Immigration and Wages: New Evidence for Britain

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Abstract:

This paper uses 1997-2005 LFS data to study the impact of immigration on natives' wages, and wage distribution. We present a theoretical model where we show that if capital is supplied at a price fixed on international markets, immigration will have on average a positive wage effect, as long as immigrants differ from natives in their skill composition. However, along the distribution of wages, some workers will lose, while others will gain We derive from this model estimating equations that we use for our empirical study. In accordance with theory, we find evidence of overall positive wage effects of immigration. Investigation of the effects of immigration along the distribution of wages of non-immigrant workers suggests that there are clear and significant differences. Natives in the middle of the wage distribution gain from immigration, while natives at the bottom of the distribution lose in terms of wages.

In 2001, the last census year, 4.8m immigrants lived in the UK, which amounts to 8.47 percent of the total population, or 9.75 percent of the working age population. Since then, Britain has experienced a further increase in its foreign born population, and the share of foreign born in the total population in 2005 was 11.5 %.

There are concerns about the effect that this increase in foreign born individuals may have on wages and employment of native workers. Most of the empirical literature on immigration for the US establishes only small employment- and wage effects (see e.g. LaLonde and Topel 1991, Card 2001), although this view is not unanimous (see e.g. Borjas 2003). These findings for the US may not necessarily be transferable to the UK, as the skill structure of immigrants differs between the two countries. Recent work on the British labour market (Dustmann, Fabbri and Preston 2005) points to possible small negative employment effects, in particular for workers in medium skill categories, but no, or positive wage effects. In this paper, we provide new analysis of wage effects of immigration to Britain, using a wider framework of analysis and evaluation than in our earlier work, and concentrating on recent immigration to Britain. Furthermore, we will particularly focus on the effect of immigration on logs of native wages at different percentiles in the wage distribution.

The usual underlying theoretical framework for analysis of immigration on wages and employment is a simple one output economy, with capital and two types of labour (skilled and unskilled) as input factors (see e.g. Altonji and Card 1991). Simplification of this model by assuming that capital supply is perfectly elastic, so that the marginal product of capital is constant (see e.g. Borjas 1999), leads in effect to a simple framework, with only skilled and unskilled labour as inputs. This assumption is not unreasonable when studying small open economies, like Britain. In this setting, an increase in unskilled labour supply through immigration would lead to a decrease in wages of unskilled workers, and to an increase in wages of skilled workers. As the wages immigrants receive are equal to the marginal product of the last immigrant, this model generates a migration surplus, which is allocated to skilled workers. The size of this surplus depends on

elasticity of demand for unskilled labour, and the share of unskilled labour in national income. We show below that for any technology and production function, the surplus that goes to skilled workers through wage increases will always be at least as large as the loss unskilled workers experience through wage cuts. An immediate, but often overlooked consequence of this is that immigration can never, in such a setting, lead to a decrease in *average* wages, although it can decrease wages of particular skill groups.

A further and clearly acknowledged consequence of this simple model is that immigration only affects wages and employment, and only creates a surplus, if immigrants differ from native workers in their skill composition. If immigrants resemble native workers in terms of skill mix, immigration will not affect wages.

The empirical literature concerned with identifying the effects of immigration on wages and employment faces a number of tough challenges. The key issue is re-construction of the counterfactual outcome distribution for native workers that would be observed if immigration had not taken place. There are different approaches in the literature, all of them based on the idea to divide the national labour market into smaller labour markets which are differently exposed to immigration, and then comparing native outcomes across these markets, or cells.[1] The obvious problem is selection into cells that is correlated with outcomes – for instance, immigrants are likely to select into cells that are economically doing well. A further problem may be that individuals of native origin leave cells that have experienced in-migration. Both problems lead to underestimation of the impact of immigration. The first problem can be overcome by exploiting quasi-experimental situations where immigrants are exogenously allocated to regional labour markets (like Card 1990 and Glitz 2006), or instrumental variable techniques. To address the second problem, Borjas (2003) and Aydemir and Borjas (2006) define labour markets as skill-age groups at different points in time on a national level, and assume that workers in different education-age cells are imperfect substitutes.

In our empirical analysis, we draw on an approach that is natural in our setting by defining labour markets as regional units at different points in time.

[1] Existing studies define labour markets in various ways, using for instance education-region-time cells, or education-age-region cells (Card 2001).

Alternatively, and as a robustness check, we define labour markets as education-age groups at different points in time. For our first approach, we take account of non-random selection of immigrants into labour markets defined in this way by using IV type estimators.

We also point to the possible surplus that is generated through immigration. We embed our empirical findings into a simple theoretical model, where we set out with the assumption that capital is perfectly mobile, and that the price of capital is set on international markets. This seems to us a perfectly reasonable assumption, in particular for a small open economy like Britain. With capital being perfectly mobile, immigration must lead to overall average wage effects that are zero (in case immigrants resemble the native population in terms of skill structure), or positive (in case immigrants differ from natives in their skill allocation). In line with that, we do find positive overall wage effects of immigration for all the different estimation techniques and identification assumptions we use.

As the impact of immigration will not be equally distributed across the skill distribution, there will be some labour types who see their wages being decreased as well as others who experience wage increases. We find that, although the overall effect of migration on wages is positive, wages at the low end of the wage distribution decrease, while wages in the middle of the distribution increase.

1. Data and Descriptives

1.1 The Data

The main dataset we use for our analysis is the UK Labour Force Survey (LFS). The LFS is a sample survey of households living at private addresses in Great Britain conducted by the Office for National Statistics (ONS). We restrict our analysis to Great Britain, and omit Northern Ireland.

The LFS was established in 1973, and was initially a biannual and then annual survey. Since 1992, the LFS has been a rotating quarterly panel. Each sampled address is interviewed for 5 consecutive times at 3 monthly intervals.

The sample size is about 55,000 responding households in Great Britain every quarter, representing about 0.2% of the population.

The LFS collects information on respondents' personal circumstances and their labour market status during a reference period of one to four weeks immediately prior to the interview. From the 1992 -1993 winter quarter onwards the LFS contains information on gross weekly wages and on number of hours worked. Initially this information was asked only in the final wave, but from the 1997 spring quarter onwards questions on wages were asked during the first and the fifth interview. There is no information on wages of self employed individuals, therefore we cannot use this group for our analysis of wages. Spatial information is available at regional level, where region is determined according to usual residence. The LFS originally identifies 20 regions[2] in the UK. We unify Inner and Outer London into Greater London, and Strathclyde and the Rest of Scotland into Scotland, to create territorially homogeneous regions, and limit our analysis to Great Britain, dropping Northern Ireland. We have therefore 17 regions, and the usual average sample size is about 20,366. As the LFS is a nationally representative survey, there are a number of drawbacks when using it to study immigration. Since immigrant population in GB was less than 10% over most of the period considered, immigrants' sample size is quite small, especially when it is broken down in smaller subgroups by region, education, or occupation. To resolve this problem, we pool several years together for some parts of our analysis. We explain this in more detail below.

We combine information from the LFS with information from various years of the Population Census. The Census is a decennial survey of all people and households. The most recent Census was in 2001. Although providing information on issues like age, education, and employment status, the Census has no information on wages. Moreover comparability across Census years is not always possible, as variable classifications change quite often. This is for instance the case for occupation and education between the 1991 and 2001 Census. In our analysis below, we use information from the Census for looking at immigrants'

[2] Tyne & Wear, Rest of Northern Region, South Yorkshire, West Yorkshire, Rest of Yorkshire & Humberside, East Midlands, East Anglia, Inner London, Outer London, Rest of South East, South West, West Midlands (Metropolitan counties), Rest of West Midlands, Greater Manchester, Merseyside, Rest of North West, Wales, Strathclyde, Rest of Scotland, Northern Ireland.

geographical distribution in 1991 and 1981 in order to construct our instrumental variables.

1.2 Descriptive Evidence

In table 1.1 we present the total foreign born population in Britain, the percentage on the total population and the percent increase over each of four Census decades. The percentage of foreign born over the total population was 5.87% in 1971, and has constantly increased over the last thirty years. In 2001, it was 8.47%, but 9.75% of the working age population (as shown in table 1.2). The percentage of the foreign born on the working age (16-65) population increased by almost 2 percentage points to 11.5% in 2005. In our analysis we will always concentrate on working age population only.

[Table 1.1, 1.2 here]

Gender and Age Distribution

Table 1.3 reports the average age of the native working age population and of the foreign born population, where we distinguish for immigrants between recent immigrants (defined as those who arrived in the year of interview, or the year before), and immigrants who arrived at least 2 years earlier (old or resident immigrants). We also break down natives and immigrant population by gender. The average age of natives in 2005 was 40, as it was for resident immigrants. Between 1992 and 2005 the average age of the native population has increased by more than one year, while over the same period the average age of the resident immigrant population has stayed relatively constant. Recent immigrants on the other hand are remarkably younger than natives and old immigrants: their average age remained constant since 1992 at around 29, which is more than 10 years younger than resident immigrants or natives. This has important implications for the labour market segments these individuals are competing with. No significant differences seem to exist between the average age of men and women in any group.

[Table 1.3 here]

Table 1.4 shows the gender composition of natives, resident immigrants and recent immigrants. About 50.6% of the native born working age population were women in 2005, and about 52.4% of the resident foreign born, and 49.8% of the recent immigrants.

[Table 1.4 here]

Education

Immigration to Britain has always been relatively highly skilled (see e.g. Dustmann and Fabbri 2005 for evidence). This is in sharp contrast to other European continental countries, like Germany, or the US, where (more recent) immigration has been mostly low skilled.[3] Figure 1.1 illustrates this. The figure displays the overall share of immigrants on the British population, as well as the shares of immigrants on three education groups: low education, intermediate education, and high education. We define education using survey information on the age at which individuals left full time education. We code as low educated all individuals who left full time education at age 16 or earlier, as intermediately educated those who left full time education between the age of 17 and 20, and as highly educated those who left full time education after the age of 21.[4]

The figure shows that the fraction of low educated individuals is consistently below the share of immigrants in the overall population, while the share of immigrants with intermediate or high educational level is consistently above the share of immigrants in the overall population. While the fraction of immigrants has increased over the period considered by about 3 percentage points, the fraction of low skilled immigrants in the population of low skilled individuals has increased by less, and the fraction of highly educated individuals has

[3] Dustmann, Glitz and Vogel (2006) provide a comparison between the immigrant populations in Germany and the UK, which shows sharp differences in educational attainments.

[4] The LFS has two alternative measures for educational achievements, age at which individuals left full time education, and "highest qualification achieved". The problem with the latter measure is that it is defined on the British education system and classifies all foreign classifications as "other qualification" (see the discussion in the appendix of Manacorda et al. (2006)).

increased by more. In 2005, more than one in five individuals classified as highly educated in Britain was foreign born, which compares with roughly one in ten in the overall population. On the other side, just over 5 percent of those who classify as low educated are foreign born.

In table 1.5 we display the fraction of natives and foreign born in each of the education categories. As the figure before, the table illustrates the dramatically higher fraction of immigrants in the highly educated category. For instance, while in 1992 22 percent of immigrants and 44 percent of recent immigrants were classified as highly educated, this was only the case for less than 10 percent of native born workers. In 2005, the fraction of highly educated natives has increased to 16.5 percent, while the fraction of highly educated immigrants has increased to 34.5 percent, driven by the inflow of highly educated immigrants throughout that period. On the other hand, the fraction of immigrants among the low skilled is systematically lower, with on average less than 15 percent of recent immigrants being low educated over the period since 1992.

From these figures we can conclude that immigrants in Britain have been consistently better educated than native born workers. There seems to be a continued tendency for immigration of better educated individuals: while 45 percent of recent immigrants to the UK in 2005 are classified as highly educated according to our classification, this is only the case for 34.5 percent of immigrants who have been in the country for more than two years, and for 16.5 percent of native born individuals.

[Table 1.5 here]

Table 1.6 breaks down education figures by gender for the year 2005. Men have the largest share of highly educated both among immigrants and natives, but native men tend to be concentrated either in the high or in the low category, while relatively more women have an intermediate education. Overall, the mean differences between the three groups we discussed above are similar for both men and women.

[Table 1.6 here]

Occupation

Although immigrants to the UK are relatively highly educated, their educational background may not necessarily allow them access to jobs that they would be able to obtain if their education had been received in the UK, as it may not be specific to the UK labour market. Furthermore, upon entry, immigrants may not be able to make use of their educational background to its full potential, as they may lack complementary skills like language, or they may have to search for their best job match (see Eckstein and Weiss 2004).

In Table 1.7 we display the occupational distribution of immigrants in 2004 and 2005, where we distinguish between 8 occupational categories. Categories are derived from the National Statistics Socio-Economic Classification (NS-SEC), used in the LFS since 2001. We aggregate these categories to match the previously used Socio-Economic Group Classification (SEG), which distinguishes between 16 categories.[5] Finally we have aggregated employers and managers of large and small establishments, self-employed and employed professionals, intermediate and junior non manual workers, skilled and semi-skilled manual workers, and we have dropped members of the armed forces and agricultural workers.[6] The last column shows the average wage by occupation in the years considered, expressed in 2005 prices[7]. The numbers in the table show that managers and professionals have by far the highest average wages, while personal service workers and unskilled manual workers have the lowest. No information on wages is available in the LFS for own account workers.

[Table 1.7 here]

Again, we distinguish between recent immigrants, and immigrants who have been in the UK for at least 2 years. Although the educational attainment of

[5] Employers and managers (large establishments.), Employers and managers (small establishments), Professional workers (self-employed), Professional workers (employees), Intermediate non-manual workers, Junior non-manual workers, Personal service workers, Foreman and supervisors (manual), Skilled manual workers, Semi-skilled manual workers, Unskilled manual workers, Own account workers, Farmers (employers & managers), Farmers (own account), Agricultural workers, Members of armed forces.

