In Light of the Brexit: a Sectoral Employment Analysis of the UK Labour Market after the EU Enlargement of 2004

Bachelor Thesis

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Abstract

Who needs migrants? In the run up to the Brexit referendum, immigration of EU migrants to the UK was among the fiercest debated themes, in particular concerning migrants from the post 2004 EU Accession countries. Using local authority data, this thesis examines how the UK labour market behaves when buffeted with a labour supply shock from these countries. It assesses how unemployment rates developed and further dissects the analysis to how sectoral employment rates responded to such shock by calculating elasticities using spatial correlation regressions. This thesis finds that the UK labour market does not necessarily behave according to simple textbook models. These textbook models predicts an increase in total employment under inflows of migration, yet when regressing using spatial correlations overall unemployment rates showed a very slight increase under increased immigration. Sectoral employment regressions show that agriculture employment experienced a very slight decrease too. There is no evidence that immigration had an effect on manufacturing employment. Transport employment did behave according to textbook models, a slight increase of employment was observed under inflows of migrants. Magnitudes of the effects of immigration on the UK labour market are tiny, unlike its impact on public perception.

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Introduction

Nobel prize economists Angus Deaton and Paul Krugman have called it the lump of labour fallacy: it is the idea that there is a fixed amount of jobs in an area, such that any increase in workers must necessarily lead to a decrease in the number of available jobs (Krugman, 2003). It is this fallacy that seems to have dominated the immigration debate in the British referendum on the European Union (Blinder, 2015)

When the A8[1] countries joined the European Union in 2004, the migrant population increased significantly (Rienzo & Vargas-Silva, 2015). The vast majority of the immigrants from the A8 countries in terms country of birth are Polish immigrants. Unlike all other EU15 countries[2] the UK, Ireland and Sweden did not impose restrictions of A8 citizens to access their labour market. As long as these immigrants registered in the Workers Registration Scheme (WRS), these A8 migrants were free to legally work in the UK. When the A2 countries[3] joined in 2007, the UK did impose restrictions (Vargas-Silva & Markaki, 2015).

Country of birth	Percentage share	Nationality	Percentage share
INDIA	9.2	POLAND	15.1
POLAND	9.1	INDIA	7.3
PAKISTAN	6.0	IRELAND	6.2
IRELAND	4.4	ITALY	3.6
GERMANY	3.6	PAKISTAN	3.6
SOUTH AFRICA	2.5	ROMANIA	3.5
NIGERIA	2.4	LITHUANIA	3.3
BANGLADESH	2.4	PORTUGAL	3.2
ROMANIA	2.2	FRANCE	3.0
UNITED STATES	2.0	GERMANY	2.7

Figure 1: Top ten sender countries of migrants by country of birth and nationality, UK 2014.

Source: Rienzo & Vargas-Silva (2015)

1 The A8 countries: Poland, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Slovakia, Slovenia

2 The EU 15 countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.

3 The A2 countries: Romania and Bulgaria

The presence of foreign-workers in the UK have grown relatively fastest in the low-skilled sectors and occupations (Rienzo, 2016). Simple textbook economic theory predicts that in the short-run, regardless of immigrants being substitutes or complements, total employment always increases, hence we want to test how the immigrants from the A8 and A2 countries have affected employment in the UK labour market i.e. who needs these migrants? We conduct this research using local authority unemployment data taken from 322 UK local authorities and further dissect the research using sectoral employment data from UK local authorities in the primary (agricultural), secondary (manufacturing) and tertiary (transport) sector.

Research question: How have A8 and A2 immigrants affected employment in the UK labour market?

Hypothesis 1: Inflows of A8 and A2 immigrants have not led to an increase in employment any sector in the UK labour market

Hypothesis 2: Inflows of A8 and A2 immigrants have led to an increase employment in at least one sector in the UK labour market.

The thesis is structured as follows, section 1 introduces the theoretical framework of the thesis. Section 2 explains the methodology of the analysis and the data used. The results obtained are shown in section 3. Next, section 4 discusses and interprets the results. Lastly section 5 concludes the thesis.

I. Theoretical Framework

Short-run analysis

The simplest models of the impact of immigration on the labour market rest upon the assumption whether immigrants are perfect substitutes or complements to native workers (Wolla, 2014). Outcomes of the analysis differ depending on the assumption used.

