js} + \tau_{sa} + \upsilon_{jsa}$ where the term τ_{js} represents the interaction between LAD and qualification. This second specification, which is similar to Borjas (2003), yields consistent results across all models. The computation of F-tests across different models reveals that the presence of numerous interactions with LADs reduces substantially the robustness of the model and of the instrument. Hence specification 13 represents an optimal balance between a parsimonious model and a good fit.

[6] Persons born in Scotland or Northern Ireland are considered natives although these two countries are excluded from the analysis. The choice of the UK rather than England and Wales as definition of country of birth is driven by the need to use a harmonised definition across data sources.

This consists of sample microdata from Census, only accessible in safe settings at ONS, which contains more detailed and disclosive information than the Sample of Anonymised Records (SAR) and the Small Area Microdata (SAM), which are available under end-user licence. CAMS data are used to derive LAD/skill-specific covariates for both natives and earlier immigrants. These include the unemployment rate, the share of non-white population, the proportion of Council houses, the percentage of females and the proportion of foreign-born population in each LAD/qualification/age group (the last variable is the same for natives and earlier immigrants).
The remaining information comes from different Census sources: Census Table C0736 is used to derive the population one year before the Census, which serves to construct migration rates. Information such as ethnic group and country of birth of immigrants, necessary to derive the instrumental variable, is obtained from Tables MG103 and C0737, while historical immigrants' settlements are derived from 1991 Census Table L06 and L07. Population excluding students has been estimated using data from Census Table MG105.

Definitions

The base geography is constituted by 374 LADs[7]. These areas are not uniform in terms of population and size: there are LADs with large populations such as Birmingham and Leeds, and areas far less populous, such as Berwick-upon-Tweed and Teesdale. London is formed by 32 boroughs, each of them corresponding to a LAD. To control for this inhomogeneous size, the analysis will be based on weighted regressions, using the population in each LAD as weight.
Table C0949 is designed to contain three broad qualification groups: no or other schooling qualifications, low qualifications (i.e. below A-level) and high qualifications; these correspond to aggregated Census categories[8]. There are two important observations about these definitions. First, the group with no or other qualifications could be affected by measurement issues if schooling qualifications were erroneously reported as "other"; this problem could be quite significant for the group of immigrants, due to difficulties in translating foreign schooling degrees into the UK system. However, as discussed by Manacorda et al. (2008), this issue affects mainly survey data, while the impact is thought to be negligible for Census data. Second, although the A-level threshold between low and

[7] England and Wales are formed by 376 LADs. Due to their relatively small size, the local authorities of City of London and Isles of Scilly have been aggregated with Westminster and Penwith, respectively.

[8] "No or other qualification" includes: No academic, vocational or professional qualifications. Other qualifications/level unknown: Other qualifications (e.g. City and Guilds; RSA/OCR; BTEC/Edexcel); Other Professional Qualifications. "Low qualification" include 1+ 'O' levels/CSE/GCSE (any grade); NVQ level 1; Foundation GNVQ; 5+ 'O' levels; 5+ CSEs (grade 1); 5+ GCSEs (grade A - C); School Certificate; 1+ A levels/AS levels; NVQ level 2; Intermediate GNVQ or equivalents. "High qualifications" include 2+ 'A' levels; 4+ AS levels; Higher School Certificate; NVQ level 3; Advanced GNVQ or equivalents; First degree; Higher Degree; NVQ levels 4 – 5; HNC; HND; Qualified Teacher Status; Qualified Medical Doctor; Qualified Dentist; Qualified Nurse; Midwife; Health Visitor or equivalents. All categories are derived from the 2001 Census question "Highest level of qualification".

high qualification is somewhat arbitrary, it is useful to isolate the low-skilled group; this also corresponds to the classification used in several UK studies of migration, such as Dustmann et al. (2005).

Three age categories are then nested into each qualification group: 16 to 24, 25 to 44 and 45 to 64 years old. Age groups are only a broad proxy for labour experience; a finer definition would require knowledge of the age at which individuals left full-time education, which is not available from Census tabulations. Nevertheless, these three age intervals are useful to capture different migration events over the life cycle: the group 16-24 includes movements of the young and inexperienced labour force; the group 25-44 contains migrations up to the stages of career development, mostly characterised by movements of the whole household; the group 45-64 tracks patterns of career change or pre-retirement. The other advantage of this classification is that it can be perfectly matched with the age groups contained in other data sources, such as SAR. Occupations, which are used in some computations, are defined according to the SOC2000 9 major groups or the 81 minor groups.

The analysis focuses on flows of working-age populations, which consist of labour force and inactive persons aged 16 to 64, including students; this is different to the approach followed by Stillman and Maré (2007) which exclude them. Since a substantial share of students belong to the labour force, their inclusion is useful to account for the potential impact exerted on the labour market by this group[9]. Sensitivity tests to compare results without student population are carried out.

The word immigrant (or new immigrant) is used to indicate a foreign-born individual that moved to the UK during the year before the Census date. UK-born immigrants who moved to England and Wales are excluded. Earlier immigrants consist of foreign-born persons that migrated into the UK more than one year before the 2001 Census. Natives include individuals that are born within the United Kingdom. In-migration and out-migration consist of counts of internal movements between LADs in England and Wales. These flows can either accrue to natives or foreign-born persons; net migration is the difference between in-migration and out-migration.

In each LAD/qualification/age group, the immigration rate is defined as the count of new immigrants over the total population before immigration. Total population growth is defined as the ratio of population in 2001 over the population in 2000. Migration rates for natives and earlier immigrants correspond to the ratio of the flows over their respective populations in 2000, e.g., native out-migration is derived as the ratio of internal outflows of natives over the native population in 2000.

[9]According to 2001 Census data, 22 per cent of new immigrants and 36 per cent of previous residents who are full-time students are also either working or actively seeking for jobs.

Some facts about migration in England and Wales

Immigration to England and Wales increased rapidly during the 1990s, while emigration was fairly stable. The resulting increase in the stock of foreign-born persons between 1990 and 2000 accounted for half of the population growth in these two countries. Figure 1 presents immigration, emigration and net immigration in England and Wales for the period 1991-2006. The analysis contained in this paper focuses only on immigration of foreign born persons, and does not consider emigration patterns. This approach is different from Hatton and Tani (2005), who consider net migration rates; however, as shown in the Figure, which is constructed using IPS data for the period 1991-2006, international net migration is mostly driven by immigration patterns, at least at aggregate level. The other component of international migration - the immigration of UK-born persons - is set out in the right-hand side of the Figure. As can be seen, aggregate patterns are stable over time. As discussed earlier, these flows will not be considered.

Table 1 reports the distributions of immigrants, total population, natives and earlier immigrants by qualification and age, occupation and LAD of residence in 2001. In the year preceding the 2001 Census, more than $220,000$ immigrants aged 16 to 64 moved to England and Wales; this flow corresponds to roughly 0.67 per cent of the total residents before immigration. The skill composition of new immigrants is very different from that of the resident population. More than 70 per cent of new immigrants are highly qualified, while this percentage is much lower for the other two groups (43.5 per cent for earlier immigrants and 28 per cent for natives). Less-qualified persons constitute the largest share of natives (about 41 per cent), while accounting only for 24 per cent of earlier immigrants and 13 per cent of new immigrants. On the other hand, the share with no/other qualifications among natives and earlier immigrants is two times larger than for immigrants. Within each educational group, the age profile reveals that more than 90 per cent of new immigrants are younger than 44 years. For the groups of earlier immigrants and natives, this percentage is about 70 per cent for low or high qualifications, and falls to about 40 per cent for the category of no/other qualifications. To provide insight into the distribution of new immigrants, the Appendix reports a graphical representation of the immigration rates for different groups.

The occupation profiles are also very different across groups[10]. More than 56 per cent of recent immigrants are in the managerial and professional occupations, while this percentage falls to about 43 per cent for earlier immigrants and less than 36 per cent for natives. Only 3 per cent of immigrants are in the processing and machine-operating occupations, while this share is three times larger for earlier immigrants and natives. The percentage in elementary occupations is similar across the three groups.