[6] Agricultural workers constitute less than 1 percent in the native born population, and about 0.2 percent in the immigrant population

[7] We discount wages using the 2005-based CPI.

immigrants is higher than that of native born workers, the occupational distribution of those who have been in the country for at least 2 years is remarkably similar. Recent immigrants, i.e. those who arrived within 2 years of the interview, although being much better educated than the overall immigrant population (see discussion above), tend to be less in white collar and managerial jobs, and more in manual jobs. This strongly suggests that new arrivals are unable to put their human capital into immediate use, and start lower down the occupational distribution. This is similar to results for Israel - see work by Eckstein and Weiss (2004). It also suggests that educational categorisation may not be a good measure when defining labour markets in which native born workers and immigrants compete. The numbers in that table seem to suggest that better educated new arrivals among the immigrant population compete with native workers much further down the occupational distribution.

Table 1.8 shows the occupational distribution, distinguishing between men and women. While men are more concentrated in white-collar high-pay occupations, such as professionals, and employers and managers, women are more concentrated in skilled and unskilled manual jobs. Women are disproportionately concentrated in intermediate non-manual occupations and in personal service works. Both male and female recent immigrants tend to have lower-paid jobs, compared to natives and previous immigrants. For instance 8.5% of recent immigrant men work in unskilled manual jobs, while this share is only 4.6% for natives and 1.9% for immigrants who have been in the country for at least 2 years. Similarly, 10 percent of recently arrived foreign born women work in personal services, while only less than 3 percent of native and older immigrant women are employed in this occupation group.

[Table 1.8 here]

In table 1.9 we break down the occupational distribution by educational attainment, again distinguishing between natives, recent immigrants, and immigrants who have been in the country for more than 2 years. The figures show that within each education group, immigrants are distributed more towards the lower end of the occupational distribution. This is particularly so for recent

arrivals. For instance, while among highly skilled natives, only 2.6 percent work as skilled, semi-skilled or unskilled manual workers, this number is 7.6 percent for immigrants who have been in the country for at least two years, and 17 percent for highly educated recent immigrants. On the other hand, while 38 percent of native born workers who are highly educated are employers, managers or professionals, this number is only 30 percent for recent immigrants.

[Table 1.9 here]

In table 1.10 we provide more detail about the occupational distribution of immigrants in relation to their years of residence in the UK. We compare immigrants who have been in the UK for less than two years, 2 to 4 years, 4 to 6 years, and 6 to 10 years. The figures in the table show clearly an upward movement of immigrants along the occupational distribution with years of residence in UK. The share of the immigrant population in each of the three lowest paid job decreases over time. While 7.4% of the most recent immigrants are personal service workers, this number is 3.8% for immigrants who have been in the UK for 2 to 4 years, and 2.4% for those who have been in the UK for 4 to 6 years. Similarly 8.3% of immigrants who have been in the UK for less than two years are unskilled manual workers, while this is the case for only 5.7% of those with 2 to 4 years of residence, and 4.8% of those with 4 to 6 years of residence. On the other hand, the share of immigrant employers or managers is 9% among those with up to two years of residence, but it then increases to almost 13% among immigrants with 6 to 10 years of residence.

[Table 1.10 here]

All this suggests that recent immigrants tend to compete with native workers who are further down the occupational distribution than their educational background would suggest. At least at the beginning of their immigration history, there seems to be substantial occupational downgrading among immigrants. This suggests caution in interpreting the recent rise in the share of high and

intermediately educated immigrants (see figure 3.1) as an increase in labour market competition for high and intermediately educated natives

Industry Distribution

Table 1.11 shows the distribution of immigrants and natives across industries. Industries are classified according to the Standard Industrial Classification 1992 (SIC 92). The original SIC92 contains 17 industry categories[8], but we reduce them to 13 categories by grouping together agriculture, fishing, mining, and extra-territorial organizations in the residual "other" category. Again, we distinguish between "recent" immigrants and "old" immigrants.

[Table 1.11 here]

The industry distribution of old immigrants and natives is fairly similar. Natives are relatively more represented in manufacturing and construction, while immigrants are more represented in hotels and restaurants and in health and social work.

However, differences are more pronounced when we compare new immigrants with immigrants who have been in the UK for at least two years, and with native workers. For instance while the share of older immigrants in manufacturing has almost halved between 1992-1993 and 2004-2005, with a similar trend for natives, the share of recent immigrants in manufacturing has remained almost constant between 1992-1993 and 2004-2005. Also, the share of recent immigrants working in hotels and restaurants has increased over time from 9.4 to 12.7 percent, while the share of immigrants with more than two years of residence and of natives in that sector has remained constant. Finally, the share of recent immigrants working in private households is substantially larger than the corresponding share of old immigrants (although the striking figure for 1992-1993

[8] Agriculture, hunting and forestry; Fishing; Mining, quarrying; Manufacturing; Electricity, gas & water supply; Construction; Wholesale, retail & motor trade; Hotels & restaurants; Transport, storage & communication; Financial intermediation; Real estate, renting & business activities; Public administration & defence; Education; Health & social work; Other community, social & personal; Private households with employed persons; Extra-territorial organisations & bodies.

could be due to the small sample size). It is worth noting that hotels and restaurants and work in private households are the two industries with the lowest average pay.

Low-Pay

Table 1.12 reports for natives, old immigrants, and recent immigrants the ratio of individuals with an hourly wage below the 10th percentile (calculated on the whole regional population) in each industry to the total number of individuals of that group that work in that industry. We pool years 2001-2005 to increase the number of observations in each cell, but consider the year-specific 10th wage percentile. We do not consider own account workers, as we do not have information on their wages. Across all industries 10.2% of natives, 8.8% of older migrants and 16.9% of recent immigrants have a wage below the 10th percentile, but this share differs dramatically across industries. In general old immigrants are the group with lowest share of individuals below the 10th percentile. The only exception is in manufacturing, where 5.3% of natives and 7.6% of old immigrants earn less than the 10th percentile. On the other hand, in most industries the group with the highest percentage of individuals below the 10th percentile is that of recent immigrants. The sector with the largest difference in the share of low paid individuals between recent immigrants and the rest of immigrants and natives is that of work in private households: almost 88% of recent immigrants working in private households receive a wage below the 10th percentile, while this is the case for 37% of resident immigrants and 21.5% of natives. In another typically low-pay sector, hotels and restaurants, the percentage of natives and recent immigrants earning less than the 10th percentile is very similar, respectively 36.7% and 33.9%. Notice however that, as we have shown in table 1.11, the fraction of recent immigrants in this sector is almost three times larger than the fraction of natives.

Overall, table 1.12 shows that recent immigrants not only tend to cluster in low-pay sectors, but also within sectors there is a tendency for recent immigrants to be generally paid less than natives and older immigrants.

[Table 1.12 here]

Area of Origin

Table 1.13 reports the areas of origin of all immigrants. It also reports the areas of origin of all immigrants with a wage below the tenth percentile and of immigrants with high education. As before, we distinguish between recent and old immigrants. The East Europe category is interesting. Eastern Europeans are a very recent group in the UK: in 2001-2002 only 5.3 percent of resident immigrants were Eastern European, but 11.5 percent of new arrivals. Moreover, Eastern European immigrants in 2001 who have been in the UK for 2 years or more account for less than 5% of low-wage immigrants; however, among the recent immigrants, almost 29% of the low-wage ones are from Eastern Europe. The inflow from Eastern Europe has increased in recent years. In 2004-2005 24% of recent immigrants were Eastern Europeans, and they constituted more than 41% of low-wage recent immigrants. Recent Eastern European immigrants are over-represented in the low-wage group, and under-represented in the high education group: in 2004-2005 19% of highly educated recent immigrants were Eastern European, but they were 24% of all recent immigrants. On the other hand, older Eastern European immigrants were generally more highly educated: they were 7.5% of old immigrants with high education, but 6.5% of all old immigrants.

[Table 1.13 here]

Employment and Activity Rates

Table 1.14 shows the employment and activity rates for natives, as well as recent and old immigrants. 73% of working age natives are employed, compared to 60% of recent immigrants and 65% of those who have been in the UK for more than two years. The labour market participation of natives is higher than that of immigrants: 23% are inactive, compared to more than 30% of immigrants. The

employment rate of recent immigrants is slightly lower than that of older immigrants, as expected, but not dramatically so.

[Table 1.14 here]

In table 1.15 we further break down the employment and activity rates by gender. The employment rate of men is higher than the employment rate of women, and so is men's labour market participation for both natives and immigrants. For both men and women, immigrants have a higher proportion of unemployed and inactive individuals.

[Table 1.15 here]

Region of Residence

Table 1.16 shows the region of usual residence of immigrants and natives in 1992 and 2005. The regional categorisation in this table is the same as the one we use for some of our estimators below. The numbers show that foreign born individuals are disproportionately concentrated in Greater London: over 40% of all immigrants live here, whereas less than 10% of natives do. The distribution of immigrants and natives has remained relatively constant over time.

[Table 1.16 here]

Discussion

The numbers in the tables in this section suggest that recent immigrants have jobs that do not correspond to their educational attainments. However, over time immigrants improve their position in the labour market, and this process is relatively rapid. This has a number of implications for our analysis below. First, when investigating the effect of changes of the immigrant population in some pre-defined labour market on the change in economic outcomes of natives, it seems to

matter how widely we define the time period over which we draw comparison. As immigrants move across the occupational distribution after entry, they are likely to compete with different native groups just after arrival than after say 2-3 years. This is a process that is not unusual in the migration literature: immigrants lack upon arrival the information as well as key skills (like language) that are required to put their human capital into productive use. During the first years in the UK, they acquire these skills as well as information and gradually move to better jobs.

Second, it seems equally important to emphasise that any analysis of the impact of immigration on native labour market outcome can only be related to a particular immigration inflow, as immigrant composition changes over time, thus implying different competitive pressure on natives across the native skill- or wage distribution.

For the analysis we provide below, this has important consequences, as immigrants despite being better educated, are more likely to put pressure on native workers as well as resident immigrants at the low end of the wage distribution.

It seems important at this stage to emphasise that our interpretation above is based on the assumption that all migrations are permanent, or that return migration is not selective across the skill distribution. If immigrants return and if return is selective, then this may partly be responsible for the changes in the occupational distribution of recent and older immigrants (see Dustmann and Weiss 2006 for evidence). However, as we use for our analysis yearly changes in the foreign born population, these out-migrations do not matter for the immediate competitive pressure immigrants impose on the native born population.

2. Analysis

We now set out the overall theoretical and empirical framework on which our analysis of the effects of immigration on native outcomes is based. We start off with the theory. Here we discuss first the overall effect we should expect immigrants to have on the wages of the non-immigrant (or resident) population. Our analysis is based on standard economic theory, where as a starting point an equilibrium is considered where all workers are fully employed. In our model, we

do not restrict the number of industries that may produce different products, and we allow for any number of labour input types. Typically a type of labour input would be classified as a particular skill group, which could for instance be an age-education cell. We also allow for any number of capital inputs into production. Within this simple model we study the effect of labour migration which may be of any skill type and of any size.

Making the assumption that capital is available in unlimited supply at world market prices, which seems not unreasonable for a small open economy like the UK, we show that an increase in immigration of any skill mix, if it has wage effects, will always lead to an *increase* of average wages in the economy. This is the *immigration surplus* which in the absence of capital rigidities will be allocated to non-immigrant wage earners.

Although on average immigration will increase the non-immigrant wage, immigration *decreases* wages of workers with whom they are most directly in competition. As a consequence, it seems to us that the appropriate way to study the effect of immigration on wages is to consider wage effects along the wage distribution. We provide the theoretical argument by setting out a simpler model, confining the number of output goods to just one, and assuming a CES production technology, where we consider a large number of skill types. This model shows the implications immigration has for the wage structure of native workers, and suggests distributional implications.

A natural way of implementing this model is to define labour markets as regional areas at a particular point in time, the so-called *spatial correlation approach*. We derive estimation equations using that type of variation from our model, and we describe the empirical implementation. As this approach has been frequently criticised in the literature as not taking account of an important adjustment mechanism of native workers to immigration (by emigrating away from an area that has been exposed to immigration), we also use as a robustness check an alternative approach, which is based on age-education groups on national level, and which we explain in detail.

2.1 General theory

We start with as general a setting as possible. Suppose the economy consists of many firms producing many outputs using many inputs. Specifically, suppose the i^{th} firm produces outputs $\boldsymbol{y_i}$ using capital inputs $\boldsymbol{k_i}$ and labour inputs $\boldsymbol{l_i}$, where each of these can be a vector of any length, according to technological restrictions specifying that the output plan $\boldsymbol{(y_i,k_i,l_i)}$ lies in some technology set. We assume technology obeys constant returns to scale, outputs are sold at fixed world prices $\boldsymbol{p}$ and capital inputs are elastically supplied at world capital prices $\boldsymbol{r}$. Wages are denoted $\boldsymbol{w}$.

Individual firms maximise profits taking prices as given which is well known to lead to outcomes equivalent to maximisation of economy-wide profit $\boldsymbol{p\cdot y-r\cdot k-w\cdot l}$ at the given prices where $\boldsymbol{y=\Sigma_i y_i}$, $\boldsymbol{k=\Sigma_i k_i}$ and $\boldsymbol{l=\Sigma_i l_i}$. Equilibrium profits of zero are assured by the assumption of free entry but follow also from the assumption of constant returns to scale.

Wages are determined to equate aggregate demand for labour $\boldsymbol{l}$ to supply $\boldsymbol{n}$. Before immigration $\boldsymbol{n=n^0}$ where $\boldsymbol{n^0}$ is native labour and after immigration $\boldsymbol{n=n^1=n^0+m}$ where $\boldsymbol{m}$ is immigrant labour.