Immigrants as substitutes

Given is a simple supply and demand model, where the downward sloping line denotes the labour demand from firms and the upward sloping line denotes the labour supply of workers. The y-axis denotes the wage at which any firm would hire or worker would work, given its respective labour demand or labour supply function. The x-axis denotes the amount of workers employed.

If migrants are assumed to be perfect substitutes to native workers, then the labour supply curve shifts outwards. As a result the equilibrium wage decreases from w_0 to w_1. Note also that employment of natives has decreased from N_0 to N_1, since natives are unwilling to work at the prevailing lower wage w_1, but that total employment has increased from N_0 to E_1

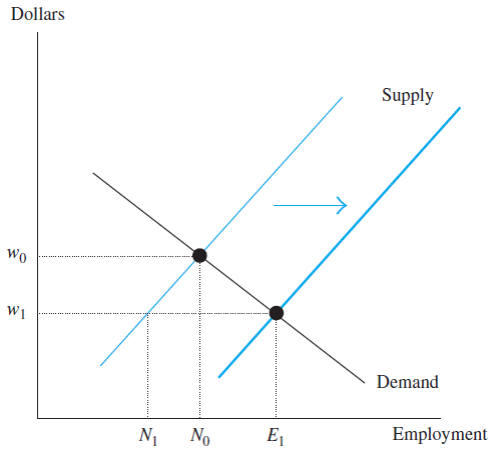

Figure 2

Immigrants as complements

If migrants are assumed to be perfect complements when they differ in skills to native workers. The labour demand curve then shifts outwards. Migrants and natives do not compete in the same labour market. In case the migrants possess lower skills than natives, this allows native workers to specialize at jobs, better suited to their skills hence increasing their productivity. This is reflected in the figure by an increase of the wage from w_0 to w_1. The higher wage drives an increase in total employment from N_0 to N_1, as native workers who previously refused to enter the labour market at wage w_0, are incentivized to work at wage w_1. Again total employment increases, regardless whether migrants are substitutes or complements.

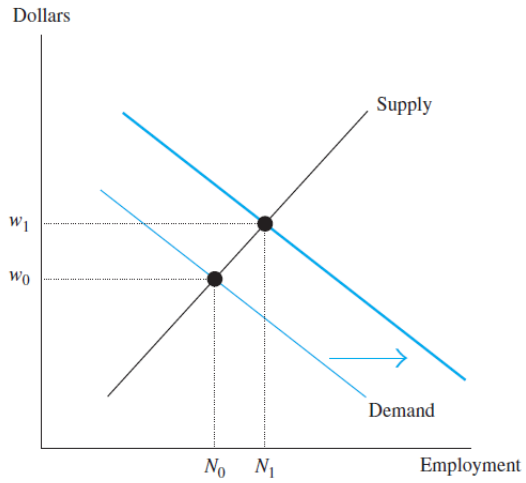

Figure 3

Long-run analysis

For the long-run analysis we need an aggregate production function (Borjas, 2013). Suppose the aggregate production function of a country can be modelled by a Cobb-Douglas function:

$$q = K^{\alpha} A L^{1-\alpha} \qquad (1)$$

Where q denotes the quantity of output, K the capital stock, A is the labour augmenting technology, and L the labour stock. α describes an arbitrary parameter and is defined for $0 < \alpha < 1$. Furthermore expression (1) exhibits constant returns to scale.

The return of capital r is given by the partial derivative with respect to K of expression (1) multiplied by the price p of 1 output q:

$$r = p * MPK = p\frac{\partial Q}{\partial K} = p\alpha A\left[\frac{K}{L}\right]^{\alpha-1} \qquad (2)$$

Likewise, the wage is given by the partial derivative with respect to L of expression (1) multiplied by the price p of 1 output q:

$$w = p * MPL = p\frac{\partial Q}{\partial L} = p(1-\alpha)A\left[\frac{K}{L}\right]^{\alpha} \qquad (3)$$

When in the short-run, a labour market shock in a market with perfect substitutable workers occurs i.e. an increase in L in expression (2) + (3), such shock would raise the return of capital r and lower the wage w. An increase in the return of capital, subsequently leads to an increase in the capital stock K, which in turn pushes the return of capital back to its long-run value i.e. the variable r has a fixed long-run value.