[10]The definition of SOC2000 occupation groups can be found in the ONS website http://www.ons.gov.uk/about-statistics/classifications/current/ns-sec

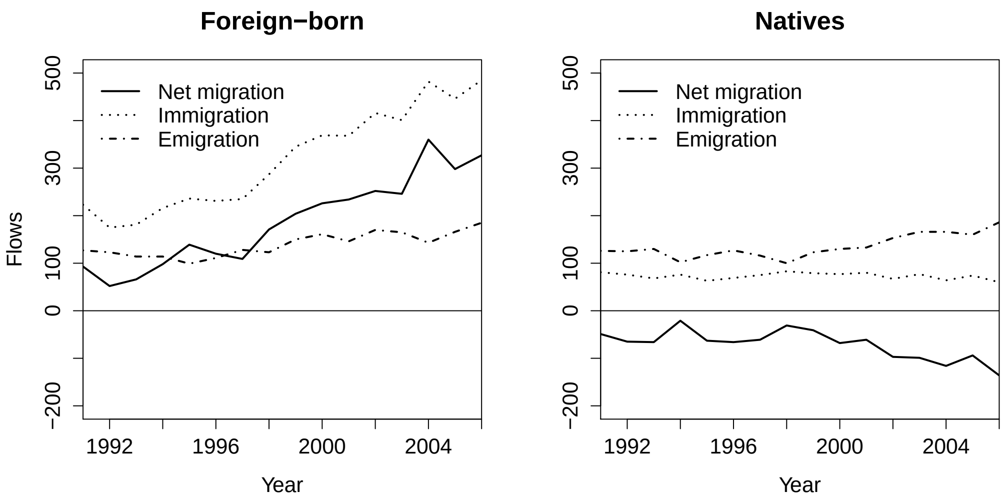


Figure 1: Immigration flows of foreign-born and natives, thousands. Source: IPS

The shares of total population of each group which accrue to the top ten populated LADs are set out in the bottom part of the table. These LADs include more than 12 per cent of immigrants, 13.5 per cent of earlier immigrants and 9 per cent of natives. The top LAD for all three groups is Birmingham, but the share of earlier immigrants is twice as much as that of natives. Interestingly, the shares of new immigrants are very different to those of earlier immigrants in all LADs, while in the case of four top LADs (Leeds, Sheffield, Bradford and Liverpool) they are similar to natives. Among the reasons that could explain this is the fact that earlier immigrants have moved out of the LADs where they firstly arrived. The figures for the total population resemble very much the profile for natives, except for certain LADs where the concentration of earlier immigrants is particularly large. For example, the percentage of poorly-educated individuals in the total population is slightly smaller than among natives, (39 vs 41 per cent), due to the fact that the proportion of low-skilled persons among earlier immigrants is substantially lower than natives. The same argument applies to those LADs with percentages that differ between the total population and natives. For example, the shares of total population of Birmingham and Ealing are relatively larger compared to those of natives, due to the high concentration of earlier immigrants. The occupation profile is nearly identical between natives and the total population.

A preliminary description of the relationship between immigration and internal movements is set out in Table 2. This table reports, in descending order of flows, the LADs with largest immigration and internal migration for the groups with low and high qualifications. With the exception of Birmingham, all destinations for poorly-educated new immigrants are situated in London. Six out of ten of such LADs are also top destinations for earlier immigrants. However, eight out of ten of the main origins of internal migration

Table 1: Skill distribution and geographic dispersion for different groups

		Immigrants	Earlier immigrants	Natives	Total population
Total		222,942	3,374,241	29,726,880	33,324,063
Qualification	**Age**				
No/other qualif.		15.9	32.4	31.2	31.2
	16-24	49.3	9.6	9.6	8.5
	25-44	41.7	27.7	29.0	40.2
	45-64	9.0	62.7	61.3	51.3
Low qualif.		13.1	24.1	40.8	39.0
	16-24	52.6	21.5	21.5	19.9
	25-44	40.0	54.3	54.0	50.9
	45-64	7.4	24.2	24.5	29.2
High qualif.		70.9	43.5	28.0	29.8
	16-24	32.1	20.0	19.2	13.3
	25-44	60.6	50.9	52.1	58.1
	45-64	7.2	29.1	28.7	28.7
Occupations					
Managers and senior officials		13.1	14.9	13.6	13.7
Professional occup.		23.2	14.0	9.6	10.1
Ass. profess. and technical occup.		19.6	13.7	12.4	12.6
Administrative and secretarial occup.		12.1	12.2	13.7	13.6
Skilled trades occup.		4.3	8.6	11.3	11.0
Personal service occup.		6.7	6.8	7.5	7.4
Sales and customer service occup.		6.0	7.5	8.8	8.7
Process, plant and machine operatives		2.8	8.7	9.0	8.9
Elementary occup.		12.3	13.6	14.1	14.1
Top ten populated LAD					
Birmingham		2.10	3.48	1.63	1.82
Leeds		1.42	0.99	1.44	1.39
Sheffield		1.08	0.67	1.03	1.00
Bradford		0.75	1.23	0.83	0.87
Liverpool		0.72	0.41	0.90	0.85
Manchester		1.65	1.18	0.73	0.78
Bristol		1.11	0.66	0.76	0.76
Kirklees		0.34	0.69	0.75	0.74
Croydon		0.92	1.64	0.53	0.65
Ealing		1.94	2.52	0.40	0.62

Source: Census Table C0949 and C0737. Occupations defined according to SOC2000.

are also among the London boroughs. With few exceptions, the top origins and destinations of low-qualified natives differ from those of new immigrants and are situated mainly in the Metropolitan Counties (e.g. Manchester and Leeds).

For the group with high qualifications, the majority of destinations for new immigrants are situated in London, but the list also includes Oxford and Cambridge. Another interesting aspect is that the ranking of the destinations within London is somewhat inverted: while the top LADs for low-qualified immigrants are located in Outer London, those for the highly qualified belong to the inner part. A similar ranking is found in the migration patterns of earlier immigrants, with both top destinations and origin in the Inner London area. The migration pattern of highly qualified natives is rather diverse, with four of the top origins and destinations located mostly in Inner London and the rest situated in areas similar to those of low-qualified natives. The descriptive evidence in Table 2 reveals

Table 2: LADs with highest migration flows for different groups

	Rank	Immigrants	Earlier immigrants		Natives	
			In-migration	Out-migration	In-migration	Out-migration
High qualif.						
	1	Westminster	Westminster	Westminster	Wandsworth	Wandsworth
	2	Kensington & Chelsea	Wandsworth	Camden	Leeds	Birmingham
	3	Camden	Camden	Wandsworth	Lambeth	Leeds
	4	Wandsworth	Lambeth	Hammersmith & Fulham	Manchester	Lambeth
	5	Hammersmith & Fulham	Hammersmith & Fulham	Kensington & Chelsea	Birmingham	Manchester
	6	Oxford	Kensington & Chelsea	Brent	Bristol	Camden
	7	Brent	Southwark	Southwark	Nottingham	Bristol
	8	Ealing	Barnet	Lambeth	Sheffield	Sheffield
	9	Southwark	Brent	Ealing	Camden	Nottingham
	10	Cambridge	Ealing	Haringey	Southwark	Barnet
Low qualif.						
	1	Brent	Newham	Brent	Birmingham	Birmingham
	2	Newham	Brent	Newham	Leeds	Leeds
	3	Birmingham	Ealing	Haringey	East Riding of Yorkshire	Manchester
	4	Ealing	Barnet	Lambeth	Manchester	Bristol
	5	Barnet	Lambeth	Ealing	Bristol	Croydon
	6	Wandsworth	Enfield	Wandsworth	Medway	Bromley
	7	Westminster	Redbridge	Southwark	South Gloucestershire	Wandsworth
	8	Southwark	Westminster	Barnet	Bromley	Lewisham
	9	Kensington & Chelsea	Croydon	Hackney	Nottingham	Liverpool
	10	Lambeth	Harrow	Westminster	Liverpool	Hillingdon

Source: Census Table C0949 and C0737.

that migration patterns differ substantially by qualification group and country of birth; moreover, it reiterates the importance of analysing the relationships between immigration and internal migration at LAD level.

Assessing the substitution of skill groups

The model in Section 3.4 is built on the assumption that there is imperfect substitution between qualification and age groups. The nested structure of the model suggests that substitutability is larger within groups and smaller between; this corresponds to the findings of works such as Borjas (2003). The model also assumes that immigrants and natives are imperfect substitutes in the same age cell. This feature was recently incorporated into structural models for the case of the USA by Ottaviano and Peri (2006), who estimated an elasticity of substitution between 5 and 6 and for the UK by Manacorda et al. (2008), who found a value of about 7.

There is no single metric to gauge the substitution between and across groups; a simple and effective method, used previously by Borjas (2003) and Ottaviano and Peri (2006) is to construct an index of congruence on the lines of that originally proposed by Welch (1999) and which measures the affinity in the occupational distributions of different groups. The rationale is that groups composed of individuals with similar occupations are closer substitutes than groups with dissimilar distributions, and hence face higher competition in the labour market. The index of congruence is:

$$F_{hl} = \frac{\sum_g \frac{(f_{hg}-f_g)(f_{lg}-f_g)}{f_g}}{\sqrt{\sum_g \frac{(f_{hg}-f_g)^2}{f_g} \sum_g \frac{(f_{lg}-f_g)^2}{f_g}}},$$

with $F_{hl} \in [-1, 1]$. Here f_{hg} and f_{lg} are the shares of group h and l in occupation g. The term f_g is the proportion of total population in occupation g. The index is constructed in a way such that $F_{hl} = 1$ if occupations of group h have the exact distribution of group l and $F_{hl} = -1$ if the two groups have completely different distributions. It is possible to construct this index for all the sub-aggregates of the labour input.

Table 3 reports the value of F_{hl} between natives and earlier immigrants within the same education and age group. The index is calculated using the 81 minor groups (three digit) of the SOC2000. The congruence index between natives equals 1 for individuals in the same qualification/age group and is larger for contiguous cells. For example, for the group of low-skilled, the index between natives aged 16-24 and 25-44 is 0.22 and between those aged 25-44 and 45-64 it is 0.55, while the index between natives aged 16-24 and 45-64 is $-.31$, revealing a smaller degree of substitution. The degree of substitution across qualification groups can be assessed in a similar way. Cells that are relatively far from the diagonal have relatively smaller value, indicating less substitutability between different groups. The imperfect substitution between natives and immigrants is observed along the diagonal of the lower panel of Table 3. The index ranges from 0.60 to 0.94, indicating imperfect substitution between the two groups. In general, values are larger for the highly qualified than for the low-qualified.