Let $\boldsymbol{y^0}$ and $\boldsymbol{k^0}$ be the equilibrium outputs and capital inputs and $\boldsymbol{w^0}$ be the equilibrium wages before immigration and let $\boldsymbol{y^1}$ and $\boldsymbol{k^1}$ be the equilibrium outputs and capital inputs and $\boldsymbol{w^1}$ be the equilibrium wages after immigration.

By the assumption that profits are maximised at zero before and after immigration

$$\boldsymbol{0 = p\cdot y^0-r\cdot k^0-w^0\cdot n^0 \geq p\cdot y^1-r\cdot k^1-w^0\cdot n^1} \qquad (1)$$

and

$$\boldsymbol{0 = p\cdot y^1-r\cdot k^1-w^1\cdot n^1 \geq p\cdot y^0-r\cdot k^0-w^1\cdot n^0.} \qquad (2)$$

Hence, by subtraction of the rightmost expression in (2) from the leftmost expression in (1)

$$\Delta w \cdot n^0 \geq 0 \qquad (3)$$

which is to say the average wage of natives must rise. This is the immigration surplus. It arises because demand curves for labour cannot slope up and immigrants are therefore paid no more than the value of their addition to output. Given that profits are zero, the resulting surplus is returned to existing factors and, given perfectly elastic supply of capital, payments to existing labour must rise.[9]

Furthermore, by subtraction of the leftmost expression in (2) from the rightmost expression in (1)

$$\Delta w \cdot n^1 \leq 0. \qquad (4)$$

Note here that if n^1 is proportional to n^0, so that immigrant skill composition is the same as that in the existing population, then (3) and (4) can both be true only if $\Delta w=0$ so there are necessarily no changes to equilibrium wages (and consequently also no surplus).

This is not the only case in which wage changes are zero. If the number of output types produced is the same as the number of labour types before and after immigration then immigration should also lead to no change in equilibrium wages (see Leamer and Levinsohn 1994).

Further, by subtraction of (3) from (4) ,

$$\Delta w \cdot m \leq 0 \qquad (5)$$

[9] If capital is less than perfectly elastically supplied then some of the surplus may go to capital and it can be said only that existing inputs as a whole gain.

Hence, given ***m>0***, if wages do change then equilibrium wages must fall for some types. The inequality in (5) shows the sense in which these falls must tend to be greater where immigration is most intense.

2.2 CES production

To arrive at an empirically applicable specification we now consider a particular technology. Let the number of output types be reduced to one, denoted *y*, but continue to allow for a number of labour types, $i=1,\ldots,L$. Let the output be traded on world markets at a fixed price *p* which we normalise to equal 1.

We adopt a CES production function whereby if labour supplied by the *i*th type is l_i then

$$y = \left[\sum_i \alpha_i l_i^{\sigma}\right]^{1/\sigma}$$

where $\sigma \leq 1$ determines the elasticity of substitution and α_i determines productivity of the *i*th type[10]. We assume without loss of generality, a numbering of labour types such that $\alpha_i > \alpha_j$ for $i>j$.

Firms can employ either native labour l_i^N or immigrant labour l_i^I of each type *i* and we assume that native and immigrant labour of the same type are both perfect substitutes and equally productive

$$l_i = l_i^N + l_i^I .$$

Hence native and immigrant labour of the same type will be paid the same wage in equilibrium.

First order conditions for cost-minimising input choice imply w_i, the wage of the *i*th type, is proportional to

[10] Note that we impose constant returns to scale in labour inputs alone. We can regard this as a production function in which we have substituted out capital inputs, chosen optimally as a function of labour inputs and fixed capital prices.

$$\alpha_i l_i^{\sigma-1}\left[\sum_i \alpha_i l_i^{\sigma}\right]^{(1/o)-1}$$

and the unit cost is

$$c=\left[\sum_i w_i^{\sigma/(\sigma-1)}\alpha_i^{-1/(\sigma-1)}\right]^{(\sigma-1)/o}$$

We assume that equilibrium is characterized by two things. Firstly the markets for each labour type clear[11] so that $l_i=n_i$ for all i, where n_i is the supply of labour of the ith type. The labour supply is made up of natives and immigrants, so that $n_i = n_i^N + n_i^I$ where n_i^N and n_i^I are the supply of immigrant and native labour respectively. We assume for the moment that supply is perfectly inelastic.

We let $\pi_i^N = n_i^N / \sum_j n_j^N$ and $\pi_i^I = n_i^I / \sum_j n_j^I$ denote the distribution of total native and immigrant labour supply across types and $m = \sum_j n_j^I / \sum_j n_j^N$ denote the ratio of immigrants to natives.

Secondly, profits are zero in equilibrium so $c=1$.

Solving the implied system gives expressions for equilibrium wages of all types

$$\ln w_i = \ln \alpha_i + (\sigma-1)\ln n_i + \left(\frac{1}{\sigma}-1\right)\ln\left[\sum_j \alpha_j n_j^{\sigma}\right]$$

Then

$$\ln w_i^0 \approx A_i + (\sigma-1)\left[\ln \pi_i^N - \sum_j \omega_j \ln \pi_j^N\right]$$

[11] We assume the existence of an equilibrium in which wages w_i are ordered across types similarly to productivity α_i. It is possible that if low skilled types were in sufficiently short supply the wages required to equate their supply and demand would exceed wages of the high skilled. If the high skilled are able to do low skilled jobs then clearly this would not be an equilibrium. Strictly, the appropriate equilibrium condition would require that for each skill type the demand for those with skills no lower than that type should be no less than the supply of those with skills no lower than that type. We assume away this complexity.

And

$$\ln w_i^1 \approx A_i + (\sigma - 1)\left[\ln \pi_i^N - \sum_j \omega_j \ln \pi_j^N\right] + (\sigma - 1)\left[\frac{\pi_i^I}{\pi_i^N} - \sum_j \omega_j \frac{\pi_j^I}{\pi_j^N}\right] m \qquad (6)$$

where

$$A_i = \ln \alpha_i + (\frac{1}{\sigma} - 1)\sum_j \omega_j \ln \alpha_j$$

and

$$\omega_i = \frac{\alpha_i n_i^{\sigma}}{\sum_j \alpha_j n_j^{\sigma}}.$$

In the absence of immigration the log of the wage of any skill type can be related approximately linearly to the logs of the native skill group shares π_i^N with coefficients reflecting the elasticity of substitution and equilibrium factor shares ω_i.

That wage is decreased by immigration if and only if the intensity of immigration at that point in the distribution of types exceeds an appropriate weighted average of immigration intensity across the whole distribution. Note that if the distribution of skill types in the immigrant inflow exactly matches that in the native labour force, $\pi_i^I = \pi_i^N$ for all i, then the effect on wages is zero, as earlier proved more generally. Otherwise the coefficient from a regression of $\ln w_i^1$ on the immigrant native ratio m should be proportional to $\frac{\pi_i^I}{\pi_i^N} - \sum_j \omega_j \frac{\pi_j^I}{\pi_j^N}$. This is clearly not a deep structural parameter but a reflection of the composition of the immigrant inflow over the period of the data.

The overall average wage effect of immigration is found by averaging the implied effect on levels of wages and is zero to first order. Extending the

approximation to higher order terms would show that the second order effect is necessarily positive as established earlier in a much more general setting.

These observations can be translated into observations about wage quantiles. Let $\iota(p)$ denote the smallest i such that $\sum_{j\le i}\pi_i^N \ge 100p$. Then $w_{\iota(p)}$ is the pth wage percentile, expressions for which follow from the discussion above. Furthermore, interquantile wage gaps take a particularly simple form

$$\ln w^1_{\iota(p)} - \ln w^1_{\iota(q)} \approx [A_{\iota(p)} - A_{\iota(q)}] + (\sigma-1)\left[\ln \pi^N_{\iota(p)} - \ln \pi^N_{\iota(q)}\right] + (\sigma-1)\left[\frac{\pi^I_{\iota(p)}}{\pi^N_{\iota(p)}} - \frac{\pi^I_{\iota(q)}}{\pi^N_{\iota(q)}}\right]m$$

so the effect of immigration on interquantile wage gaps is determined simply by relative intensity of immigration at the two points.

We can extend the above model to allow for elastic labour force participation by allowing labour supply in each type to depend upon the wage, $n_i=f_i(w_i)$. Not only demand but also supply of each labour type now depend upon the wage paid and, for example, equilibrium wage falls may lead to withdrawal of participation and therefore increasing unemployment for the labour types affected. The overall effect on employment will depend upon the distribution of participation elasticities across labour types. If responsiveness of participation at the top end is low but higher at low wages then it is quite plausible that immigration which depresses wages at the lower end of the distribution will lead to increasing average native unemployment even though, as argued above, average mean wage must rise.

Finally we might want to extend the model to allow for more than one type of output to be produced. In such a setting then output substitution towards goods which are produced relatively intensively with labour types predominating in the immigrant inflow will offset resulting wage pressures. For example, low skilled immigration, if it depresses low skilled wages, will increase the profitability of sectors using low skilled labour intensively. Expansion of production in those sectors will bid back up wages of low skilled labour somewhat. Indeed if there are as many output types as labour types and immigration does not change the

number of goods produced in equilibrium (see Leamer and Levinsohn 1994) then this will continue until the economy re-equilibriates in the long run at the initial wage levels in order to restore zero profit in each industry. This extreme but not obviously unrealistic possibility shows that it should not be presumed that equilibrium wages need be affected at all by immigration. The question of whether they are affected needs therefore to be resolved empirically.

2.3 Estimation

A major challenge in the literature on the impact of immigration on economic outcomes of native born workers is identification of wage- or employment effects. We observe economic outcomes of native born workers after migration has taken place. The missing counterfactual is their outcome distribution had migration not taken place. It is this counterfactual situation that has to be re-constructed.

The basic idea to address this issue is to divide the economy into different labour markets, which experience different intensities of immigrant inflows. Labour markets may be defined as spatial units at different points in time (see e.g. Altonji and Card 1991), but also as occupation or education groups across spatial units (see e.g. Card 2001), occupation groups at different points in time (e.g. Friedberg 2001), or education- age groups at different points in time (e.g Borjas 2003). The key underlying assumption in all these studies is that immigrants and natives are perfect substitutes within these labour markets (see Ottaviano and Peri 2006 and Manacorda et al. 2006 for approaches that relax that assumption). If immigrants were randomly allocated to labour markets defined in any of these ways, then comparison of wages or employment of native workers before and after immigration, and across labour markets with high and low immigration intensity, would result in an estimate of the effect of immigration. The problem is that immigrants tend not to allocate themselves randomly to labour markets of any sort or definition.

The literature has taken different directions to resolving this. One approach is using quasi-experimental data. The classical example is Card's (1990) work on the Miami boatlift. Other examples include exploitation of random

allocation schemes of immigrants (see e.g. Glitz 2006, Piil Damm 2005). Another approach is an IV type approach, by using variation that is correlated with immigrant allocation to labour markets, but not correlated with temporary shocks that allocate immigrants into particular markets. Such instruments, when defining labour markets on regional level, could be previous immigrant settlement patterns (see Bartel 1989), or information on previous occupational allocation when using labour markets defined by occupation and possibly time (see Friedberg 2001).

A remaining problem is that immigrants may lead to native workers moving out of labour markets that experience in-migration. This is particularly problematic for approaches that use spatial units or occupations to define labour markets. One way to solve this problem is to define labour markets using characteristics that can not be changed easily by individuals (like age and education) and to avoid using spatial variation. Borjas (2003) and Aydemir and Borjas (2006) follow this approach.

For Britain, we do not have any quasi-experimental allocation of immigrants into labour markets, however defined. We therefore rely on approaches that either use IV type methods, or approaches that define labour markets on national level. We define labour markets in two different ways. First, we use variation across spatial units and across time (often referred to as the spatial correlation approach). The ensuing estimation equations follow straightforwardly from the theoretical model we have set up above. This approach may still lead to an overly optimistic picture of immigration on native outcomes if natives leave labour markets that experienced in-migration, although the relatively large regional definitions we use in our analysis make it more likely that any movements if they then occur will be internalised (see Borjas et al. 1997 for a similar argument). To address this, and check robustness of our overall results, we also report results using variation across skill cells, defined on national level as age-education groups, following Borjas (2003) and Aydemir and Borjas (2006). As immigrants to Britain may select into age-education cells that are experiencing positive shocks, estimates should be considered as upper bounds.

2.4 Estimators

Using spatial variation over time

The typical equation for estimation has a form similar to (6), where a particular outcome, say y_{it} – in that case the log of a particular wage ln w_{it} – is related linearly to the immigrant native ratio m_{it} and other controls X_{it} with time and market effects. More specifically, our first estimator, using spatial variation over time, has the following form:[12]

$$y_{it} = \beta m_{it} + \gamma X_{it} + \theta_t + \phi_i + u_{it} \qquad (7)$$

where y_{it} is the labour market outcome of interest for natives in region i at time t (such as the average wage or a particular quantile of the wage distribution), m_{it} is the ratio of immigrants to natives in region i at time t, X_{it} is a vector of control variables, θ_t are time-specific fixed effects, ϕ_i are region-specific fixed effects.

We estimate the model in (7) in differences, therefore eliminating region-specific fixed effects:

$$\Delta y_{it} = \beta \Delta m_{it} + \gamma \Delta X_{it} + \Delta \theta_t + \Delta u_{it} \qquad (7\text{-a})$$

We construct an instrument for the *changes* in immigration ratios over time, which we explain in more detail below.