If the variable r has a fixed long run value – assuming p is constant – then it can be shown that $\left[\frac{K}{L}\right]$ too must have a fixed long-run value. In other words, a labour market that is shocked in the short-run with perfect substitutable workers, will increase the return of capital and lower the wages. As a result, employers will take advantage of this by investing more in capital, raising the capital-to-labour ratio in the economy. Eventually due to the higher capital-to-labour ratio, workers become more productive, which in the end leads to an increase in wages.

The important insight is that the decrease in wages in the short-run, is counterbalanced by the return of capital, such that in the long-run, the wages return to its initial value. Thus, the effect of migration on wages is nil, *in the long-run the return of capital and wages are constant* (Borjas, 2013).

II. Data and Methodology

Methodology

Spatial correlation

The predominant empirical strategy to estimate the effect of immigrants on the unemployment rate of natives or the overall unemployment level is to use spatial correlations (Borjas, 1999). The spatial correlation is defined as the correlation between labour market outcomes in a locality and the extent of immigrant penetration. The spatial correlation would identify this relation accurately if the following two conditions hold: immigrant flows penetrate labour markets in the host country randomly *and* if natives do not respond to these supply shocks. The majority of the empirical studies in this literature define the labour market as a geographical entity, such as the City of London or the metropolitan county Greater Manchester.

The generic regression model used in the spatial correlation literature is (Ashenfelter & Card, 1999):

$$\Delta y_{j,s}(t,t') = \beta_t \Delta m_{j,s}(t,t') + X_{j,s}(t)\alpha_t + u_{j,s}(t,t') \qquad (4)$$

Where $\Delta y_{j,s}(t,t')$ is the change of employment opportunities experienced by natives who live in region j and belong to skill group s between the years t and t'; $\Delta m_{j,s}(t,t')$ is a measure of the immigrant supply shock in that region for that skill group over the (t,t') time interval; X is a vector of control variables; and $u_{j,s}(t,t')$ is a residual term.

We modify expression 1 by estimating the effect of the immigrant share on overall labour market outcome (Dustmann, Fabbri & Preston, 2005) i.e. the effect of immigration on the unemployment rate in the local authority. This is done by estimating the following regression model differencing for the years 2011 and 2001:

$$\Delta y_i = \beta_0 + \beta_1 \Delta x_i + u_i \qquad (5)$$

Where y is the unemployment rate in the local authority or for the sectoral analysis the sectoral employment in the local authority, x is the immigrant share

in the local authority, and u is a residual. The subscript i denotes the local authority.

Control variables

Naturally unemployment rates would differ among local authorities even in the absence of any immigration. Thus crucially, when comparing the effect of immigrants on the unemployment rate across areas, we need to control for factors such as age or education levels that result in dispersion of unemployment rates across local authorities when estimating a spatial correlation.

To avoid omitted variable bias we add age as a control vector. We control for the population age in a local authority using the mean age since age is a determinant of local unemployment. Youths always have a higher unemployment rate than adults (Barwell, 2000). Youths experience higher unemployment rates due to firms being constrained by 'last in, first out' rules. Where the freshly hired worker is more prone to be laid off rather than the seasoned worker. Another explanation is that youths have acquired less firm specific workplace human capital, making them less costly to lay off i.e. when economic conditions improve youths which have little firm specific skills will be in ample supply. Lastly, youths may have a higher propensity to quit jobs. Omitting the variable age in the regression model would result in spurious correlation.

Furthermore we add a vector for education level in the locality. Higher levels of education results in a lower probability of unemployment (Mincer, 1999). Mincer cites three reasons why educated workers experience a lower chance of being laid off and shorter unemployment duration. First costs of on-the-job search for new employment relative to costs of searching while unemployed are lower for more educated workers; second higher educated workers are more efficient in acquiring and processing job search information; and lastly firms and workers search more intensively to fill more skilled vacancies. We thus expect that in local authorities with a higher proportion of educated workers, lower unemployment rates are observed.

Data description

Local authority level data for all variables are obtained from the 2001 and 2011 Census conducted by the Office for National Statistics. The Office for National Statistics (ONS) is the UK's largest independent producer of official statistics and is the national statistical institute for the UK.

As for the statistical geographical demarcation of the cities we use the 2011 Statistical Geography Hierarchy, defined by the ONS. The dataset only consists of data for the country England, the other countries of the UK which are Scotland, Wales and Northern-Ireland are not part of the dataset. A total amount of 322 local authorities are included in the data set.