Table 3: Congruence index between natives and immigrants

		Natives								
		No/other qualif.			Low qualif.			High qualif.		
		16-24	25-44	45-64	16-24	25-44	45-64	16-24	25-44	45-44
Natives										
	16-24	1.00								
No/other qualif.	25-44	0.75	1.00							
	45-64	0.52	0.90	1.00						
	16-24	0.75	0.32	0.17	1.00					
Low qualif.	25-44	0.01	0.11	0.23	0.22	1.00				
	45-64	-0.56	-0.45	-0.16	-0.31	0.55	1.00			
	16-24	0.19	-0.30	-0.41	0.68	0.03	-0.09	1.00		
High qualif.	25-44	-0.65	-0.76	-0.81	-0.58	-0.54	0.00	0.02	1.00	
	45-44	-0.53	-0.60	-0.64	-0.55	-0.71	-0.13	-0.16	0.81	1.00
Immigrants										
	16-24	0.76	0.48	0.29	0.66	-0.04	-0.41	0.32	-0.51	-0.41
No/other qualif.	25-44	0.52	0.60	0.53	0.29	0.02	-0.31	-0.12	-0.54	-0.42
	45-64	0.54	0.79	0.79	0.16	0.06	-0.26	-0.34	-0.67	-0.50
	16-24	0.64	0.22	0.10	0.94	0.12	-0.26	0.73	-0.50	-0.48
Low qualif.	25-44	0.09	0.09	0.20	0.35	0.65	0.43	0.22	-0.52	-0.61
	45-64	-0.27	-0.13	0.12	-0.14	0.49	0.77	-0.12	-0.27	-0.30
	16-24	0.14	-0.34	-0.43	0.57	-0.11	-0.09	0.94	0.09	-0.09
High qualif.	25-44	-0.54	-0.67	-0.73	-0.47	-0.54	-0.07	0.09	0.87	0.61
	45-44	-0.51	-0.58	-0.60	-0.52	-0.68	-0.14	-0.16	0.78	0.81

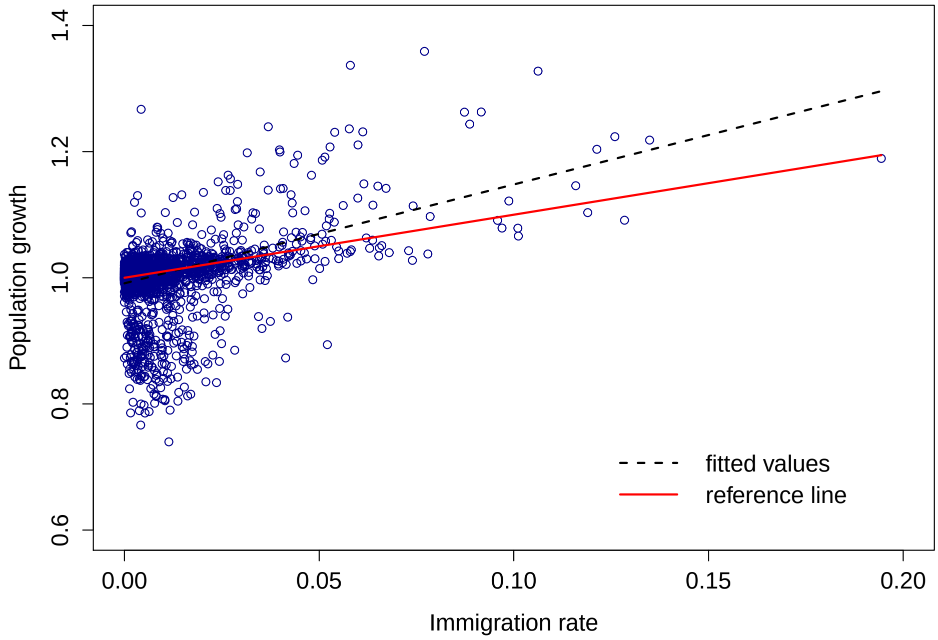
Source: SAR. The two panels refer to total resident population in 2000.

Analysis

In the analysis, the increase in the supply of migrants is represented by the immigration rate, defined as the number of immigrants in a given LAD/qualification/cell over the resident population in the same cell. The response of previous residents to immigration can be gauged by their propensity to enter or tendency to leave the local labour market, which is represented by the in-migration and out-migration rate, respectively, or by the net migration rate. A useful starting point for the analysis can be effectively made by representing the raw correlation between the immigration rate and the net migration of the groups of interest. Using the prediction of the identity 9 and the reduced form 11, a regression of total population growth on r_{jsa} will yield a coefficient of 1 with an intercept of 1 in case immigration does not cause displacement. Figure 2 uses observations for the 374 LADs in England and Wales for all qualification/age groups to compare the case of no off-setting migration with the fitted values derived from the simplest version of equation 11. Regressions use the populations in each LAD as weights. The resulting coefficient is

1.568 (s.e. 0.048), with $R^2 = 0.24$; for the un-weighted OLS, these values are somewhat smaller (1.314, s.e. 0.055 and $R^2 = 0.14$). It can be seen that even at levels with relatively large immigration, there is no evidence of a negative effect.
These patterns are, however, aggregate; hence it is useful to consider the effects of immigration flows on the groups of natives and earlier immigrants. Figure 3 represents scatter plots of net internal migration of these two groups against the immigration rate[11].

Figure 2: Total population growth and immigration, weighted estimates, all groups

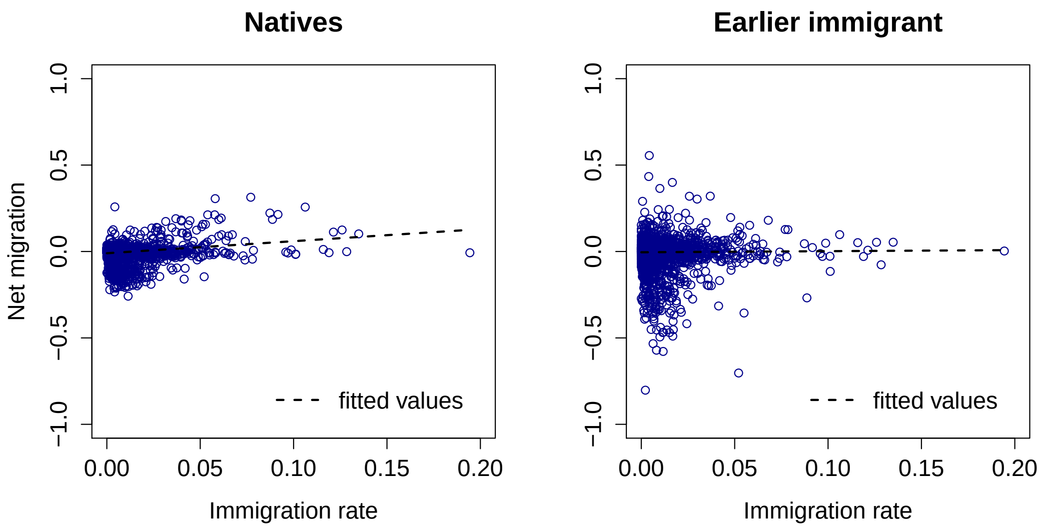


Estimation Results

The present sub-section contains the results of the estimation of the model in equation 11 for a series of alternative specifications. Robustness checks are carried out in the next section.
The first two columns of Table 4 contain the estimates for the cases of standard and weighted OLS, where the weights are represented by the size of the population in each LAD. All migration rates for natives are significant at the 1 per cent level. In-migration rates are high, implying that for every new immigrant, nearly 3 natives enter the same LAD; out-migration rates, although high, are just above 2. As a consequence, the estimated coefficient for net migration, which is roughly the difference between the in-migration and the out-migration coefficients, is significantly positive. In-migration rates

[11]The graph for earlier immigrants does not show one obvious outlier. Regression has been performed with and without this observation, and results are identical

Figure 3: Net internal migration and immigration, weighted estimates, all groups



for earlier immigrants are very similar to those for natives; however, out-migration rates are much larger, with nearly 3 persons leaving for every new immigrant entering the local labour market. This yields an estimate for net migration that is essentially zero, although the sign of the estimate is sensitive to the type of weights used. The last row reports the value for population growth; the weighted estimate corresponds to the dotted line in Figure 2. Throughout the paper, results are presented for weighted regressions; weighting helps adjusting for the inhomogeneous sizes of LADs and yields better fits, although the pattern of the results is generally similar to the case of standard OLS.

The relatively large figures for in-migration and out-migration, however, could be induced by the correlation between LAD/qualification/age specific shocks and immigration, hence creating issues of endogeneity. As an example, an outward shift in the demand for certain skills in a LAD will attract both immigrants and previous residents, hence creating upward bias in the estimates of in-migration. As discussed in the previous section, the endogeneity bias can be reduced by instrumenting the current immigration with a flow measure that is independent of current economic conditions.