A potential problem for studies based on regional labour markets is the possibility that natives respond to in-migration by leaving particular regions. In this case, the potentially adverse impact of immigration on the local labour market would be dispersed to the rest of the economy, leading to an overly optimistic assessment of immigration. This problem is particularly serious when defining labour markets as small spatial units (see Borjas et al. 1997), and less important

[12] See Dustmann, Fabbri and Preston (2005) for a derivation of this estimator from a theoretical model.

when using larger spatial units. To an extent we can control for this by including functions of native skill group proportions, ln π_i^N, among the controls X_{it} but this is not an ideal solution since there are obvious concerns about whether such proportions ought themselves to be regarded as endogenous in such a setting and there are less obvious instruments to deal with the issue.

In the case just discussed, and as we explain further below, we use regions as local labour markets, which are sufficiently large to eliminate this problem. Nevertheless, and following Borjas (2003), we also follow here an alternative approach, which considers the labour market on a national basis, but identifies the effect of immigration by dividing the labour markets across skill groups on a national basis. This depends on the argument that individuals are not perfect substitutes across age groups within the same skill groups (see Card and Lemieux 2001), and, as the other approaches, that immigrants and natives are perfect substitutes within age-education cells. As this approach does define skill cells on a national level, and uses "fixed" (at least in the short run) classifications for defining labour markets, it is not vulnerable to the out-migration problem. However, it requires pre-allocation of immigrants to particular skill groups within which they are assumed to compete with natives, on the basis of pre-determined characteristics, like education and age. As our discussion in the descriptive section has shown, that may be quite problematic for new immigrants (and these are the ones who create the variation we use for estimation), as they downgrade substantially. This should be kept in mind when we discuss our results.

The regression equation in this case is as follows:

$$y_{ijt} = \beta m_{ijt} + \theta_i + \varsigma_j + \xi_t + (\theta_i \times \varsigma_j) + (\theta_i \times \xi_t) + (\varsigma_j \times \xi_t) + u_{ijt} \quad (8)$$

where y_{ijt} is the mean value of the labour market outcome of interest for individuals with education i and potential work experience j in period t; m_{ijt} is the ratio of immigrants to natives with education i and experience j period t; θ_i is a vector of education fixed effects, ζ_j is a vector of experience fixed effects, and ξ_t is a vector of time fixed effects.

We also estimate equation (8) in first differences, eliminating education and experience fixed effects:

$$\Delta y_{ijt} = \beta \Delta m_{ijt} + \Delta \xi_t + \Delta(\theta_i \times \xi_t) + \Delta(\varsigma_j \times \xi_t) + \Delta u_{ijt} \qquad (8\text{-a})$$

2.5 Identification

As we discuss above, a potential problem is the endogenous allocation of immigrants into particular labour markets. One solution is to use instrumental variables estimation. For our first approach which involves estimation of equation (7), we use settlement pattern of previous immigrants as instrument. This instrument has been used in various studies in this literature, following Altonji and Card (1991). The instrument is motivated by a study of Bartel (1989) who shows that settlement patterns of previous immigrants are a main determinant of immigrants' location choices. When estimating (7) we use years 1997-2005, and we compute the ratio of immigrants to natives for each year in each of the 17 regions. We estimate equation (7) in differences, which eliminates region specific permanent effects that are correlated with immigrant settlement patterns and economic conditions alike. Still, if temporary shocks determine immigrant inflows, the estimator is likely to be biased. We therefore instrument the *change* in this ratio using two alternative but closely related instruments: the 1991 ratio of immigrants to natives for each of these regions, from the Census of Population, and four period lags of the ratio of immigrants to natives in each region from the LFS. These instruments are valid under the assumption that economic shocks are not too persistent over time.

Both instrumental variables are strongly correlated to the ratio of immigrants to natives. In figure 2.1, we plot the immigrants-natives ratio in 1991 against the change in the immigrants-natives ratio in the years 1997-2005, by region and year. The graph shows a strong correlation between the two variables. The regression of the change in the immigrant-native ratio on the 1991 ratio and time dummies gives a coefficient of 0.06 with a t-statistic of 7.72 and an R^2 of 38.5%. Similar results are obtained for the fourth lag of the immigrant-natives ratio. A regression of the endogenous variable on this instrument and on time

dummies gives a coefficient of 0.043, with a t-statistic of 7.76 and an R^2 of 38.7%. Figure 2.2 shows graphically the correlation between the fourth lag of the immigrants-natives ratio and the change in the immigrants natives ratio.

We have also conducted some robustness checks by using alternative instruments. Firstly, we use similar instruments to those described above: further lags of the ratio of immigrants to natives (going back to the 14th lag) and the 1981 immigrants-natives ratio. Then we construct a series of instruments based on the predicted inflow of immigrants in each region. Initially we use the difference in the immigrants-natives ratio between 1981 and 1991 as a predictor of the annual immigrant inflow in each region. Then we take explicitly into account the area of origin of immigrants and design a variable which predicts the total immigrant inflow in each region in every year, net of contemporary demand shocks. In order to do so we divide immigrants into 15 areas of origin[13] and calculate the number of immigrants from area *c* who entered the UK in every year. We then allocate every group of immigrants across regions according to the location of previous immigrants from the same area. If we define M_{ct} as the number of new immigrants from area *c* in year *t*, and $\lambda_{ci} = \frac{M_{ci}}{M_c}$ as the fraction of immigrants from area *c* in region *i* in a base period, $\lambda_{ci} M_{ct}$ is then the predicted number of new immigrants from area *c* in region *i* in year *t*. As base periods, we experiment with different years: 1981, 1985, and 1991, using data from the LFS and for 1991 also using data from the Census. Finally, we sum over all origin groups to obtain a predicted total immigrant inflow into region *i* which is "cleansed" of local demand shocks: $\sum_c \lambda_{ci} M_{ct}$.

As we show later, results with these alternative instrumental variables are very similar to those obtained with the instruments described above.

2.6 Measurement error

As we explained in section 1.1 the LFS is a nationally representative survey, and since immigrant population was less than 10% of the total population

[13] Irish Republic, Old Commonwealth, Eastern Africa (New Commonwealth, NC), Other Africa (NC), Caribbean (NC), Bangladesh, India, Pakistan, South East Asia (NC), Cyprus, Other New Commonwealth, European Community (1992 members), Other Europe, China, Rest of the World.

for most of the years we consider, the number of observations for immigrants may be quite small. Therefore measures of regional immigrant concentration may suffer from measurement error due to small sample size. Moreover we estimate our equations in first differences. This tends to amplify the impact of measurement error. The consequence of measurement error on the estimation is the so called "attenuation bias": the estimated coefficient tends to underestimate the magnitude of the effect of the regressor on the dependent variable. A solution to this problem is again the use of instrumental variables that are correlated to the variable measured with error, but not correlated to the source of the error. The same instruments we use to correct for endogeneity are therefore also suitable to correct for measurement error.

A further source of worry in our estimates is the possibility of measurement error in the wage variable. The LFS variable on the average gross hourly pay (hourpay) is a derived variable, obtained by dividing the gross weekly pay by the numbers of hours worked including overtime. Therefore errors in the measurement of either of the three original variables may result in measurement error of the hourly pay (see Dickens and Manning 2002 for a discussion). In all years we have a sizeable number of observations below £1 per hour (in 2005 terms): they are 76 in 2005, and 355 in 1997 for instance. In 2005, 10 of the individuals earning less than £1 per hour were employers or managers, and 5 professionals. In 1997, 44 were employers or mangers, and 12 professionals. On the other hand, measurement error at the top may also be a problem: about 20 individuals every year report an hourly wage above £100 per hour, with some reporting figures above £400, as in the case of an intermediate non manual worker earning £533 in 2004.

This measurement error is of a totally different type than the measurement error in the immigrant concentration variable, and needs therefore to be dealt with in a different way. In our analysis on the impact of immigration on wages we use some alternative measures of average pay by region to try to limit the extent of measurement error in this variable, as we explain in the next section.

3. Estimation

3.1 Sample and data for analysis

We perform our analysis using data from the LFS. We present results with the two different approaches explained before: the spatial correlation approach, and the skill cell correlation approach. We prefer the spatial correlation approach because it avoids classifying immigrants in skill cells which, as we show in section 2, can be quite misleading.

For the spatial correlation approach we use years from 1997 to 2005 and we use four different measures of average wages to test the robustness of the results to measurement error. First we use the simple average regional wage. Then we compute a robust regional average by trimming in every region and year the wage distribution of natives at the region- and year- specific 1^{st} and 99^{th} percentile. This measure reduces the impact of outliers on our averages by considering only central observations in the wage distribution. Across all regions and year the average value of the first percentile is £1.6 per hour, while the minimum is £0.13 and the maximum £2.8. The average 99^{th} percentile is £31.23 per hour, the lowest is £19.56 and the highest is £51.72.

We also calculated a wage index constructed as the weighted sum of the average wages in each education group, defined as above in terms of the years of education (see discussion in section 3.2). The educational composition of the native population is kept constant by choosing as weights the share of each education group in the native population in a base year (which we choose to be 1998). By holding constant the skill composition of the assessed population, this measure is isolated from the effects of changing native skill composition. The theoretical results of earlier sections show that wage changes should raise average wages in a population with skill composition as at the time of immigration and this measure comes closest to capturing that.

Finally, we also use a robust version of this index based on wages in the trimmed sample. The robust index is constructed using robust average wages for

each education group, where the average wages by education group are computed on the same trimmed sample as above.

In table 3.1 we report mean and standard deviations of all the variables we use.

[Table 3.1 here]

3.2 Immigration and Average Wages

The first set of results we present uses variation across regions and over time to identify the effects of immigration on wages. In table 3.2, we present results from estimating equation (7) for men and women together in differences (columns 1 and 2), and from IV estimation, using alternatively previous settlement patterns from the 1991 census (columns 3 and 4) and 4-period lags of the regressor (columns 5 and 6). Estimation is based on yearly data for the years 1997-2005 and for 17 regions. This has been the period with the largest inflow of immigrants: As table 3.2 shows, the percentage of the foreign born in the working age population increased from 8.7 percent in 1997 to 11.5 percent in 2005. Wages are expressed in 2005 real terms. The first row reports the estimated coefficient of a regression on the log of average wages in each region and year. The second row uses a robust version of the average wage as described above. The third row reports results for regressions using the wage index as dependent variable, and the fourth row the robust version of the index where average wages by education group are computed on the trimmed sample.

[Table 3.2 here]

Specifications in columns 1, 3 and 5 regress the change in log average wages on the change in the ratio of immigrants to natives and on year dummies only. Specifications 2, 4 and 6 control in addition for the average age of natives and immigrants in the region, and for natives' education. As educational measures we use the logarithm of the ratio of natives in each education group to natives

with no qualifications. This second specification eliminates to some extent variation across regions in native skill composition.

Results are consistent across all specifications, and show a positive impact of immigration on natives' average wages. In both OLS differences regressions, the coefficient on the ratio of immigrants to natives is positive and significant, and slightly decreasing when we condition on natives' skill and age composition. The estimates based on the robust wage measures are slightly smaller.

Coefficient estimates based on IV regressions are reported in columns 3 to 6. We should expect the coefficients to be smaller as immigrants location choice may be correlated with temporary labour market shocks. On the other hand, the concentration measures we use are likely to suffer from measurement error due to small sample sizes, which is accentuated in differences, and will lead to a downward bias. In fact, the coefficient estimates we obtain using IV are larger than those we get in the simple OLS regression, which may suggest that measurement error dominates the selective migration choices of immigrants. Results are remarkably stable and consistent across the different specifications.[14] The coefficients indicate that an increase in the foreign population of the size of 1% of the native population would lead to an increase of about 0.4% in *average* natives' wages. This qualitative result is in line with our model above.

In table 3.3 we report results from regression of average wage (column 1) and robust average wage (column 2) on the ratio of immigrants to natives and year dummies only, where we experimented all the instrumental variables we have described in section 2.4.

[Table 3.3 here]

The first five rows use different lags of the ratio of immigrants to natives as IV. Rows six to eight use respectively the immigrants-natives ratio in 1991, in 1981, and the change in this ratio between the two years, taken from the Census.

[14] It is worthwhile to note that the standard errors of the IV estimator are smaller than the standard errors of the OLS estimator in differences. The reason is that standard errors are calculated on the assumption of lack of serial correlation in the residuals of the levels equation so that the differenced equation is assumed to have residuals with a specific pattern of first order serial correlation. OLS is not efficient given such serial correlation, even under exogeneity of the regressors, and IV may accordingly give lower standard errors.

Finally, rows nine to twelve use the predicted inflows of immigrants in each region, calculated as described in 2.4 taking into account the ethnic composition of the inflows. Each of these final rows is different in either the base year or the data source chosen to construct the variable λ_{ci}, the share of immigrants from area *c* predicted to settle in region *i*: we use either the 1991 Census (row nine) or the 1991, 1985, and 1981 LFS (in row 10, 11, and 12 respectively). Results using different instrumental variables are very similar, which reassures us that our estimates are not driven by the choice of a specific instrument.

We now split the labour market along various dimensions to investigate which groups are affected by immigration. In Table 3.4, we present results for different education groups, following the classification we have introduced above. Estimation is based on equation (7).

[Table 3.4 here]

Again we have used two different measures of average wages: the simple average and the robust measure obtained from the trimmed wage distribution. Although all specifications give positive coefficients, the estimated coefficients are different across the two measures, with the robust wage measure resulting in smaller coefficient estimate throughout.

The IV results suggest a positive effect on wages for all education groups, although the effect on high and low educated is not significant when we use the robust measure. The size of the coefficients also varies between the two measures. However, in both cases the coefficient for highly educated is larger than that for the intermediately and low skilled.

The impact of immigration may also be different for wages of men and women. Table 3.5 reports results of separate regressions on log average wages of men and women.

[Table 3.5 here]

Results vary quite considerably between genders. The estimated IV coefficient for native men is positive and significant, suggesting that an inflow of immigrants of the size of 1% of the native population would increase native men's wages by about 0.6%. The robust measure is slightly smaller in magnitude. On the other hand the size of the estimated coefficients for women is smaller and significant only when we consider the robust average.