Important to note is that the variables used for the analysis and displayed in table 1 is the *first differenced* variable from the census data in 2011 with the census data in 2001. All variables except for age in table 1 should be read as percentage increases or decreases. Age should be read as changes in years.

Defining the variables

Unemployment follows the definition of the ONS: a person is defined as unemployed if he or she is usually resident in the area and aged between 16-74 years old. He or she is not in employment and is available to start work in the next 2 weeks and has either looked for work in the last 4 weeks or is waiting to start a new job.

Agricultural employment is defined as the % of people aged 16 years or older and usually resident in the local authority that is employed in the agricultural sector. Likewise, manufacturing employment is defined as the % of people aged 16 years or older and usually resident in the local authority that is employed in the manufacturing sector. Lastly transport employment is defined as the % people aged 16 years or older and usually resident in the local authority that is employed in the transport sector.

The immigrant share is the defined as the amount of residents with Poland or Romania as country of birth and usually resident in the area divided by the total

usually resident population of the area. We opt for these resident populations as they comprise the vast majority of A8 and A2 immigrants in the UK.

The mean age is defined as the mean age of the usually resident population of the area at the time of the Census. Mean age is calculated by dividing the sum of each person's age by the number of people. Ages used are the age at last birthday (in whole years).

Education Tier 1 is calculated as the amount of people usually resident in the area aged 16 and over with as highest qualification, no qualification divided by the total usually resident population of the area. Similarly Education Tier 2 is the % of people usually resident in the area aged 16 and over with as highest qualification 5+ O Level (Passes) or equivalent. Education Tier 3 is the % of people usually resident in the area aged 16 and over with as highest qualification 2+ A Levels or equivalent and Education Tier 4 is the % amount of people usually resident aged 16 and over with as highest qualification a degree (BA, BSc), Higher Degree (MA, PhD, PGCE) or equivalent.

Table 1: Description of Variables

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Unemployment	322	0.965	0.542	-0.820	2.790
Agricultural Employment	322	-0.726	0.460	-2.449	-0.0745
Manufacturing Employment	322	-5.807	1.961	-14.09	0.140
Transport Employment	322	-1.996	1.120	-6.255	0.944
Immigrant Share	322	0.960	0.920	0.0586	5.831
Age	322	1.052	1.007	-2.680	3.470
Education Tier 1	322	-6.008	1.693	-14.29	-2.920
Education Tier 2	322	-4.288	1.461	-9.800	-0.471
Education Tier 3	322	4.141	1.858	-3.796	7.684
Education Tier 4	322	7.630	1.545	1.149	11.59

Explaining the trends

During the period 2001-2011, we observe an increase in the mean unemployment as well as a decrease in employment in the primary, secondary and tertiary sector. Of the three sectors, manufacturing employment shows the largest contraction, with a mean decrease of almost -6%. The explanation for these figures is the unfolding of the Great Recession in 2008 and the Eurozone Debt Crisis in 2009, resulting in a nation-wide spike in unemployment rates.

We observe that during the period 2001-2011, the population in England aged. The mean age increased by 1 year, with a maximum increase of 3.5 years. In some local authorities the demographic population became younger, a minimum of -2.6 years is observed.

In the same time interval, the resident population became higher educated. The resident population that belonged to education tier 1 and tier 2 decreased, with the strongest progress observed for tier 1: the resident population with as highest qualification no qualification decreased on average by 6%, with some localities even -14.3%. On the flipside, the proportion of higher educated people increased. The resident population that had a degree as highest qualification increased on average by 7.6%.

We thus observe that the UK population progresses like most other advanced economies. The population becomes older and higher educated.

III. Results

Overall unemployment

The basic relationship between overall unemployment and the immigrant share is displayed in the in table 2, model 1. The estimated effect is sensitive to which specific control variables are used. When controlling for the variable age as in model 2, the coefficient of the immigrant share is cut by half. The significance level for the immigrant share drops from the 1% level to the 10% level. Age is significant at the 5% level. In model 3, adding the variable education tier 1 has negligible effect on the coefficient of the immigrant share. The individual significance level of the coefficient of education tier 1 is insignificant. The null-hypothesis that this coefficient is zero is not rejected. The coefficient of the immigrant share remains significant at the 10% level. In model 4, adding the vector education tier 2 results in an increase of the immigrant share coefficient. The significance level of the immigrant share increases from the 10% level to the 5% level. Furthermore education tier 2 is significant at the 10% significance level.