Specifications (c) and (d) in Table 4 include two different instrumental variables. In (d), the instrument is derived by combining information on the shares of foreign-born population in 1991 by countries of birth (which corresponds to R_b in 10), the share of new immigrants from country of birth in each LAD (γ_{jb}) and the countrywide proportion of immigrants from a given country of birth allocated to each qualification/age group (θ_{sab})[12]. A comparison between specifications (c) and (d) reveals that the instrumental variable substantially reduces the estimates, especially those of in-migration. For natives the coefficient of net migration is larger than that in column (c); for earlier immigrants

[12]The countries of birth considered are: Eastern Europe, Western Europe, Africa, South Asia, Rest of Asia and Other countries. This classification allows a perfect match between 1991 and 2001 Censuses.

the value is positive too, but the standard error is too large to make it significant.

Instruments such as in (d) are widely used in the migration literature. Specification (e)

Table 4: Impact of immigration on internal migration

	(a)	(b)	(c)	(d)	(e)	(f)
Natives						
In-migration	2.513***	2.891***	2.163***	0.828***	0.516***	0.583***
	(0.067)	(0.067)	(0.068)	(0.125)	(0.133)	(0.160)
Out–migration	2.101***	2.195***	0.034	–0.218**	–0.129	–0.147
	(0.085)	(0.073)	(0.041)	(0.071)	(0.073)	(0.084)
Net-migration	0.412***	0.697***	2.129***	1.047***	0.645***	0.731***
	(0.055)	(0.049)	(0.074)	(0.133)	(0.141)	(0.159)
N	3366	3366	3366	3366	3366	2130
Earlier immigrants						
In-migration	2.677***	2.758***	1.567***	1.018*	0.880*	1.630***
	(0.151)	(0.153)	(0.237)	(0.412)	(0.425)	(0.195)
Out–migration	2.871***	2.696***	0.117	0.694***	0.942***	1.927***
	(0.135)	(0.110)	(0.114)	(0.198)	(0.205)	(0.185)
Net-migration	–0.194	0.063	1.450***	0.324	–0.061	–0.298
	(0.155)	(0.149)	(0.240)	(0.418)	(0.433)	(0.189)
N	3366	3366	3366	3366	3366	1045
Population growth	1.314***	1.568***	2.931***	1.799***	1.419***	1.476***
	(0.055)	(0.048)	(0.072)	(0.130)	(0.138)	(0.135)
N	3366	3366	3366	3366	3366	2841
OLS/IV	OLS	OLS	OLS	IV	IV	IV
Fixed effects	N	N	Y	Y	Y	Y
Weights	N	Y	Y	Y	Y	Y
Controls	N	N	N	N	N	N

Standard errors in parentheses. *** significant at 0.1%; ** significant at 1%; * significant at 5%. The reported coefficient refers to the immigration rate. Models (b) to (e) are weighted by the population in each LAD. Model (d) is instrumented by historical settlements of foreign-born by country of birth; models (e) and (f) by historical settlements of foreign-born by ethnic group. Controls included in (f) are logs of: unemployment rate, share of non-white population, percentage of Council house and fraction of women for both native and earlier immigrants group and the share of foreign-born population common to the two groups.

proposes another instrument, which is constructed by using information on ethnicity of immigrants. This is thought to be a refinement of (d) due to the close relationship, in England and Wales, between immigration and existing enclaves of the same ethnic group (Stillwell and Duke-Williams, 2005). The variable is derived in the same fashion as in (d), with the difference that b represents the ethnic group; R_b thus indicates the stock of population in 1991 that belongs to each ethnic group, γ_{jb} the proportion of recent foreign-born immigrants in ethnic group b and θ_{sab} the distribution by ethnic group and skill[13]. Table 5 reports the results from the first stage regression for net internal migration for

[13]The ethnic groups considered are: White, Black, South Asian and Chinese and Other. The use of broad classes is dictated by the fact that ethnic groups are only partially comparable between 1991 and 2001, since the ethnic classification experienced major changes.

both instruments. The estimation refers to the full specification (i.e. model (f) in Table 4). The table also contains the partial R^2 and the F-test for instrument weakness.

Table 5: First stage regression of IV estimation

	Country of birth		**Ethnic group**	
	Natives	Earlier imm.	Natives	Earlier imm.
β	0.635***	0.565***	0.647***	0.580***
se_β	(0.020)	(0.028)	(0.021)	(0.030)
N	2130	1045	2130	1045
partial R^2	0.364	0.355	0.344	0.333
F-stat	998.91	407.39	918.70	377.90

Standard errors in parentheses. *** significant at 0.1%; ** significant at 1%; * significant at 5%. The reported coefficient refers to the first stage regression of historical settlement of foreign-born by country of birth and historical settlements of foreign-born by ethnicity, respectively. All regressions are weighted by the population in each LAD and include fixed LAD, qualification and age effects.

As can be seen, the predictive power of the two instruments is substantially similar. This translates into minor changes in the estimates. In general the use of the ethnic group instrument yields lower estimates for the in-migration rates and thus it better controls for the upward bias caused by endogeneity. Although the analysis has been carried out using both instruments, only results based on the ethnic group instrument are reported, as this is usually associated with lower estimates for net migration.

The final column of Table 4 adds to specification (e) a vector of covariates that aims at controlling for observable group-specific characteristics in each LAD/qualification/age cell. These variables are similar to those used in previous studies such as Card (2001) and Stillman and Maré (2007); they are obtained from CAMS data and include unemployment rate, share of non-white population, percentage of females for both natives and earlier immigrants and the percentage of foreign-born, which has the same value for both natives and earlier immigrants. As a further control, and adding to previous literature, the proportion of Council houses in each cell has been added, in order to control for shocks associated with the housing market. Inspection of the results in column (f) suggests that these variables are important in explaining migration patterns and have a substantial impact on the estimates. The coefficients of in-migration and out-migration for natives are much smaller, but the coefficient of net migration is still significantly positive. This fact suggests that this group is not adversely affected by immigration; instead there appears to be a pattern of complementarity, since natives and immigrants move to the same locations. This finding is reinforced by the fact that earlier cohorts of foreign-born are displaced by recent immigrants, as demonstrated by the now significantly negative coefficient for net migration. This result implies that, on average, for every ten immigrants that enter a given LAD/qualification/age cell, roughly four natives are added to the population of each LAD, while about three earlier immigrants leave.

To investigate these findings in more depth, Table 6 presents a set of models that can be considered "restrictions" of the full specification contained in column (f) of Table 4. The first column confines the analysis to the 250 most populous LADs. The aim is to prevent the results in Table 4 being affected by the measurement error associated with the added covariates, since these might contain some noise due to small cell size.

Table 6: Impact of immigration on internal migration - cases

	Top 250 pop.lad	Top 150 pop.imm	London boroughs	South England	No/other low qualif.
Natives					
In-migration	0.667***	0.069	0.509	0.407	–0.054
	(0.175)	(0.236)	(0.387)	(0.210)	(0.062)
Out–migration	–0.121	–0.265*	0.067	–0.385***	–0.305***
	(0.091)	(0.123)	(0.142)	(0.111)	(0.045)
Net-migration	0.788***	0.335	0.442	0.791***	0.251***
	(0.174)	(0.234)	(0.344)	(0.215)	(0.056)
N	1660	1075	280	1143	1432
Earlier immigrants					
In-migration	1.619***	1.629***	0.476	0.975***	0.871***
	(0.200)	(0.214)	(0.339)	(0.252)	(0.141)
Out–migration	1.930***	2.211***	0.893***	1.486***	1.345***
	(0.190)	(0.199)	(0.216)	(0.201)	(0.139)
Net-migration	–0.311	–0.582**	–0.417	–0.511*	–0.475**
	(0.195)	(0.202)	(0.267)	(0.229)	(0.156)
N	947	763	277	633	702
Population growth	1.544***	0.887***	1.185***	1.584***	1.067***
	(0.156)	(0.216)	(0.308)	(0.178)	(0.055)
N	2092	1288	288	1510	1902

Standard errors in parentheses. *** significant at 0.1%; ** significant at 1%; * significant at 5%. The reported coefficient refers to the immigration rate instrumented by historical settlements of foreign-born by ethnic group. All models are weighted by the population in each LAD and include fixed LAD, qualification and age effects, and the control variables as in Table 4 column (f). South England comprises East of England, South East, South West and London.

As can be seen, results are very similar to those in the last column of Table 4. The second column focuses on the top 150 destinations for immigrants. These include 87 per cent of new immigrants, 82 per cent of earlier immigrants and 55 per cent of native population. Migration rates for natives are still sensitive to immigration, but the standard error is too large to reject the null hypothesis of no effect. On the other hand, the impact on earlier immigrants is consistent with previous specifications and displacement is larger and significant. Similar values and signs of the estimates appear for the case of London, although results are not significant. The fourth column contains a further geographical restriction to the South of England, an area with relatively high immigration rates. For natives, the estimates for in-migration and out-migration are similar to the benchmark case in Table 4; for earlier immigrants, the estimates for in-migration are substantially lower, yielding a large significant negative coefficient for net migration. The final column restricts the analysis to the group with no, other or low qualifications. The pooling of two educational groups still allows the use of fixed effects and hence estimates are directly comparable with previous ones. The coefficient for in-migration of natives is negative, although not economically or statistically significant. The estimate for out-migration is negative too, indicating that the propensity to leave is inversely related to immigration. This yields a value for net migration that is positive, although lower than in the benchmark case. Conversely, for the case of earlier immigrants, displacement is consistently negative and implies that an inflow of ten low-skilled immigrants leads to an outflow of about five earlier immigrants.