In table 3.6 we look at the effect of immigration on the average wages of resident immigrants (those who have been in the UK for at least two years). Coefficients are not dissimilar to those we find for natives, but they are all insignificant, which may be related to the relatively small sample size we have available to construct the wage measures.

[Table 3.6 here]

3.3 Effects along the wage distribution

Our results above seem to suggest that immigration to Britain over the last decade has had a positive effect on average wages of native born workers. This is in line with our theoretical exposition, and suggests that immigrants differ in their skill composition from natives, and therefore induce an overall surplus. But exactly where along the distribution do immigrants compete with native workers? The numbers on educational achievements of immigrants, and in particular recent immigrants, suggest that immigrants are well educated and have higher educational attainments than native workers. On the other side, when investigating the jobs and occupations immigrants attain just after arrival (and these are the inflows we consider in our analysis), it seems that they put pressure rather on the lower part of the labour market.

A classification along educational lines may not be too appropriate, as immigrants compete with natives across different education groups, as table 3.8 suggests. A division along the wage distribution may be more suitable. In order to investigate that, we analyse now the impact of immigration across the wage distribution. The dependent variable we use is the appropriate sample wage

quantile in each cell. The same dummies and control variables as above are included. Results are reported in table 3.7.

[Table 3.7 here]

Columns 1 and 2 report the OLS results, while columns 3 to 6 show the IV results, with the two different instruments. The regression results show a sizeable negative impact of immigration on the lower wage quantiles. According to IV estimates in column 4, which use the 1991 settlement patterns of immigrants as instrument and includes all controls, the impact of an inflow of immigrants of the size of 1% of the native population would lead to a 0.6% decrease in the 5^{th} wage percentile and a 0.4% decrease in the 10^{th} wage percentile; on the other side, it would lead to an almost 0.7% increase in the median wage and a 0.5% increase in the 90^{th} percentile. Estimates using the fourth lag of the ratio of immigrants to natives, in columns 5 and 6, give the same picture, but with slightly smaller coefficients. Both IV estimates indicate a strong positive impact of immigration around the median wage, but a negative effect at the bottom of the wage distribution. According to these estimates, immigration seems to put considerable downward pressure on the lower part of the wage distribution, but increases wages at the upper part of the distribution.

To obtain a more detailed picture, we have estimated the model at a finer grid of wage percentiles. In figure 3.1 we plot the estimated coefficients of regressions on percentiles from the 5^{th} to the 95^{th} percentile, in intervals of 5 percentage points for the OLS regression (figure 3.1.a) and for the IV regression (figure 3.1b) where we use the 1991 ratio of immigrants to natives as IV and no controls (the figures for the OLS regression with controls and for alternative IVs are very similar, and they are not reported). The dotted lines are the 95% confidence interval. The IV graph shows clearly the negative impact on low wage percentiles and the positive impact on percentiles further up the wage distribution.

[Figure 3.1 here]

Overall, these results suggest that immigration tends to stretch the wage distribution, particularly below the median. To make this clearer, we report the implied estimates for the impact of immigration on inter-decile differences. Using the same conceptual framework as before, our dependent variables are now the differences between the 90th and the 10th wage percentile, the difference between the median and the 10th percentile, and the difference between the 90th percentile and the median. The coefficients estimates reported in table 3.8 correspond precisely to differences in estimates in the previous table. These estimates suggest that an increase in the immigrant population by about 1 percent of the native population increases the 50-10 differential by about 1 percentage point. This is quite a substantial number, given that the 90-10 differential has increased by 12.1 percentage points between 1995 and 2000, and the 50-10 differential over the same period has increased by 2.9 percentage points[15]. Furthermore, there seem to be hardly any effect of migration on inequality at the upper end of the wage distribution.

[Table 3.8 here]

3.5 Checking Robustness: Using variation across skill cells

One concern with approaches based on variation in immigrant inflows across regional labour markets is that immigration may lead to out-migration of native workers, thereby distributing its possible impact across the economy. The literature on the US is divided about the seriousness of this problem (see Borjas 2003, Card and DiNardo 2000). Out-migration of natives should be more problematic the smaller the choice of the local labour market (see Borjas, Katz, Freeman 1997). By using annual changes and fairly large areas as local labour markets we should largely internalise any native responses to immigration. Nevertheless, to check the robustness of our results, we use an estimator suggested by Borjas (2003) that circumvents this problem by defining labour markets as skill-age groups in different time periods on national level (see discussion and equation 8 above).

[15] Our calculations based on table 12.2 in Machin (2003).

To implement this approach, we construct four time periods by pooling data for the years 1994-1996, 1997-1999, 2000-2002 and 2003-2005 to avoid too small cell sizes. We then divide our sample for each of the four time period in education-experience cells. We distinguish between three education categories, based on the classification we introduce above, and eight experience categories, defined by five-year intervals from 0 to 40 years. It is important to distinguish different level of experience because, as we mentioned in section 2.4, there is a considerable degree of heterogeneity among workers in the same education group, but with a different number of years of experience. Table 3.9 shows the logarithm of average wages of natives in each education-experience cell in the four time periods we consider. There is substantial variation in wages within education groups across experience cells.

[Table 3.9 here]

In Figure 3.2 we display the ratio of immigrants to natives in each education group by experience cell for all time periods considered. The figure illustrates that there is some variation over time, in the sense that the different skill cells experience different migratory inflows.

[Figure 3.2 here]

We report estimation results in table 3.10. We have estimated the model in two different specifications.[16] In columns 1 and 2, we have followed specification (8) including a full set of time, education, and experience dummies, as well as two by two interactions. In columns 3 and 4 we have estimated it in first differences (specification 8-a), with time dummies and interactions of education and experience dummies with time dummies. In columns 2 and 4 we have also added as additional regressor a control for the logarithm of natives in each cell. In the first row we report results for log average wages of natives of both sexes. In the second and fourth row we show the results for regressions on log average wages

[16] Notice that we use here the ratio of immigrants to natives, and not, like Borjas, the ratio of immigrants to the population. This seems more natural in our setting and ensures comparability of coefficients with earlier results.

of men and women separately, while in the fourth row results for log average wages of residents immigrants. Since we are now using time periods constructed by pooling together three years, we define resident immigrants in every period as those who were in the UK before the start of the period.

The results for natives of both sexes are positive but not significant in any specification.

[Table 3.10 here]

The second and third rows replicate the previous analysis separately for men and women. None of the coefficients is significant for native men, while both first difference specifications give positive and significant coefficients for native women. Finally, the fourth row shows the results of regressions on the log average wage of resident immigrants. Results are not significant and not constant in sign across specifications.

This approach depends crucially on imperfect substitutability of workers across age- and education groups, and on the ability of the analyst to assign immigrants to those skill cells where they compete with native workers. If imperfect substitutability across cells is a poor assumption, then this will lead to poor identification. Furthermore, our descriptive evidence has shown that immigrants select initially into skill groups that are below their qualifications. As it is the arrival of these new immigrants that drives the coefficients of interest, pre-assignment of the type required with this approach may be quite imprecise and this may be one reason for the poor precision of estimates.

4. Summary and Conclusions

Our analysis is based mainly on data from the LFS and the 1991 and 2001 census. We show that there was a substantial immigration to Britain between 1996 and 2005, with the share of foreign born workers on the British working wage population increasing by about 3 percentage points. Most of these workers have been highly educated, with the average level of education of immigrant populations in the UK steadily increasing. Overall immigrants and in particular the new immigrants, seem much better educated than their native born counterparts. New immigrants are also considerably younger than the overall British workforce.

We show that, while resident immigrants look very similar in their occupational distribution to native workers, new immigrants, despite being better educated, tend to downgrade upon arrive, thus competing with natives in occupations and jobs that are below their level of education. New immigrants upgrade however over the first years of residence in the UK. This suggests that despite their higher average levels of education, many new immigrants are not able to put their skills into immediate productive use and compete with native workers towards the bottom of the wage distribution initially.

Our empirical analysis on the wage effects of immigration relates the changes in immigrant share in different regions in Britain to the change in wages, using yearly data. Our results suggest that immigration to the UK over the last decade had on average a positive effect on wages. This is in accordance with a model where capital is supplied at prices that are set on international markets, which seems a reasonable assumption for a small economy like the UK. Such a theory also establishes however that there will be losers as well as winners, and shows the conditions at different positions of the skill distributions according to which natives will be benefited or harmed by an inflow of migration. Overall, migration should harm some workers, but benefit others; those who benefit will gain more than those who lose which leads to a positive overall surplus. Our model calls for analysis of the impact of wages along the wage distribution of resident workers.

Implementing such an analysis suggests that wages at the low end of the distribution decreased through immigration over the period under consideration. Immigration over this period tended to increase numbers of non-immigrant workers at the low end of the distribution.

Our results also show, and again in accordance with what we should expect based on our theoretical model, that the losses experienced by workers at the low end of the wage distribution are more than compensated by wage increases of workers further up the wage distribution. Consequently, our estimates suggests that immigration led to an increase in the spread of the wage distribution, by decreasing wages at lower percentiles, but increasing wages further up the wage distribution. More specifically, we estimate that immigration to the UK over the last decade has contributed to an increase in the spread of the distribution below the median, but has done little to affect the distribution above the median.

Our analysis adds a number of important insights to the academic debate on the impact of migration. Most importantly, we make the simple point that, if capital is elastically supplied at world market prices, the migration surplus should be allocated across the pre-existing workforce. An immediate consequence of this is that average wages of native workers should increase as a consequence of immigration if they are affected at all. This is consistent with the positive wage effects that are sometimes found in the literature on immigration. To establish where immigration harms, and where it benefits native workers, we suggest estimation along the wage distribution.

It is important to recognise that the empirical results we present should not be casually generalised to immigration in different circumstances. As our theoretical discussion explains, the effects of migration that we recover in empirical analysis are crucially dependent on the particular skill mix of the new immigrant population. If this changes, then the effects will change, possibly dramatically. Thus, it seems to us that any generalisation of the effects of migration across countries, and even across time for the same country, is inappropriate.

We should also mention that the analysis we provide is only as good as the data we have available. The LFS is a survey, with relatively imprecise wage information. Finally, immigration to Britain is mainly into greater London – as

our descriptive evidence suggests, it is London which still attracts 40 percent of all new immigrants. Therefore, London is important for the results we obtain.