When adding education tier 3 in model 5, the coefficient of the immigrant share jumps from 0.087 to 0.143. Thus an increase in the immigrant share of 1% increases the overall unemployment rate in a local authority by 0.143%, holding other regressors constant. The significance level of the immigrant share also increases from the 5% significance level to the 1% level, compared to model 4. Age, education tier 1 become individually statistically significant at the 1% level, as education tier 3. Also, changes for the coefficients of age, education tier 1 and education tier 2 observed. Education tier 2 becomes statistically insignificant.

In model 6 adding the variable education tier 4 does not contribute much to the analysis. The effect of education tier 4 on the coefficient of the immigration share is tiny, with as effect mainly a widening standard error of the immigrant share coefficient. Furthermore the coefficient of education tier 4 is individually statistically insignificant.

Thus since the control variables education tier 4 is redundant, we arrive at model 5 as our final model. Where increasing the immigrant share by 1% leads to an increase in the unemployment rate of the local authority by 0.143%, holding

other regressors constant. The constant is interpreted as, if the change in immigrant share is equal to zero between 2001 and 2011, the OLS estimate would predict an unemployment rate change by 1.25% between 2001 and 2011.

The R-squared of all models are generally low. Ranging from 0.04 to 0.28. The regression models limitedly explain the variation in employment and are no potent predictors of local unemployment. The signs of the coefficients for the immigrant share on unemployment are consistent with the literature (Baas, Brücker, & Hauptmann, 2010). More on this in the discussion section.

Table 2

The effect of the immigrant share on local authority unemployment rates

Dependent Variable: Unemployment Local Authority	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	1	2	3	4	5	6
Immigrant Share	0.124***	0.0682*	0.0668*	0.0870**	0.143***	0.141***
	(0.0320)	(0.0396)	(0.0396)	(0.0422)	(0.0382)	(0.0512)
Age		-0.0950**	-0.0848**	-0.0943**	-0.218***	-0.217***
		(0.0429)	(0.0424)	(0.0435)	(0.0453)	(0.0457)
Education Tier 1			-0.0204	0.0223	0.0939***	0.0932***
			(0.0247)	(0.0387)	(0.0279)	(0.0318)
Education Tier 2				0.0665*	0.0453	0.0437
				(0.0352)	(0.0306)	(0.0487)
Education Tier 3					0.138***	0.138***
					(0.0256)	(0.0257)
Education Tier 4						-0.00165
						(0.0374)
Constant	0.846***	1.000***	0.868***	1.400***	1.245***	1.247***
	(0.0404)	(0.0877)	(0.168)	(0.376)	(0.278)	(0.284)
Observations	322	322	322	322	322	322
R-squared	0.044	0.067	0.070	0.086	0.194	0.194

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Primary sector employment

In table 3 we analyze the effect of the immigrant share on employment in the total employment in the agricultural sector in each local authority. Model 1 suffers from omitted variable bias, since adding the variable age in model 2 results in a switch of the sign of the immigrant share coefficient. Furthermore the significance level of the variable immigrant share decreases from the 1% significance level to being statistically insignificant. The null-hypothesis that the coefficient of the immigrant share is zero is not rejected. Age is individually significant at the 1% level.

In model 3 the variable education tier 1 is added. The immigrant share coefficient remains statistically insignificant, with no switches in sign nor large differences in the coefficient. Both the variable age and education tier 1 are statistically significant at the 1% level. In model 4 when adding the variable education tier 2, the immigrant share coefficient increases slightly, but remains individually statistically insignificant. This holds too for the education variables. Age continues to be statistically significant at the 1% level. In model 5, we add education tier 3 as a control variable. The immigrant share coefficient shows a decrease, and again the null-hypothesis cannot be rejected. The coefficient of education tier 1 shows a slight decrease with the significance level displaying a jump from being statistically insignificant to significant at the 5 % level. Age shows little difference from the previous models.