Sensitivity analysis

This section addresses potential issues that might affect the estimation. In the first subsection, models in Table 6 are estimated excluding students, hence eliminating the confounding effect generated by individuals that move solely for educational purposes. The second subsection proposes a definition of local labour market based on Travel to Work Areas, which prevents commuting patterns being captured by migration flows. The last subsection reports the estimates using bilateral migration flows (i.e. from LAD to LAD), to control for the presence of origin-destination effects and to analyse intra- and inter-regional flows separately. Finally, an alternative classification of skill groups is introduced by using predicted occupations as in Card (2001). All robustness checks confirm that there is no displacement for natives; on the other hand, results show evidence which confirmed that some groups of earlier immigrants move out from LADs in response to recent immigration.

Controlling for student migration

A substantial fraction of immigrants and internal migrants is constituted by students. Table 7 shows that a large proportion of the flows in each qualification/age cell are still in education, but with differences across groups.

To investigate how student population affects the results, the analysis of the previous section is repeated for the non-student population. Since information on student status is not available in table C0949, flows of non-student migrants are estimated by combining data from the Census and from SAM and SAR microdata. The Appendix describes in detail the algorithm used. Estimation results are presented in Table 8, where results are reported for the case of net migration only. Although derivation of the non-student pop-

Table 7: Percentage of students for different groups

		Immigrants	Internal immigrants		Net migration	
			Natives	Earlier immigrants	Natives	Earlier immigrants
Qualification	**Age**					
No/other qualif.						
	16-24	47.0	23.2	39.4	45.9	37.1
	25-44	15.8	1.2	6.2	1.0	3.0
	45-64	4.3	0.6	1.2	0.2	0.4
Low qualif.						
	16-24	58.3	24.7	46.3	38.2	55.9
	25-44	10.8	1.5	7.5	1.1	3.7
	45-64	6.6	0.8	1.8	0.4	0.8
High qualif.						
	16-24	61.1	53.1	57.7	39.5	58.5
	25-44	21.0	3.7	10.9	2.3	8.0
	45-64	5.7	1.4	2.5	0.6	1.3

Source: CAMS.

ulation is quite an accurate procedure, it could still generate some measurement error; as a consequence, this sensitivity check should be used to compare whether the patterns of Table 6 are corroborated rather than to obtain a point estimate of the parameters of interest.

Estimates for the 250 most populous LADs reveal that the coefficient for natives is larger than that in Table 6; this is also true for earlier immigrants, since the coefficient is now positive, significant at 5%. A similar pattern emerges from inspection of the results for the 150 top immigrant LADs. The case of London is rather interesting: for natives, as in Table 6, the impact of immigration on net internal migration is positive but insignificant; in contrast, for earlier immigrants the impact is now statistically significant, with a magnitude of about 0.70.

The coefficients for the South Regions confirm the results of Table 6, although only in the case of natives is the relationship significant. Finally, for the group of no/other or low qualifications, the coefficient is positive (although small) for natives, while it is negative (although smaller than that in Table 6) for earlier immigrants. The conclusion is that inferences in Table 8 are very similar to those presented in Table 6.

An alternative definition of local labour market

A potential drawback with the use of migration data at LAD level is that movements between LADs could capture a change in the current residence rather than a movement to a new labour market. As an example, one person could decide to move from a LAD inside London to a peripheral LAD, where house prices are lower, but continue to work in central London, commuting each day. In this case, migration flows between LADs will

Table 8: Impact of immigration on internal migration - excluding students

	Top 250 pop.lad	Top 150 pop.imm	London boroughs	South England	No/other low qualif.
Natives					
Net-migration	1.200***	1.313***	0.355	0.909***	0.120*
	(0.122)	(0.152)	(0.281)	(0.157)	(0.052)
N	1508	1003	278	1037	1255
Earlier immigrants					
Net-migration	0.266	0.332*	–0.689**	–0.309	–0.327**
	(0.156)	(0.166)	(0.247)	(0.186)	(0.124)
N	861	692	264	575	637

Standard errors in parentheses. *** significant at 0.1%; ** significant at 1%; * significant at 5%. Dependent variable is the net migration rate of respective groups. The reported coefficient refers to the immigration rate instrumented by historical settlements of foreign-born by ethnic group. All models are weighted by the population in each LAD and include fixed effects, and the control variables as in Table 4 column (f). South England comprises East of England, South East, South West and London.

overestimate the flows out of London. A solution is to use self-contained labour markets, i.e. areas where commuters live and work. UK Government Office Regions match this definition, but perhaps in too broad a sense, since there are plenty of sub-regional labour markets within them. In addition, self-containment at regional level is problematic when considering areas such as the East of England and the South East, where commuting to London may hinder an exact delineation[14] Perhaps the natural size of a local labour market stands between LADs and regions. Acknowledging this fact, ONS has derived a geography, the Travel to Work Areas (TTWA) which correspond to self-contained labour markets. These are constructed by aggregating Lower Super Output Areas (areas with $1,500$ people on average) using commuting data from the 2001 Census. The criteria to define a TTWA include supply- and demand-side self-containment, which correspond, respectively, to the percentage of employed residents working in the same area and the percentage of jobs that go to local residents[15] There are 186 TTWA in England and Wales and, similarly to LADs, these are not homogenous. Perhaps the most striking case is London, which is considered as a single TTWA. The advantage of using TTWAs is that they give quite a precise approximation of the local labour market; the disadvantage is that their boundaries intersect those of LADs, at which level most of the statistics are collected[16].

To test the sensitivity of the results, the models in Table 6 are estimated using a cus-

[14]See:http://www.statistics.gov.uk/about/methodology_by_theme/labour_market/sub_nat_lmissues.asp.

[15]In a "commuting" migration matrix, where "origins" consists of the residence of individual and the "destinations" are their workplace, the supply-side self-containment is the ratio of the diagonal elements to row sum while the demand-side self-containment is the ratio of the diagonal elements to column sum. A description of the procedure can be found at: http://www.statistics.gov.uk/geography/ttwa.asp.

[16]Only recently has ONS started to release labour market indicators also at TTWA level.

tomised definition of TTWA, henceforth referred as to TTWAD. These correspond to TTWAs with boundaries that are adjusted to fully encompass one or more local authorities. This geography is constructed by matching the 374 LADs with the 186 TTWAs using the employed population in each LSOAs as weight[17]. Each LADs is divided into shares of employed population to each TTWAs: the largest share determines the pertinence of the LAD to the TTWA[18]. The final TTWAD geography consists of 162 areas, since 26 are cancelled out due to the fact that they are formed by small fractions of LADs. The conversion is likely to generate some measurement errors, most of which accrue to those LADs that belong to two or more TTWAs, since it is not possible to distinguish which part of migration within or between a LAD corresponds to migration between or within a TTWA. This problem does not exist for LADs completely encompassed by TTWA boundaries. With this caveat in mind, a measure of the efficacy of the conversion algorithm is obtained by analysing the change in the measure of self-containment achieved by using TTWADs rather than LADs. Self-containment for LADs and TTWADs is calculated using commuting data from the 2001 Census. The supply-side self-containment across the 374 LADs is 60 per cent, while the demand-side self-containment is 65 per cent. The TTWAD geography reaches a value of about 76 per cent and 79 per cent, respectively[19]. Although this value mechanically increases with fewer areas considered, this derived geography represents local labour markets well if one considers that supply- and demand-side self-containment for the ONS' TTWAs are 77 per cent and 81 per cent, respectively. Hence TTWADs appropriately approximate the current official definition of local labour market. As a further refinement, one of the specifications is restricted to a subsample of TTWADs formed by LADs with an average value of inclusion of 50 per cent. Finally, covariates at LAD level have been aggregated to TTWAD by summing the values in levels and deriving weighted averages for rates, with weights represented by the populations in 2000. Table 9 contains the results of the estimation using TTWADs. From the estimates in the first three columns, it can be seen that the coefficients are much larger than in Table 6. Although part of this fact could be attributed to the measurement error related to the definition of TTWAD, larger estimated effects are expected when considering a larger area, as noted by Sparber and Peri (2007).

According to these findings, for every new immigrant that enters the TTWAD, more than one native is added to the population. The coefficients for earlier immigrants are significantly positive, although much smaller than those of natives. In the case of individuals with no/other or low qualifications, however, the negative impact is remarkably

[17]Employed population excludes full-time students. Using other weights, such as total population or labour force yields exactly the same TTWAD geography.

[18]There are only 13 cases with LAD shares under 50 per cent attributed to a TTWAD.

[19]The results do not change when TTWAD are derived using total population rather than employed population.

larger than that in Table 6. This result is substantially unchanged when only TTWADs that are good overlaps of LADs are considered. These findings confirm that there is no displacement effect for natives, although the estimates are somewhat larger than those in Table 6. For the case of earlier immigrants, evidence of displacement is confirmed only for the group with lowest skills, with a coefficient that is about three times larger.