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Figures

Figure 1. 1

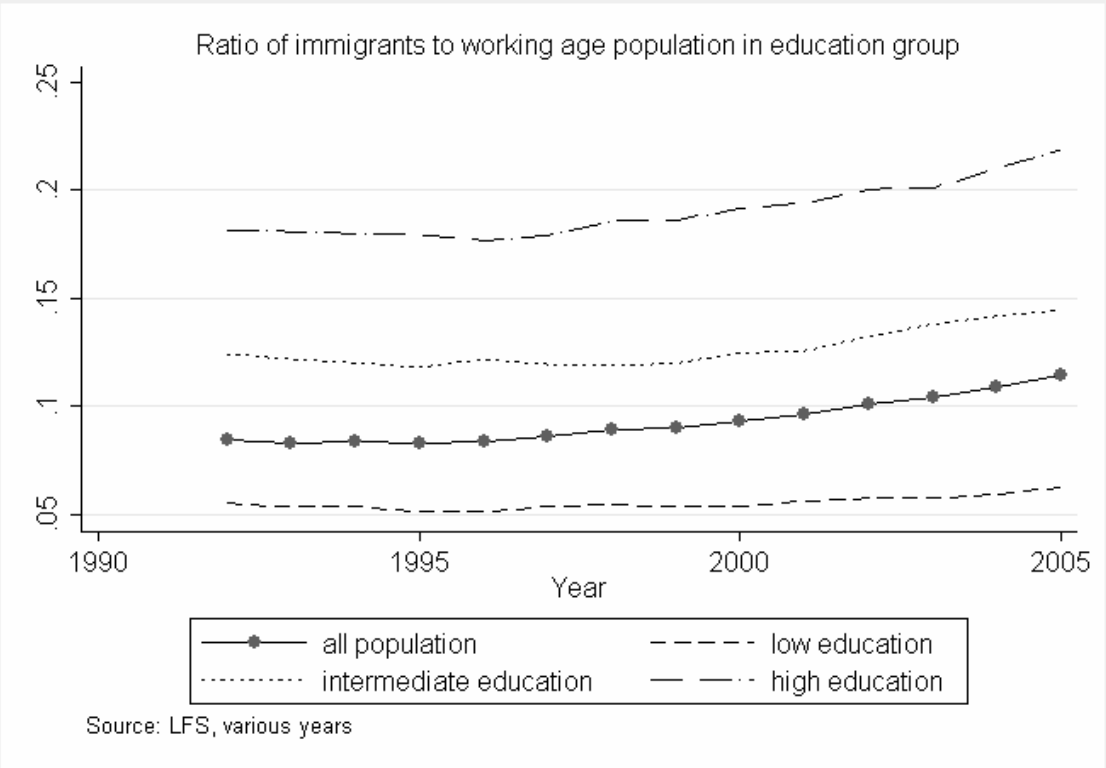


Figure 2. 1

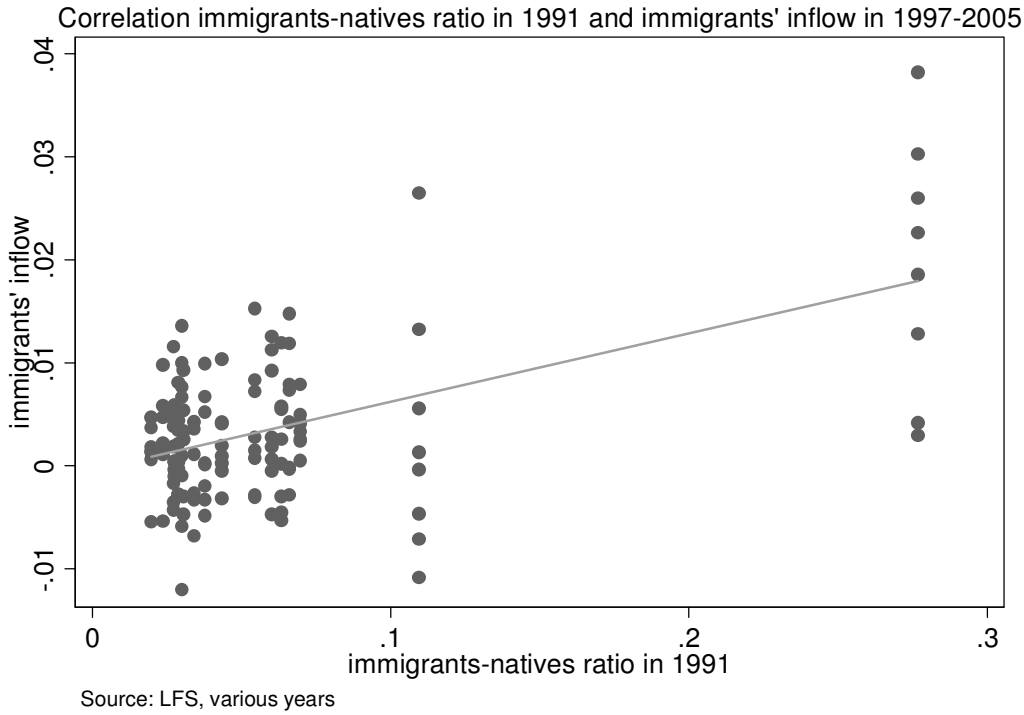


Figure 2. 2

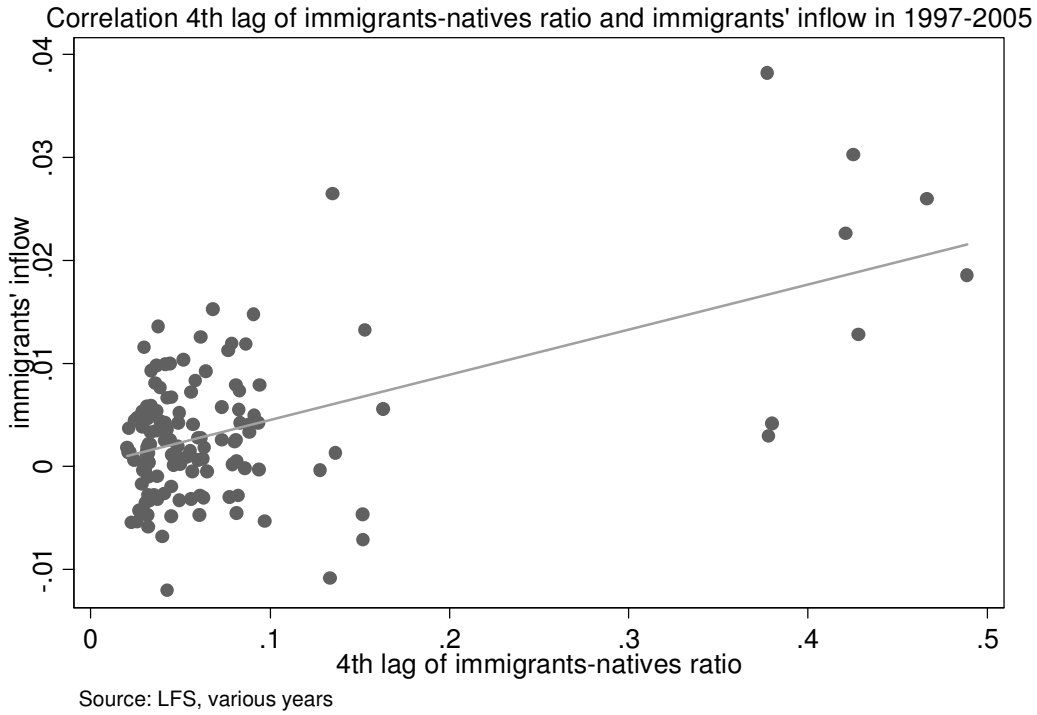


Figure 3. 1.a

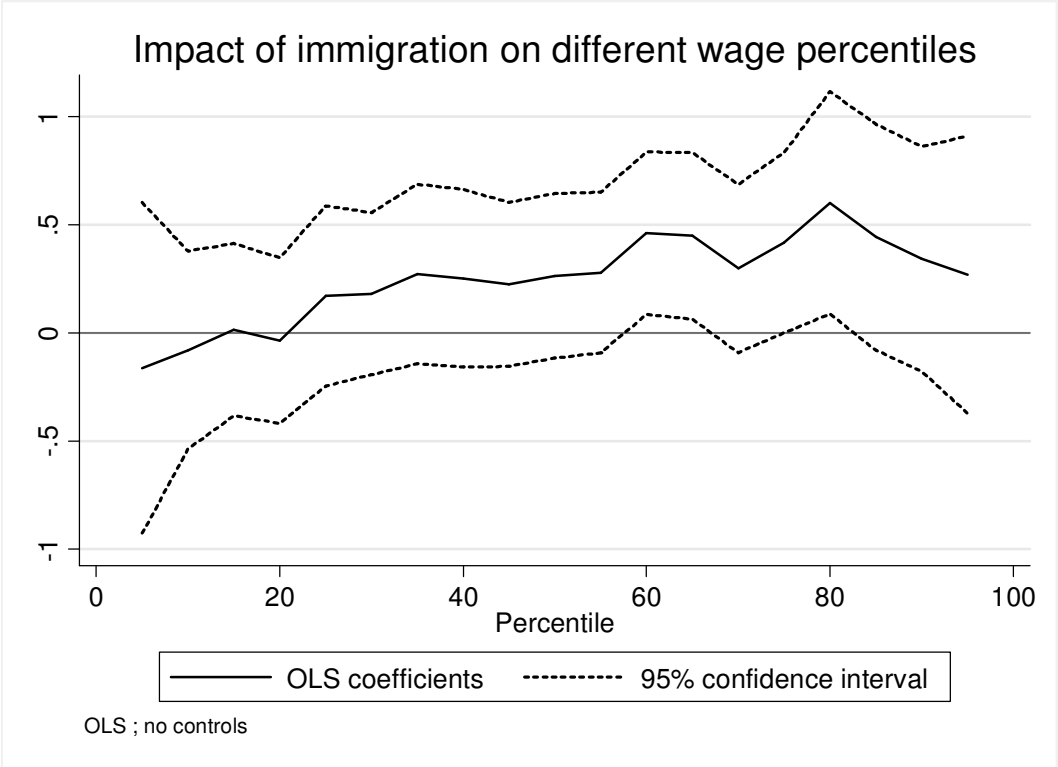


Figure 3.1.b

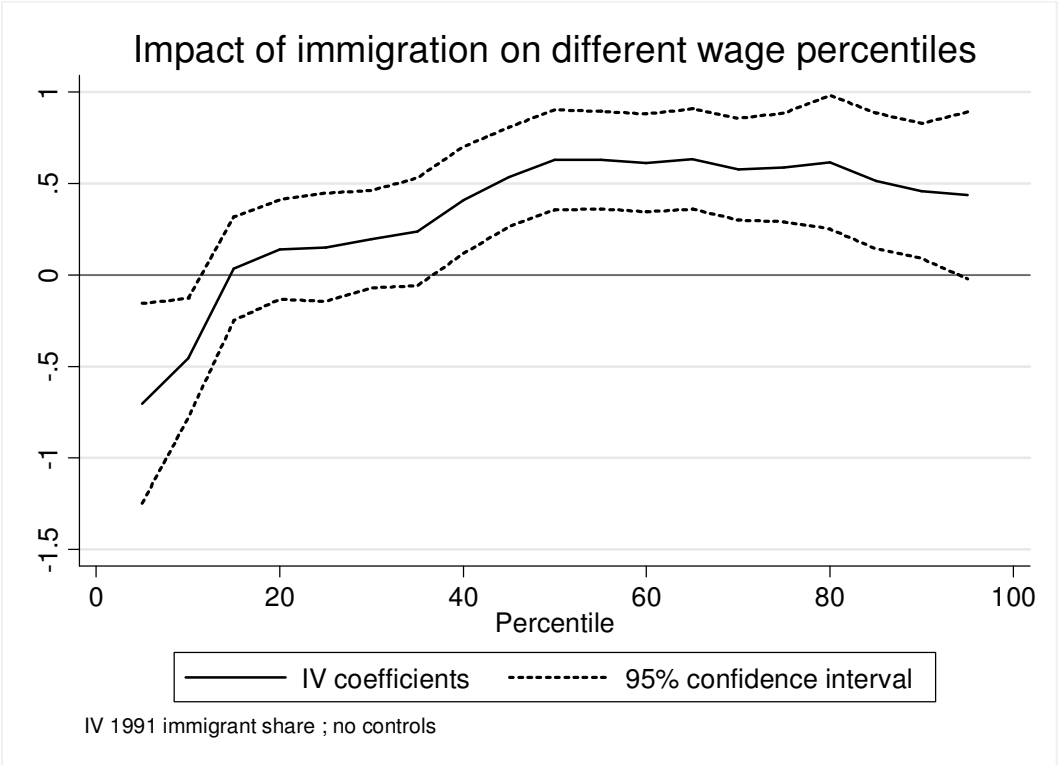
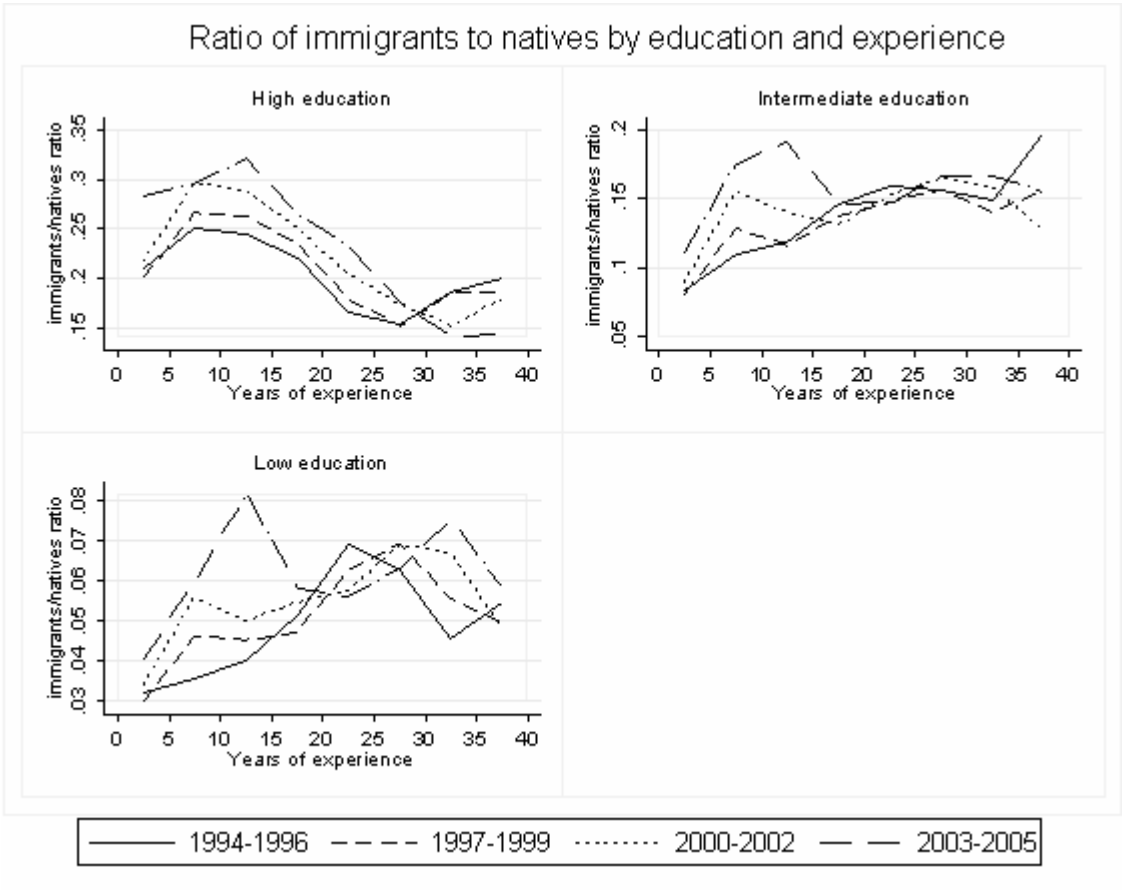


Figure 3. 2


Ratio of immigrants to natives by education and experience
High education
Intermediate education
Low education
immigrants/natives ratio
Years of experience
1994-1996
1997-1999
2000-2002
2003-2005

Tables

Table 1.1 – Foreign born population in Great Britain			
	Total foreign born	***Percentage increase over previous decade***	***Percentage of total population***
1971	3,086,402		5.87
1981	3,359,825	8.86	6.27
1991	3,746,122	11.50	6.82
2001	4,835,598	29.08	8.47
Source:1971, 1981, 1991, 2001 Census			

Table 1.2 – Foreign born working age population in Great Britain, 1993-1995	
	Percentage of total working age population
1993	8.35
1995	8.3
1997	8.7
1999	9.09
2001	9.75
2003	10.45
2005	11.5
Entries are the share of immigrants in the working age population (16-65) of both sexes.	
Source:LFS, various years	