In model 6, we add education tier 4. Large differences occur in model 6 compared to model 5. The immigrant share coefficient show a relatively large decrease from -0.034 to -0.137 and the coefficient is statistically significant at the 1% level. Thus the null-hypothesis that the coefficient is zero can be rejected at the 1% level. An 1% increase in the immigrant share leads to a -0.137% decrease in the employment share in agriculture, given constant control variables. Significance levels of age, education tier 1, education tier 2 and education tier 4 are at the 1% level, with the only exception education tier 3.

The final model is model 6 where we include all control variables. The constant is interpreted as if the change in the immigration share is equal to zero between 2001 and 2011, the OLS estimate would predict a decrease in agricultural

employment by -0.37 %. Like in the overall unemployment model, the agricultural regression model exhibits a low R-squared. The model is not an accurate predictor of the agricultural employment share.

Table 3

The effect of the immigrant share on agricultural employment in local authorities

Dependent Variable: Agricultural Employment	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	1	2	3	4	5	6
Immigrant Share	0.113***	-0.0311	-0.0340	-0.0267	-0.0340	-0.137***
	(0.0327)	(0.0367)	(0.0376)	(0.0405)	(0.0420)	(0.0454)
Age		-0.245***	-0.223***	-0.227***	-0.211***	-0.203***
		(0.0249)	(0.0278)	(0.0274)	(0.0280)	(0.0271)
Education Tier 1			-0.0441***	-0.0286	-0.0380**	-0.0890***
			(0.0115)	(0.0177)	(0.0175)	(0.0185)
Education Tier 2				0.0240	0.0268	-0.0974***
				(0.0229)	(0.0237)	(0.0326)
Education Tier 3					-0.0181	-0.00670
					(0.0149)	(0.0167)
Education Tier 4						-0.123***
						(0.0189)
Constant	-0.835***	-0.438***	-0.724***	-0.531***	-0.511**	-0.368**
	(0.0392)	(0.0514)	(0.0990)	(0.193)	(0.197)	(0.187)
Observations	322	322	322	322	322	322
R-squared	0.051	0.257	0.280	0.283	0.286	0.352

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Secondary sector employment

In table 4 we regress the immigrant share on the employment share of manufacturing, controlling for age and education. Across models 1-6, the spatial correlation estimates does not result in a stable coefficient of the immigrant share neither a significant coefficient. The sign of the coefficient of the immigrant share in model 6 is positive but insignificant. The null-hypothesis that the immigrant share is equal to zero is not rejected. In model 6 a 1% increase in the immigrant share leads to a 0.191% increase in the employment share in manufacturing. The constant is interpreted as if the change in the immigration share is equal to zero between 2001 and 2011, the OLS estimate would predict a decrease in manufacturing employment by -1.7%. The spatial correlations estimates show that there is no evidence that the immigration share has an effect on the employment in the manufacturing sector.

Table 4

The effect of the immigrant share on manufacturing employment in local authorities

Dependent Variable: Manufacturing Employment	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	1	2	3	4	5	6
Immigrant Share	0.250*	0.163	0.204	0.0992	0.0555	0.191
	(0.141)	(0.171)	(0.155)	(0.168)	(0.181)	(0.209)
Age		-0.147	-0.455***	-0.406***	-0.309***	-0.319***
		(0.128)	(0.114)	(0.108)	(0.118)	(0.117)
Education Tier 1			0.616***	0.395***	0.339***	0.406***
			(0.0776)	(0.0971)	(0.105)	(0.107)
Education Tier 2				-0.344***	-0.327***	-0.164
				(0.109)	(0.105)	(0.139)
Education Tier 3					-0.108	-0.123*
					(0.0687)	(0.0701)
Education Tier 4						0.162**
						(0.0796)
Constant	-6.046***	-5.808***	-1.820***	-4.573***	-4.452***	-4.639***
	(0.169)	(0.286)	(0.464)	(0.978)	(0.906)	(0.919)
Observations	322	322	322	322	322	322
R-squared	0.014	0.018	0.272	0.304	0.309	0.315

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Tertiary sector employment

Table 5 shows the results of the differences OLS estimates when regressing the immigrant share on the employment share of the transport sector. In model 1, when not controlling for age, education the coefficient of the immigrant share is slightly negative and statistically not significant. Controlling for age in model 2, results in a switch of the sign: the coefficient of the immigrant share turns positive. However, again as in model 1 we cannot reject the null-hypothesis that the coefficient of the immigrant share is equal to zero. The coefficient of age in model 2 is positive and individually statistically significant at the 1% level.