Place-to-place migration

So far, the analysis has used destination- and origin- specific flows. Each of these flows can be decomposed into bilateral migrations between LADs so that it is possible to relate the net migration flows between two LADs with their difference in the immigration rates. The advantage of segmenting flows in such a fashion is that it enables controlling for origin-destination fixed effects, allowing for a further robustness check of the estimates in Table 6. These fixed effects capture the connectivity existing between two specific LADs that is generated by the existence of similar economic conditions or by the presence of social networks that link them. Equation 11 can be rewritten as follows:

$$g^i_{jsa} = \beta r^i_{jsa} + \mathbf{Z}^i_{jsa}\boldsymbol{\chi} + \tau^i_j + \tau_s + \tau_a + \tau_{sa} + \upsilon^i_{jsa} \tag{13}$$

Where g^i_{jsa} represents the net migration rate between LAD j and i (i.e. flows from i to j minus flows from j to i divided by half the total population of i and j) in each qualification/age cell; r^i_{jsa} is the net immigration rate (i.e. immigration rate in j minus immigration rate in i); the matrix $\mathbf{Z}^i_{jsa}$ contains differences in the covariates (expressed in logs); origin-destination fixed effects are captured by τ^i_j, which correspond to a set of dummies for each pair of bilateral flows. Table 10 reports the results of the estimation of

Table 9: Impact of immigration on internal migration - travel to work areas

	Top 250 pop.lad	Top 150 imm. LAD	South England	No/other, low qualif.	50% self contained
Natives					
Net-migration	1.995***	1.823***	2.659***	0.346***	0.306***
	(0.150)	(0.230)	(0.224)	(0.060)	(0.072)
N	745	415	485	705	462
Earlier immigrants					
Net-migration	0.670***	0.681**	1.134***	–1.471***	–1.489***
	(0.189)	(0.241)	(0.332)	(0.318)	(0.383)
N	484	321	302	436	313

Standard errors in parentheses. *** significant at 0.1%; ** significant at 1%; * significant at 5%. Dependent variable is the net migration rate of respective groups. The reported coefficient refers to the immigration rate instrumented by historical settlements of foreign-born by ethnic group. All models are weighted by the population in each TTWAD and include fixed effects and the control variables as in Table 4. South England comprises East of England, South East, South West and London.

equation 13 for all models of Table 6. The reported coefficients are smaller in magnitude because, as discussed in Hatton and Tani (2005), when estimating bilateral net migration flows, the displacement effect is spread across all other LADs. In the first column, the coefficient for natives is positive and significant, consistent with the estimations carried out in the previous subsections. The coefficient for earlier immigrants is negative and significant. For the case of 150 top immigrant LADs, results are in line with those of Table 6. For the case of London, the pattern is again similar to the baseline estimation, with the effect for natives being essentially zero, while for earlier immigrants there is evidence of displacement, with quite a substantial impact. The results for the South England are consistent with those in Table 6. Another important advantage of using origin-destination flows is that it allows separating between intra- and inter-regional flows. For the estimates of low-skilled, coefficients are reported for migrations within and between regions. The impact on natives is essentially zero, while for earlier immigrants there is a substantial negative effect, consistent with all models previously estimated. Interestingly, the impact for migrants within the region is larger than that between regions. This suggests that the effect of immigration on the local labour market can be substantially different between and within regions. Studies that use regional data usually ignore this difference.

Table 10: Impact of immigration on internal migration - LAD to LAD flows

	Top 250 pop.lad	Top 150 imm. LAD	London boroughs	South England	No/other, low qual. intra-reg	inter-reg
Natives						
Net-migration	0.002	0.004	–0.003	0.003	0.000	0.001
	(0.001)	(0.002)	(0.004)	(0.001)	(0.002)	(0.001)
N	81904	38975	3407	45080	14198	58304
Earlier immigrants						
Net-migration	–0.008**	–0.009**	–0.015*	–0.008*	–0.019**	–0.014*
	(0.003)	(0.003)	(0.006)	(0.004)	(0.006)	(0.007)
N	15723	13086	3250	9823	3022	5530

Standard errors in parentheses. *** significant at 0.1%; ** significant at 1%; * significant at 5%. Dependent variable is the net migration rate of respective groups. The reported coefficient refers to the differential in immigration rates between LADs instrumented by the differential in historical settlements of foreign-born by ethnic group. All models are weighted by the average population of LAD pairs and include fixed origin-destination, qualification and age effects, and control variables as in Table 4 (in differences). South England comprises East of England, South East, South West and London.

Predicted occupations

To test the sensitivity of the results to the particular type of skill groups used, in this subsection an alternative classification using predicted occupations is proposed. Occupations are derived following the procedure described in Card (2001); this consists of estimating a multinomial logit model where the probability of being in an occupation is modelled using micro-level data. The rationale of using predicted and not effective occupations is that individuals might shift to a new occupations (also) in response to immigration.

In order to derive predicted occupation groups, detailed data from CAMS at LAD level have been accessed. Probabilities are modelled for all the groups of interest (non-movers, internal migrants and recent immigrants) using information about age, sex, school qualification, ethnic group, country of birth and a dummy for residing in London. Table 11 reports the estimates for net migration of all models in Table 6.

Table 11: Impact of immigration on internal migration - predicted occupations

	Top 250 pop.lad	Top 150 pop.imm	London boroughs	South England	Low qualif. occup.
Natives					
Net-migration	0.639***	0.719*	2.090	1.825***	0.360*
	(0.179)	(0.343)	(1.096)	(0.471)	(0.165)
N	1815	1178	287	1269	1008
Earlier immigrants					
Net-migration	–0.976	–0.921	–1.617*	–3.830*	–0.298
	(0.644)	(0.699)	(0.699)	(1.871)	(0.583)
N	865	715	278	598	441

Standard errors in parentheses. *** significant at 0.1%; ** significant at 1%; * significant at 5%. Dependent variable is the net migration rate of respective groups. The reported coefficient refers to the immigration rate instrumented by historical settlements of foreign-born by ethnic group. All models are weighted by the population in each LAD and include fixed LAD and occupation effects and the control variables as in Table 4. Low qualification occupations are: personal service occupations; sales and customer service occupations; process, plant and machine operatives; elementary occupations. South England comprises East of England, South East, South West and London.

Results substantially confirm the empirical evidence contained in Table 6, although the estimated coefficients are not directly comparable. In particular, it should be noted that the estimated coefficients and their standard errors are larger than those in Table 6, resulting in a lower precision of the estimates. For all the models of UK-born individuals the coefficient is positive; for the model of 250 most populous LADs the estimates are close to those of Table 6, while, for the model that refers to South England, the coefficient is rather large. This is somewhat mirrored in the large negative estimate for earlier immigrants. Although the remaining estimates for earlier immigrants are not statistically significant (most of them are at the borderline of 10% significance level), the pattern across models is very similar to that of Table 6.

Reconciling the empirical evidence on displacement

The results of the empirical analysis are conclusive of the fact that immigration does not induce displacement of native population. In high immigration areas such as London and the South of England, as well as for individuals with lower skills, the effect on native population is, at most, close to zero. This evidence clashes with the empirical findings of previous studies such as Hatton and Tani (2005), which found significant displacement effects. In this section, the two different approaches are compared; the conclusion is that the use of data with information about skills of migrants yields completely different results.

Hatton and Tani (2005) report a displacement of 30 to 35 of previous residents for every 100 new (net) immigrants; this figure increases and becomes significant (to about 50) for the case of 6 Southern Regions. In their paper they use regional migration data from 1982 to 2000 extracted from NHSCR and IPS, which only report flows by age and sex. Will analysis containing information on skill level produce different results? To answer the question, in Table 12 some of the models previously estimated have been estimated with and without information on qualification and age. Although this analysis is only partially comparable with Hatton and Tani (2005) and is based on a very small number of observations, the resemblance to their findings is striking[20].

Table 12: Impact of immigration on internal migration - regional level

	No skill breakdown		Qualification and age		No/other, low qualif.	
	All regions	6 regions	All regions	6 regions	Natives	Earlier imm.
Net-migration	–0.340*	–0.442	1.747***	2.241***	0.407**	–0.798
	(0.146)	(0.175)	(0.303)	(0.426)	(0.127)	(0.647)
N	10	6	90	54	60	60

Standard errors in parentheses. *** significant at 0.1%; ** significant at 1%; * significant at 5%. Dependent variable is the net migration rate of respective groups. The reported coefficient refers to the immigration rate instrumented by historical settlements of foreign-born by ethnic group. All models are weighted by the average population of LAD; models in the last four columns include fixed LAD qualifcation and age fixed effects. The six regions refer to the Southern Regions defined by Hatton and Tani (2005), i.e. West Midlands, East Midlands, East of England, South East, South West and London.

The first two columns show that a regression of net migration on immigration rate across nine regions yields a slope of −0.340 (s.e.0.146) for the 9 regions (−0.442 (s.e.0.175) [21]. Consistent with the findings of Hatton and Tani (2005), displacement is larger in the Southern Regions. The next two columns report the results of the same regressions when

[20] The immigration variable in Hatton and Tani (2005) is constituted by net immigration, i.e. excluding emigration and includes all UK regions.