Table 1.3 – Average age in 1992, 1998, 2005									
	Natives			***Foreign Born***					
				Old			***Recent***		
	1992	***1998***	***2005***	***1992***	***1998***	***2005***	***1992***	***1998***	***2005***
All	38.6	39.47	40.26	40.22	40.57	39.89	28.95	28.53	29.35
Men	38.45	39.44	40.21	40.4	40.61	39.77	29.59	29.46	29.58
Women	38.76	39.51	40.31	40.07	40.53	39.99	28.37	27.77	29.12
Entries are the average age of the working age (16-65) population of the group in every year.									
Source: LFS various years									

Table 1.4 – Gender Composition in 1992, 1998, 2005									
	Natives			***Foreign Born***					
				Old			***Recent***		
	1992	***1998***	***2005***	***1992***	***1998***	***2005***	***1992***	***1998***	***2005***
Men	49.83	49.63	49.36	47.81	46.69	47.57	46.93	44.89	50.16
Women	50.17	50.37	50.64	52.19	53.31	52.43	53.07	55.11	49.84
Entries are the share of men and women among working age (16-65) natives and immigrants every year.									
Source: LFS various years									

Table 1.5 – Education in 1992, 1998, 2005, both sexes

Education	***Natives***			***Foreign Born***					
				Old			***Recent***		
	1992	***1998***	***2005***	***1992***	***1998***	***2005***	***1992***	***1998***	***2005***
High	9.7	12.68	16.49	22.27	27.87	34.55	44.13	52.46	45.04
Intermediate	21.32	23.72	26.76	32.47	32.71	34.26	39.57	33.74	41.09
Low	68.98	63.6	56.75	45.26	39.41	31.19	16.3	13.8	13.87

Entries are the share of working age (16-65) natives and immigrants of both sexes in each education group in each year.
High education: left full time education at age 21 or later
Intermediate education: left full time education between age 17 and 20 (included)
Low education: left full time education not after age 16, or never had full time education

Source: LFS various years

Table 1.6 – Education in 2005, men and women

	Men			***Women***		
	Native	***Foreign***		***Native***	***Foreign***	
		Old	***Recent***		***Old***	***Recent***
High	17.12	37.39	46.62	15.83	31.91	43.47
Intermediate	23.94	31.69	40.77	29.71	36.65	41.41
Low	58.94	30.92	12.61	54.46	31.44	15.12

Entries are the share of working age (16-65) natives and immigrants in each education group in each year.
High education: left full time education at age 21 or later
Intermediate education: left full time education between age 17 and 20 (included)
Low education: left full time education not after age 16, or never had full time education

Source: LFS 2005

Table 1.7 – Occupational distribution in 2004 and 2005, both sexes

	Natives	***Foreign Born***		***Average wage***
		Old	***Recent***	
Professionals	5.70	9.94	7.90	17.32
Employers and Managers	15.33	15.22	8.99	16.5
Non-Manual Workers	42.11	39.71	34.83	10.66
Foreman and Supervisors	8.09	6.82	4.61	8.4
Skilled and Semi Skilled Manual	15.91	14.87	23.70	7.6
Unskilled Manual Workers	4.03	3.65	8.30	6.43
Personal Service Workers	1.62	1.82	7.36	5.34
Own Account Workers	7.21	7.98	4.31	-

Entries are the share of working age (16-65) natives and immigrants of both sexes in each occupation group in years 2004-2005 pooled.
Average wage is the average wage in the occupation in 2004-2005, expressed in 2005 terms.
No information on wages of own account workers is available. Average professionals' wage is calculated for professional employees only.

Source: LFS 2004,2005

Table 1.8 – Occupational distribution in 2004 and 2005, men and women

	Men			***Women***		
	Natives	***Foreign Born***		***Natives***	***Foreign Born***	
		Old	***Recent***		***Old***	***Recent***
Professionals	7.42	12.43	9.31	3.69	7.28	6.19
Employers and Managers	19.25	18.86	10.34	11.10	10.80	5.60
Non-Manual Workers	26.72	26.88	25.50	59.13	55.16	45.37
Foreman and Supervisors	9.80	7.76	5.96	6.28	5.51	3.06
Skilled and Semi Skilled Manual	21.66	18.66	30.82	9.44	10.54	17.74
Unskilled Manual Workers	4.59	3.94	8.47	3.43	3.36	8.78
Personal Service Workers	0.54	1.01	4.83	2.75	2.55	10.02
Own Account Workers	10.03	10.44	4.78	4.17	4.79	3.24

Entries are the share of working age (16-65) natives and immigrants in each occupation group in 2004-2005 pooled.

Source: LFS 2004,2005

Table 1.9 – Occupation by level of education in 2004 and 2005, both sexes

	High education			***Intermediate education***			***Low education***		
	Natives	***Foreign Born***		***Natives***	***Foreign Born***		***Natives***	***Foreign Born***	
		Old	***Recent***		***Old***	***Recent***		***Old***	***Recent***
Professionals	18.33	20.65	14.17	4.6	3.94	1.74	2.01	1.92	1.69
Employers and Managers	19.5	17.83	15.56	17.79	14.87	3.09	12.74	12.02	2.37
Non-Manual Workers	53.19	43.95	42.26	51.94	44.76	31.36	33.28	26.43	15.74
Foreman and Supervisors	2.03	3.43	3.68	6.51	7.52	5.13	10.97	10.94	7.94
Skilled and Semi Skilled Manual	2.33	6.48	12.96	9.79	14.83	31.99	23.61	27.49	41.39
Unskilled Manual Workers	0.32	1.11	3.9	2.02	3.62	10.92	6.32	7.56	20.15
Personal Service Workers	0.47	0.93	4.3	1.63	2.21	10.15	1.93	2.47	6.39
Own Account Workers	3.83	5.6	3.16	5.72	8.26	5.61	9.14	11.17	4.32

Entries are the share of working age (16-65) natives and immigrants of both sexes in each occupation group by level of education in 2004-2005 pooled.

Source: LFS 2004, 2005

Table 1.10 – Occupational distribution of immigrants in 2004 and 2005 by years in the UK				
	Years in UK			
	<2	***2 - 4***	***4-6***	***6-10***
Professionals	7.9	12.04	9.87	10.15
Employers and Managers	8.99	9.41	12.74	12.92
Non-Manual Workers	34.83	39.08	40.69	38.87
Foreman and Supervisors	4.61	6.29	6.08	7.29
Skilled and Semi Skilled Manual	23.7	18.07	15.07	15.56
Unskilled Manual Workers	8.3	5.72	4.77	4.47
Personal Service Workers	7.36	3.76	2.41	2.07
Own Account Workers	4.31	5.65	8.37	8.66
Entries are the share of working age (16-65) immigrants in each occupation group in 2004-2005 pooled. Each column shows different cohorts of immigrants.				
Source: LFS 2004,2005				

Table 1.11 – Natives and Immigrants industry distribution, both sexes									
	1992-1993			***2000-2001***			***2004-2005***		
	Natives	***Immigrants***		***Natives***	***Immigrants***		***Natives***	***Immigrants***	
		Old	*Recent*		*Old*	*Recent*		*Old*	*Recent*
Manufacturing	21.77	20.64	14.59	17.14	14.39	11.91	13.97	11.52	14.38
Construction	7.39	5.65	2.29	7.17	4.18	2.60	7.78	4.58	5.39
wholesale, retail & motor trade	15.92	14.19	10.47	15.69	14.37	10.59	15.92	13.98	12.11
hotels & restaurants	4.69	9.13	9.42	4.50	8.75	10.19	4.45	8.74	12.69
transport, storage & communication	6.37	6.97	3.39	6.90	7.74	5.03	6.68	7.97	5.66
financial intermediation	4.30	3.88	6.35	4.28	4.59	5.82	4.21	4.61	4.52
real estate, renting & business activities	7.64	9.03	11.52	10.66	13.08	18.73	10.82	13.86	13.20
public administration & defence	6.18	4.98	4.10	6.22	4.27	3.57	6.77	5.09	2.98
Education	6.85	6.61	11.19	8.01	7.61	8.82	9.07	8.53	6.58
health & social work	9.78	12.64	10.82	10.99	13.89	11.01	12.02	14.70	13.87
other community, social & personal	4.72	4.28	4.55	5.43	5.19	5.83	5.59	4.81	5.05
private households with employed persons	0.54	0.46	8.57	0.43	0.70	3.91	0.43	0.69	2.31
Other	3.86	1.56	2.74	2.58	1.23	1.98	2.29	0.93	1.26
Entries are the share of working age (16-65) natives and immigrants in each industry in different years in 1992-1993 pooled, 2000-2001 pooled, 2004-2005 pooled. *Industry classification: SIC92*									
Source: LFS, several years									

Table 1.12 - Percentage below 10th percentile, Years 2001-2005 pooled			
	Natives	*Immigrants*	
		Old	*Recent*
All industries	10.19	8.77	16.92
Industry			
manufacturing	5.29	7.58	17.67
construction	7.28	5.06	5.17
wholesale, retail & motor trade	21.02	16.63	16.28
hotels & restaurants	36.70	26.07	33.86
transport, storage & communication	5.07	4.60	8.67
financial intermediation	1.83	1.86	1.62
real estate, renting & business activities	6.46	5.21	6.77
public administration & defence	1.90	1.85	4.15
education	6.64	6.18	7.19
health & social work	9.43	5.16	10.15
other community, social & personal	16.79	13.20	26.68
private households with employed persons	21.52	36.94	87.76
other	8.12	2.86	6.84
Entries are the share of natives or immigrants with an hourly wage below the (year-specific) 10th percentile on the total of natives or immigrants in that industry in years 2001-2005 pooled. *Industry classification: SIC92*			
Source: LFS, various years			

Table 1.13 - Immigrants' origin, both sexes												
	2001-2002						***2004-2005***					
	All immigrants		***Immigrants below 10th percentile***		***Immigrants with high education***		***All immigrants***		***Immigrants below 10th percentile***		***Immigrants with high education***	
	Old	***New***	***Old***	***New***	***Old***	***New***	***Old***	***New***	***Old***	***New***	***Old***	***New***
West Europe	25.99	22.08	25.65	23.15	22.70	22.25	22.96	15.40	24.51	9.39	21.04	17.24
East Europe	5.34	11.52	4.60	28.57	5.59	8.76	6.58	23.85	6.61	41.44	7.45	18.99
Indian Subcontinent	20.58	10.05	26.19	18.46	15.53	10.95	20.31	13.72	20.21	13.08	16.73	16.57
Other	48.09	56.35	43.55	29.82	56.18	58.04	50.15	47.04	48.68	36.09	54.78	47.20
Entries are the distribution across areas of origin of old and new immigrants, of old and new immigrants earning an hourly wage below the tenth percentile, and of old and new immigrants with high education in years 2001-2002 pooled and 2004-2005 pooled.												
Source: LFS, various years												

Table 1.14 – Employment in 2004 and 2005, both sexes			
	Natives	***Foreign Born***	
		Old	***Recent***
Employed	73.03	65.02	60.34
Unemployed	3.52	4.74	7.04
Inactive	23.45	30.24	32.61
Entries are the share of employed, unemployed, and inactive working age (16-65) natives and immigrants of both sexes in 2004-2005 pooled.			
Source: LFS 2004, 2005			

Table 1.15 – Employment in 2004 and 2005, men and women

	Men			***Women***		
	Natives	***Foreign Born***		***Natives***	***Foreign Born***	
		Old	***Recent***		***Old***	***Recent***
Employed	78.93	74.68	67.98	67.28	56.26	52.62
Unemployed	4.14	5.74	6.86	2.92	3.83	7.24
Inactive	16.93	19.57	25.16	29.8	39.91	40.15

Entries are the share of employed, unemployed, and inactive working age (16-65) natives and immigrants in 2004-2005 pooled.

Source: LFS 2004, 2005

Table 1.16 – Region of usual residence in 1992 and 2005, both sexes

	1992		***2005***	
	Natives	***Immigrants***	***Natives***	***Immigrants***
Tyne & Wear	2.16	0.57	1.99	0.79
Rest of Northern Region	3.78	0.94	3.61	0.98
South Yorkshire	2.47	0.95	2.34	1.12
West Yorkshire	3.7	3.4	3.65	3.5
Rest of Yorks.& Humberside	3.12	1.06	2.98	1.14
East Midlands	7.5	5.14	7.6	5.21
East Anglia	3.77	2.92	3.87	2.9
Greater London	9.83	41.56	9.51	43.24
Rest of South East	19.26	17.73	19.98	17.38
South West	8.5	4.39	8.93	4.73
West Midlands (met county)	4.37	6.83	4.23	5.24
Rest of West Midlands	4.95	2.25	5.14	1.53
Greater Manchester	4.55	3.89	4.45	3.41
Merseyside	2.68	0.9	2.48	0.89
Rest of North West	4.35	2.25	4.39	2.07
Wales	5.3	1.69	5.37	2
Scotland	9.7	3.54	9.48	3.87

Entries are the share of working age (16-65) immigrants and natives of both sexes living in each region in 1992 and 2005.

Source: LFS 1992, 2005

Table 3.1 – Descriptive statistics		
Variable	*Mean*	*Std. Dev.*
Log-wages, all natives		
Average hourly pay	2.212	*0.138*
Robust average hourly pay	2.183	*0.136*
Wage index	2.194	*0.131*
Robust wage index	2.123	*0.134*
Average hourly pay, men	2.337	*0.138*
Average hourly pay, women	2.076	*0.144*
Robust average hourly pay, men	2.299	*0.133*
Robust average hourly pay, women	2.059	*0.144*
Log-wages, natives by education group		
Average hourly pay, high	2.656	*0.107*
Average hourly pay, intermediate	2.266	*0.121*
Average hourly pay, low	2.065	*0.109*
Robust average hourly pay, high	2.602	*0.103*
Robust average hourly pay, intermediate	2.247	*0.098*
Robust average hourly pay, low	1.970	*0.123*
Log-wages, resident immigrants		
Average hourly pay	2.279	*0.152*
Robust average hourly pay	2.242	*0.147*
Natives' log- wage percentiles		
5^{th}	1.266	*0.148*
10^{th}	1.433	*0.129*
25^{th}	1.678	*0.131*
50^{th}	2.022	*0.132*
75^{th}	2.413	*0.134*
90^{th}	2.763	*0.139*
95^{th}	2.970	*0.152*
Immigrants-natives ratio	0.086	*0.107*
Annual change in immigrants-natives ratio	0.003	*0.007*
Average natives' age	40.331	*0.944*
Average immigrants' age	39.329	*1.992*
ln high educ./low educ.	-1.659	*0.378*
ln intermed. educ./low educ.	-1.048	*0.278*

Entries are the mean value and the standard deviation of the variables used in the analysis, across all regions and year 1997-2005.
Source: LFS 1997, 2005

Table 3.2 – Spatial correlation
Effect of immigration on log average natives' wages

Dependent variable	OLS		IV [1991 Immigration Share]		IV [4 period lag]	
	First Differences		First Differences		First Differences	
	(1)	(2)	(3)	(4)	(5)	(6)
Average	0.410 (0.186)	0.389 (0.181)	0.455 (0.132)	0.487 (0.128)	0.428 (0.138)	0.465 (0.132)
Robust average	0.291 (0.156)	0.266 (0.153)	0.396 (0.111)	0.432 (0.109)	0.356 (0.116)	0.396 (0.112)
Wage index	0.322 (0.167)	0.311 (0.169)	0.315 (0.136)	0.348 (0.120)	0.306 (0.124)	0.338 (0.124)
Robust index	0.200 (0.160)	0.169 (0.161)	0.294 (0.114)	0.344 (0.115)	0.285 (0.119)	0.338 (0.119)
Other Controls	No	Yes	No	Yes	No	Yes
Observations	136	136	136	136	136	136

Entries are the estimated regression coefficients of the ratio of immigrants to natives in regressions of different measures of' log average regional wages in every year on the ratio of immigrants to natives in the same region and year for years 1997-2005 Controls include average natives' and immigrants' age, and logarithm of the ratio of natives in each education group to natives with no qualifications.
Robust average wages are computed by trimming the wage distribution at the top and bottom percentile.
Wage index is the weighted log sum of the average wage of each education group, using time invariant weights. Its robust version uses trimmed distribution to compute education-specific averages.
Standard errors in parenthesis.

Table 3.3 – Spatial correlation
Effect of immigration on log average natives' wages –
Results with different instruments

	Average wage	Robust Average
	(1)	(2)
IV 4th lag	0.428 (0.138)	0.356 (0.116)
IV 8th lag	0.429 (0.131)	0.362 (0.110)
IV 9th lag	0.393 (0.129)	0.354 (0.108)
IV 10th lag	0.434 (0.137)	0.368 (0.114)
IV 14th lag	0.369 (0.136)	0.325 (0.114)
IV 1991 immigration share	0.455 (0.133)	0.396 (0.111)
IV 1981 immigration share	0.446 (0.137)	0.401 (0.115)
IV change 91-81	0.488 (0.130)	0.379 (0.108)
IV Predicted inflow by ethnic group (Census 91)	0.413 (0.165)	0.288 (0.138)
IV Predicted inflow by ethnic group (LFS 91)	0.411 (0.168)	0.317 (0.140)
IV Predicted inflow by ethnic group (LFS 85)	0.326 (0.186)	0.268 (0.155)
IV Predicted inflow by ethnic group (LFS 81)	0.332 (0.173)	0.290 (0.144)

Entries are the estimated IV regression coefficients of the ratio of immigrants to natives in regressions of log average regional wages and robust log average regional wages in every year on the ratio of immigrants to natives in the same region and year for years 1997-2005 . The instrumental variable used is described in the first column.
Robust average wages are computed by trimming the wage distribution at the top and bottom percentile.
Standard errors in parenthesis.

Table 3.4 – Spatial correlation
Effect of Immigration on log Average Natives' Wages by education group

Education	***Dependent variable***	OLS		IV [1991 Immigration Share]		IV [4 period lag]	
		First Differences		First Differences		First Differences	
		(1)	(2)	(3)	(4)	(5)	(6)
High	*Average*	1.049 (0.462)	1.072 (0.470)	0.680 (0.329)	0.697 (0.335)	0.672 (0.343)	0.675 (0.346)
	Robust average	0.960 (0.333)	0.984 (0.334)	0.365 (0.239)	0.433 (0.239)	0.351 (0.249)	0.399 (0.247)
Intermediate	*Average*	0.314 (0.197)	0.295 (0.200)	0.294 (0.140)	0.337 (0.142)	0.304 (0.146)	0.347 (0.146)
	Robust average	0.280 (0.303)	0.320 (0.303)	0.299 (0.216)	0.279 (0.215)	0.325 (0.225)	0.302 (0.222)
Low	*Average*	0.000 (0.219)	-0.045 (0.220)	0.377 (0.157)	0.414 (0.158)	0.373 (0.163)	0.419 (0.163)
	Robust average	0.104 (0.217)	0.066 (0.219)	0.136 (0.154)	0.184 (0.156)	0.126 (0.161)	0.179 (0.161)
Other Controls		No	Yes	No	Yes	No	Yes
Observations		136	136	136	136	136	136

Entries are the estimated coefficients on the ratio of immigrants to natives in separate regressions of different measures of the log average regional wages in every year of natives in the relevant education group on the ratio of immigrants to natives in the same region and year for years 1997-2005 Controls include average natives' and immigrants' age, and logarithm of the ratio of natives in each education group to natives with no qualifications. Robust average wages are computed by trimming the wage distribution at the top and bottom percentile. Standard errors in parenthesis.

Table 3.5 – Spatial correlation
Effect of immigration on log average wages of native men and women

		OLS		IV [1991 Immigration Share]		IV [4 period lag]	
		First Differences		First Differences		First Differences	
		(1)	(2)	(3)	(4)	(5)	(6)
Men	*Average*	0.534 (0.243)	0.536 (0.242)	0.617 (0.173)	0.631 (0.172)	0.616 (0.180)	0.632 (0.178)
	Robust Average	0.478 (0.207)	0.444 (0.206)	0.451 (0.147)	0.500 (0.146)	0.394 (0.153)	0.449 (0.151)
Women	*Average*	0.313 (0.243)	0.254 (0.235)	0.233 (0.173)	0.301 (0.167)	0.175 (0.180)	0.255 (0.172)
	Robust Average	0.119 (0.194)	0.095 (0.192)	0.301 (0.138)	0.336 (0.137)	0.274 (0.144)	0.313 (0.141)
Other Controls		No	Yes	No	Yes	No	Yes
Observations		136	136	136	136	136	136

Entries are the estimated regression coefficients of the ratio of immigrants to natives in regressions of different measures of' log average regional wages of men and women in every year on the ratio of immigrants to natives in the same region and year for years 1997-2005. Controls include average natives' and immigrants' age, and logarithm of the ratio of natives in each education group to natives with no qualifications.
Standard errors in parenthesis.

Table 3.6 – Spatial correlation
Effect of immigration on average wages of resident immigrants

	OLS		IV [1991 Immigration Share]		IV [4 period lag]	
	First Differences		First Differences		First Differences	
	(1)	(2)	(3)	(4)	(5)	(6)
Average	-0.609 (1.260)	-0.660 (1.256)	0.341 (0.896)	0.551 (0.894)	0.293 (0.934)	0.461 (0.922)
Robust Average	0.280 (1.178)	0.217 (1.156)	0.580 (0.836)	0.844 (0.820)	0.500 (0.871)	0.719 (0.847)
Other Controls	No	Yes	No	Yes	No	Yes
Observations	136	136	136	136	136	136

Entries are the estimated regression coefficients of the ratio of immigrants to natives in regressions of of' log average regional wages of resident immigrants of both sexes in every year on the ratio of immigrants to natives in the same region and year for years 1997-2005. Controls include average natives' and immigrants' age, and logarithm of the ratio of natives in each education group to natives with no qualifications. Resident immigrants are defined as all immigrants in the UK two years before the interview.
Standard errors in parenthesis.

Table 3.7 – Spatial Correlation
Effect of immigration on wage distribution – impact on different wage percentiles

	OLS		IV [1991 Immigration Share]		IV [4 period lag]	
	First Differences		First Differences		First Differences	
Wage quantile	(1)	(2)	(3)	(4)	(5)	(6)
5	-0.163 (0.386)	-0.216 (0.387)	-0.702 (0.276)	-0.633 (0.275)	-0.729 (0.288)	-0.649 (0.284)
10	-0.079 (0.231)	-0.094 (0.237)	-0.454 (0.165)	-0.440 (0.169)	-0.536 (0.173)	-0.516 (0.175)
25	0.171 (0.210)	0.136 (0.207)	0.152 (0.149)	0.243 (0.147)	0.118 (0.156)	0.211 (0.152)
50	0.264 (0.192)	0.234 (0.190)	0.629 (0.138)	0.668 (0.137)	0.615 (0.144)	0.660 (0.141)
75	0.417 (0.211)	0.385 (0.207)	0.588 (0.150)	0.638 (0.148)	0.558 (0.156)	0.613 (0.152)
90	0.342 (0.262)	0.314 (0.257)	0.459 (0.186)	0.487 (0.183)	0.379 (0.194)	0.414 (0.188)
95	0.269 (0.324)	0.245 (0.326)	0.436 (0.230)	0.426 (0.231)	0.376 (0.240)	0.375 (0.239)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	No	Yes	No	Yes	No	Yes
Observations	136	136	136	136	136	136

Entries are the estimated regression coefficients of the ratio of immigrants to natives in separate regressions of each natives' wage percentiles in every region and year on the ratio of immigrants to natives in the cell. Years 1997-2005 Controls include average natives' and immigrants' age, and logarithm of the ratio of natives in each education group to natives with no qualifications. Standard errors in parenthesis.

Table 3.8 – Spatial Correlation
Effect of immigration on wage distribution - difference between wage percentiles

	OLS		IV [1991 Immigration Share]		IV [4 period lag]	
Quantile differences	First Differences		First Differences		First Differences	
	(1)	(2)	(3)	(4)	(5)	(6)
90-10	0.421 (0.351)	0.409 (0.353)	0.913 (0.251)	0.927 (0.252)	0.915 (0.261)	0.930 (0.261)
90-50	0.077 (0.316)	0.081 (0.317)	-0.170 (0.225)	-0.181 (0.225)	-0.236 (0.234)	-0.246 (0.233)
50-10	0.343 (0.242)	0.328 (0.246)	1.083 (0.177)	1.108 (0.180)	1.150 (0.185)	1.177 (0.187)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	No	Yes	No	Yes	No	Yes
Observations	136	136	136	136	136	136

Entries are the estimated regression coefficients of the ratio of immigrants to natives in separate regressions of the difference in the natives' wage percentiles in every region and year on the ratio of immigrants to natives in the cell. Years 1997-2005 Controls include average natives' and immigrants' age, and logarithm of the ratio of natives in each education group to natives with no qualifications. Standard errors in parenthesis.

Table 3.9 – Log average hourly wages by education and experience					
Education	***Years of experience***	***Log average wages***			
		1994-1996	***1997-1999***	***2000-2002***	***2003-2005***
High	1-5	2.184	2.210	2.326	2.350
	6-10	2.555	2.572	2.684	2.685
	11-15	2.707	2.751	2.850	2.887
	16-20	2.736	2.782	2.900	2.990
	21-25	2.745	2.776	2.883	2.945
	26-30	2.833	2.774	2.849	2.925
	31-35	2.834	2.757	2.876	2.895
	36-40	2.722	2.738	2.836	2.861
Intermediate	1-5	1.636	1.699	1.819	1.864
	6-10	2.063	2.060	2.121	2.169
	11-15	2.254	2.260	2.350	2.374
	16-20	2.301	2.324	2.419	2.489
	21-25	2.336	2.398	2.462	2.510
	26-30	2.413	2.400	2.479	2.539
	31-35	2.431	2.440	2.497	2.539
	36-40	2.407	2.425	2.485	2.532
Low	1-5	1.365	1.435	1.599	1.657
	6-10	1.800	1.818	1.904	1.973
	11-15	1.954	1.983	2.071	2.130
	16-20	2.008	2.044	2.149	2.219
	21-25	2.043	2.061	2.155	2.245
	26-30	2.027	2.060	2.172	2.245
	31-35	2.058	2.068	2.156	2.247
	36-40	1.997	2.044	2.134	2.211
Log average hourly wages by education and experience, in the two time periods we use for regression analysis: 1992-1995, 2003-2005. Men and women pooled together					

Table 3.10 – Skill cell correlation
Effect of immigration on natives' wages

	OLS, fixed effects		*OLS, first differences*	
	(1)	*(2)*	*(3)*	*(4)*
Average natives' wages	0.285 (0.183)	0.185 (0.303)	0.227 (0.192)	0.050 (0.280)
Average native men's wages	0.220 (0.313)	-0.153 (0.374)	-0.034 (0.235)	-0.456 (0.333)
Average native women's wages	0.126 (0.226)	0.597 (0.399)	0.515 (0.256)	0.877 (0.368)
Average resident immigrants' wages	-0.695 (0.518)	-0.034 (0.738)	-0.124 (0.515)	0.409 (0.750)
Logarithm of natives in cell	No	Yes	No	Yes
Dummies	Time, experience, education	Time, experience, education	Time	Time
Interactions	Time and experience, time and education, experience and education	Time and experience, time and education, experience and education	Time and experience, time and education	Time and experience, time and education
Observations	96	96	72	72

Four time periods considered by pooling 1994-1996, 1997-1999, 2000-2002 and 2003-2005. Standard errors in parenthesis.