[21] Due to limited degrees of freedom of the first two columns, control variables cannot be used and they are hence excluded to keep results comparable across the different specifications.

flows are segmented by qualification and age. The results are very different: there is evidence that, for every 10 immigrants, more than 17 previous residents move in the same region/qualification/age cell. Interestingly, this positive effect is even larger when the 6 Southern Regions are considered.
To better compare these results with those in Table 6, the last two columns report the estimates for the groups with no or low qualifications, for both natives and earlier immigrants. It can be seen that the estimates are consistent with the general findings of the paper, although the magnitude of the coefficients is somewhat different and the estimates for earlier immigrants are not significant. One potential explanation for this fact is that migrations within regions are ignored.

Conclusions

The impact of immigration on internal movements of natives and foreign-born persons in England and Wales has been analysed. Immigration might cause downward pressures on wages and employment and thus displace previous residents from their local labour market. This mechanism has been described through a model that stratifies each local authority district into qualification and age cells, where immigrants and natives are imperfect substitutes. The model predicts that pressures to leave an area will be larger when the total effect of migration - transmitted within and between skill groups - is larger. Adverse effects of immigration are more likely to affect those groups with similar skill distribution, such as earlier immigrants.
Using confidential detailed 2001 Census data available only under special conditions, the displacement hypothesis has been tested through an econometric model that relates internal migration measures such as out-migration, in-migration and net-migration to the relative immigrant flows in each LAD/qualification/age cell. The main findings are that an increase in immigration does not lead to an outflow of natives from the local labour market. Natives and immigrants are instead attracted to the same areas, and this substantiates their complementarity in production. This is further corroborated by evidence of displacement for earlier immigrants, especially for individuals with no or low qualifications.
The findings of this study are similar to those that have tested the displacement hypothesis in other countries. Comparability with the findings of USA studies such as Card (2001) is somewhat problematic because of the different composition of immigrants. Results could be compared with the study of Stillman and Maré (2007) about New Zealand, since recent immigration is mainly composed of young educated individuals. The evidence of displacement effect for earlier immigrants is unique to this study. Previous literature either did not find negative effect (Card, 2001; Stillman and Maré, 2007) or

did not analyse the effect on foreign-born persons (Borjas, 2003; Hatton and Tani, 2005). The findings contained in this paper are of particular interest for the case of England and Wales. It is well known that immigrants and earlier immigrants move to similar areas because they share the same social networks (Stillwell and Duke-Williams, 2005). On the other hand, competition triggered by increased immigration and imperfect substitution leads to higher pressures on wages (Manacorda et al., 2008). Especially for the group of low-skilled migrants, the second effect seems to prevail, forcing them to migrate out of the labour market; the exact dynamics, however, remain unknown and require further research.

It is important to emphasize that the findings of this study are limited to a particular period, which corresponds to the last Census of England and Wales. When detailed data about recent migration from Eastern Europe becomes available, further research will be needed to understand if and how the dynamics of the labour markets have changed. A substantial change in the skill composition of new immigrants might affect the competition pressures in the local labour market. The total effect depends on the extent to which such change might alter the skill composition of earlier immigrants and native population. If the economy has sufficiently flexible labour markets, this impact is thought to be indiscernible in the long run, but it could create inbalances in the short run.

To conclude, the substantial contribution of this paper has been to highlight the importance of analysing migration patterns using a fine definition of local labour market and differentiating between types of workers. Using detailed data that are appropriate to the theory under discussion is a suitable starting point for investigating the equilibrating mechanism of local labour markets in response to heterogeneous immigration, and futures studies should take this into account.

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Appendix

a) *Derivation of equation 1*

Profit maximisation is expressed by:

$$\max_{L_{jsak}} \pi_j = q_j Y_j - \sum_{sak} w_{jsak} L_{jsak}$$

The F.O.C for each of the L_{jsak} inputs are:

$$\begin{aligned} q_j \frac{\partial Y_j}{\partial L_j} \left\{ \frac{\rho}{\rho - 1} \left(\sum_s \nu_{js} L_{js}^{\frac{\rho}{\rho-1}} \right)^{\frac{1}{\rho-1}} \frac{\rho - 1}{\rho} L_{js}^{\frac{1}{\rho}} \nu_{js} \right\} & \times \\ \left\{ \frac{\delta}{\delta - 1} \left(\sum_a \lambda_{sa} L_{sa}^{\frac{\delta}{\delta-1}} \right)^{\frac{1}{\delta-1}} \frac{\delta - 1}{\delta} L_{jsa}^{\frac{1}{\delta}} \lambda_{sa} \right\} & \times \\ \left\{ \frac{\eta}{\eta - 1} \left(\sum_k \psi_{jsak} L_{jsak}^{\frac{\eta}{\eta-1}} \right)^{\frac{1}{\eta-1}} \frac{\eta - 1}{\eta} L_{jsak}^{\frac{1}{\eta}} \psi_{jsak} \right\} & = \quad w_{jsak} \end{aligned}$$

Taking logarithms of both sides of the equation yields:

$$\ln w_{jsak} = \ln\left(q_j \frac{\partial Y_j}{\partial L_j} \right) + \frac{1}{\rho} \ln L_j + \left(\frac{1}{\delta} - \frac{1}{\rho} \right) \ln L_{js} + \left(\frac{1}{\eta} - \frac{1}{\delta} \right) \ln L_{jsa} - \frac{1}{\eta} \ln L_{jsak} + \kappa$$

where, $\kappa = \ln \nu_{js} + \ln \lambda_{sa} + \ln \psi_{jsak}$ and q_j is the price of the output in each LAD.

b) *Derivation of effects of immigration on wages and employment*

This expression is derived for equation 6, but the argument applies to equations 5 to 8. Consider equation 4:

$$\ln \frac{L_{jsak}}{P_{jsak}} = \frac{\epsilon\eta}{\epsilon + \eta} \left\{ \ln\left(q_j \frac{\partial Y_j}{\partial L_j} \right) + \frac{1}{\rho} \ln L_j + \left(\frac{1}{\delta} - \frac{1}{\rho} \right) \ln L_{js} + \left(\frac{1}{\eta} - \frac{1}{\delta} \right) \ln L_{jsa} + \kappa \right\} - \frac{\epsilon}{\epsilon + \eta} \ln P_{jsak}$$

Derivation w.r. to $\ln P_{jsaM}$ yields:

$$\frac{d \ln(\frac{L_{jsaN}}{P_{jsaN}})}{d \ln P_{jsaM}} = \frac{\epsilon\eta}{\epsilon + \eta} \left\{ \frac{1}{\rho} \frac{\partial \ln L_j}{\partial \ln P_{jsaM}} + \left(\frac{1}{\delta} - \frac{1}{\rho} \right) \frac{\partial \ln L_{js}}{\partial \ln P_{jsaM}} + \left(\frac{1}{\eta} - \frac{1}{\delta} \right) \frac{\partial \ln L_{jsa}}{\partial \ln P_{jsaM}} \right\}$$

where $\frac{\partial \ln L_j}{\partial \ln P_{jsaM}} = \underbrace{\frac{\partial \ln L_j}{\partial \ln L_{js}}}_{+} \underbrace{\frac{\partial \ln L_{js}}{\partial \ln L_{jsa}}}_{+} \frac{\partial \ln L_{jsa}}{\partial \ln P_{jsaM}}$ and $\frac{\partial \ln L_{js}}{\partial \ln P_{jsaM}} = \underbrace{\frac{\partial \ln L_{js}}{\partial \ln L_{jsa}}}_{+} \frac{\partial \ln L_{jsa}}{\partial \ln P_{jsaM}}$.

The partials $\frac{\partial \ln L_{()}}{\partial \ln L_{(\cdot)}}$ are all positive, as they are nested production functions increasing in their input. Positivity of $\frac{\partial \ln L_{jsa}}{\partial \ln P_{jsaM}}$ is found by using the labour supply:

$$\begin{aligned}
L_{jsaN} &= w^{\epsilon}_{jsaN} P_{jsaN} \\
L_{jsaM} &= w^{\epsilon}_{jsaM} P_{jsaM} \\
L_{jsaN} + L_{jsaM} &= w^{\epsilon}_{jsaN} P_{jsaN} + w^{\epsilon}_{jsaM} P_{jsaM} \\
L_{jsa} &= w^{\epsilon}_{jsaN} P_{jsaN} + w^{\epsilon}_{jsaM} P_{jsaM} \\
\frac{\partial L_{jsa}}{\partial P_{jsaM}} &= w^{\epsilon}_{jsaM} > 0 \\
\frac{\partial \ln L_{jsa}}{\partial \ln P_{jsaM}} &= \frac{\partial L_{jsa}}{\partial P_{jsaM}} \frac{P_{jsaM}}{L_{jsa}} > 0
\end{aligned}$$

c) *Estimation of population and flows without students*

Models are estimated using Iterative Proportional Fitting (IPF). Students population is the unknown object, indicated by $DSACX$, which is a cross-tabulation between LAD (D), qualification (S), age (A), country of birth (C) and student status (X). Available Census data from Table C0949 and MG105 are $DSAC$ and DX; interactions from SAR are SAX, CX an SC. The object of interest can be estimated with a two-step procedure: in the first part, two-way interactions are estimated using Census margins as constraint:

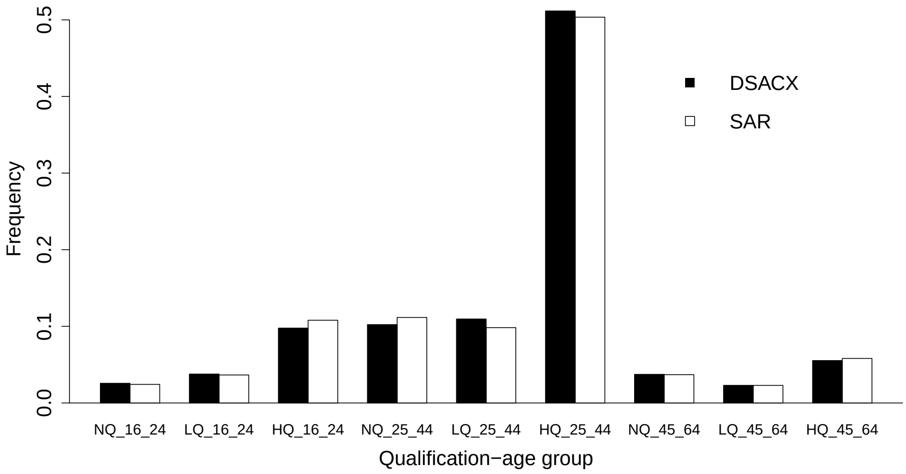
$$\begin{aligned}
\log(\phi^{SAX}_{wyz}) &= \phi^{SA}_{wy} + \phi^{X}_{z} + \log(u^{SAX}_{wyz}) \\
\log(\phi^{CX}_{mz}) &= \phi^{C}_{m} + \phi^{X}_{z} + \log(u^{CX}_{mz}) \\
\log(\phi^{SAC}_{wym}) &= \phi^{SA}_{wy} + \phi^{C}_{m} + \log(u^{SAC}_{wym})
\end{aligned}$$

Where ϕ represents parameters, for which data from Census tables provide sufficient statistics. The terms u are offsets of the model and correspond to association structures borrowed from SAR. The predicted values obtained are used as constraints in the second step.

$$\log(\zeta^{DSACX}_{kwymz}) = \overbrace{\phi^{DSAX}_{kwym}}^{\text{C0949}} + \overbrace{\phi^{DX}_{km}}^{\text{MG105}} + \overbrace{\hat{\phi}^{SAX}_{wyz} + \hat{\phi}^{CX}_{mz} + \hat{\phi}^{SAC}_{wym}}^{\text{Step 1}}$$

This procedure is similar to that developed in Raymer et al. (2008). The precision of the algorithm can be assessed comparing the estimates with the counts from SAR; this comparison is however possible only at regional level. The following graph reports the estimates for $DSACX$ for the non-student foreign-born population in London.

Figure 4: Comparison of IPF estimates and SAR



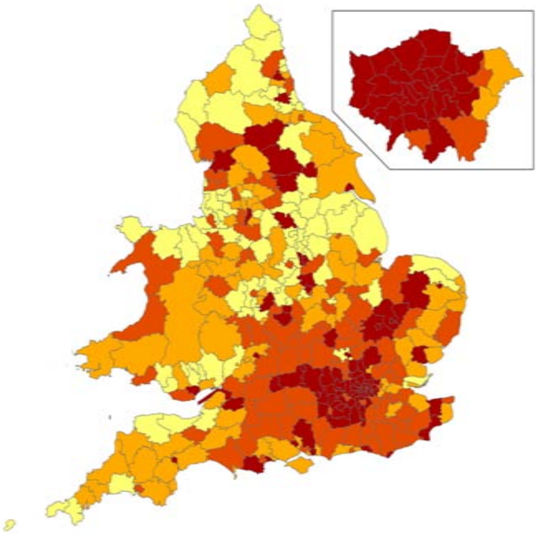
Source: own computations and SAR.

NQ=No, other or unknown qualifications;LQ=Low qualifications;HQ=High qualifications

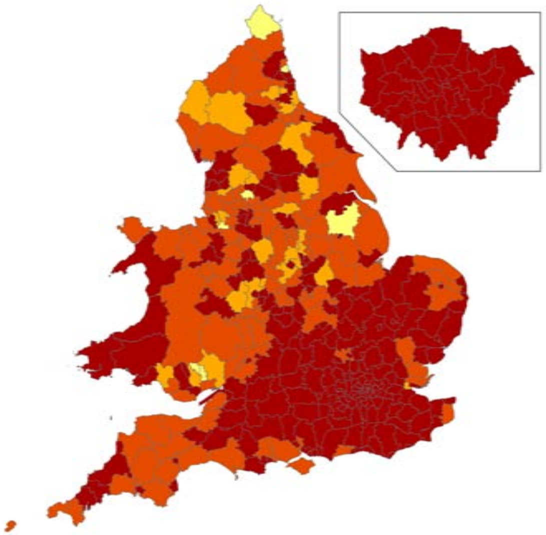
Figure 5: Local authority districts in England and Wales (inset: London)

Digitalised boundaries from UKBorders (http://borders.edina.ac.uk/)

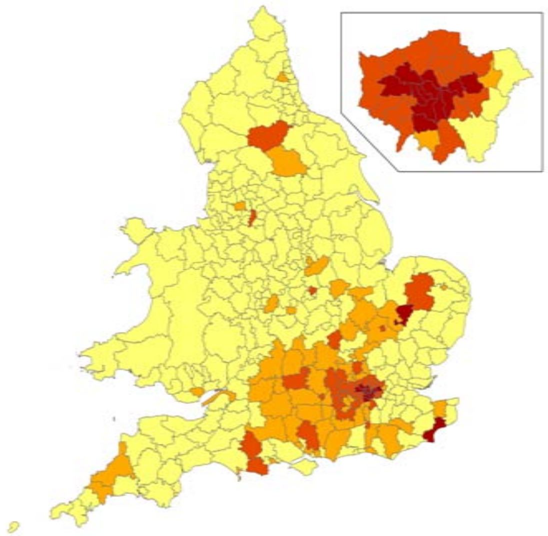
Figure 6: Immigration rates Local Authority Level in England and Wales



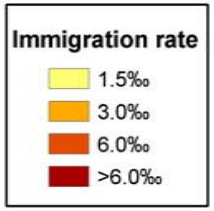
All immigrants



Immigrants with high qualification aged 25-46



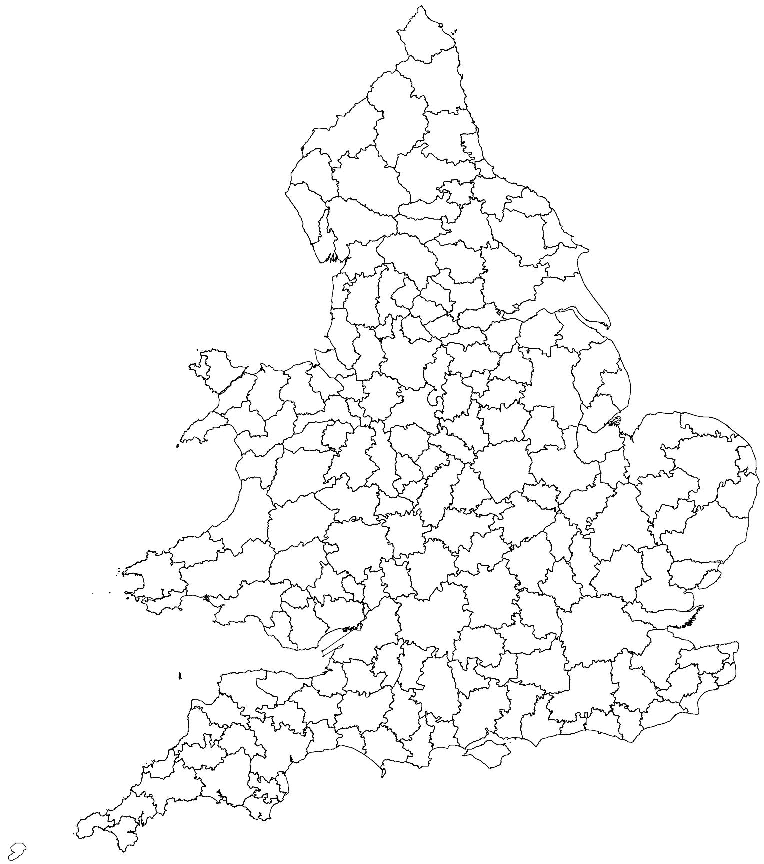
Immigrants with low qualification aged 25-46



The legend refers to the quartiles of immigration rates for all qualification and age groups (i.e. map on the left); inset: London boroughs. Digitalised boundaries from UKBorders (http://borders.edina.ac.uk/)

Figure 7: Travel to Work Areas

Derived Travel to Work Areas (TTWAD)



ONS Travel to Work Areas (TTWA)

Source: http://borders.edina.ac.uk/

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