Controlling for education tier 1 in model 3 results in a drop of the coefficient of the immigrant share compared to model 2, by approx. -0.02, though it is still statistically insignificant. The coefficient of age increases and remains significant at the 1% level, like education tier 1. The immigrant share coefficient becomes significant at the 1% level, when we control for education tier 2, as in model 4. We reject the null-hypothesis: there is evidence the immigrant share does affect the employment share in the transport sector. We also observe an increase in the coefficient by roughly 0.1, from 0.10 to 0.21. The coefficient of age adjusts slightly and remains significant at the 1% level as is education tier 2. Education tier 1 shows an increase in the coefficient to slightly negative, and is not significant anymore.

In model 5, adding education tier 3 yields an increase 0.06 in the coefficient of the immigrant share. It remains significant at the 1% level. The coefficients of age and education tier 2 show a drop, whereas the coefficient of education tier 1 switches sign. Age and education tier 2 and 3 are individually significant at the 1% level, education tier 1 is not significant. In model 6, we again observe an increase in the coefficient of the immigrant share, when we control for education tier 4. Compared to model 5, the coefficient increases by 0.03, from 0.273 to 0.306. Furthermore it remains significant at the 1% level. No sign switches are observed for the control variables compared to model 5, nor do they show changes in the

significance levels. For the final model we use model 6, including all control variables.

The constant in the transport sector is interpreted as in the other sectoral models: if the change in the immigration share is equal to zero between 2001 and 2011, the OLS estimate would predict a decrease in transport employment by -1.78 %. Also the transport sector models differs compared to the previous models of the other sectors, in terms of the R-squared. The maximum R-squared in the transport sector models is 0.396. The transport sector model explains more in the variation of the data, hence they are better predictors of the employment share in the transport sector compared to the models in the other sectors.

Table 5

The effect of the immigrant share on transportation employment in local authorities

Dependent Variable: Tranportation Employment	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	1	2	3	4	5	6
Immigrant Share	-0.0957	0.121	0.102	0.210***	0.273***	0.306***
	(0.0781)	(0.0898)	(0.0777)	(0.0701)	(0.0641)	(0.0865)
Age		0.368***	0.514***	0.464***	0.323***	0.321***
		(0.0654)	(0.0611)	(0.0629)	(0.0637)	(0.0640)
Education Tier 1			-0.292***	-0.0645	0.0169	0.0335
			(0.0433)	(0.0555)	(0.0424)	(0.0530)
Education Tier 2				0.354***	0.330***	0.371***
				(0.0790)	(0.0746)	(0.108)
Education Tier 3					0.157***	0.153***
					(0.0423)	(0.0430)
Education Tier 4						0.0400
						(0.0622)
Constant	-1.904***	-2.500***	-4.392***	-1.553**	-1.729***	-1.775***
	(0.0864)	(0.141)	(0.295)	(0.674)	(0.627)	(0.637)
Observations	322	322	322	322	322	322
R-squared	0.006	0.084	0.260	0.362	0.395	0.396

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

IV. Interpretation and Discussion

Addressing endogeneity

To assess whether immigration have led to employment gains, we need to rule out endogeneity for the spatial correlation expressions (5). A statistical model would suffer from endogeneity when the regressor is correlated with the error term. As such we then cannot identify the causal effect between the immigration share and the unemployment or sectoral employment. There would be a case of endogeneity if the direction of causality would run in both directions i.e. simultaneous causality (Stock & Watson, 2013). Thus in expression (5), we need to establish whether immigrant shares in local authorities are true causes of unemployment, and rule out the reverse i.e. unemployment have caused higher immigrant shares in local authorities. The latter would be the case if immigrants would tend to settle in impoverished local authorities. A possible solution to this problem, is to see if A8 and A2 immigrants randomly settle among local authorities. An even distribution of immigrants across England would rule out the tendency of immigrants to settle in impoverished local authorities.

For the sectoral employment models of expression (5), we need to assure that immigrants are true causes of increased employment in the three sectors, and not that employment opportunities in the three sectors have caused higher immigrant shares in the local authorities. Again identifying an even distribution of A8 and A2 immigrants would eliminate the reverse causation scenario. If immigrants would settle evenly, this would rule out the tendency immigrants settling in local authorities with employment booms in certain sectors.

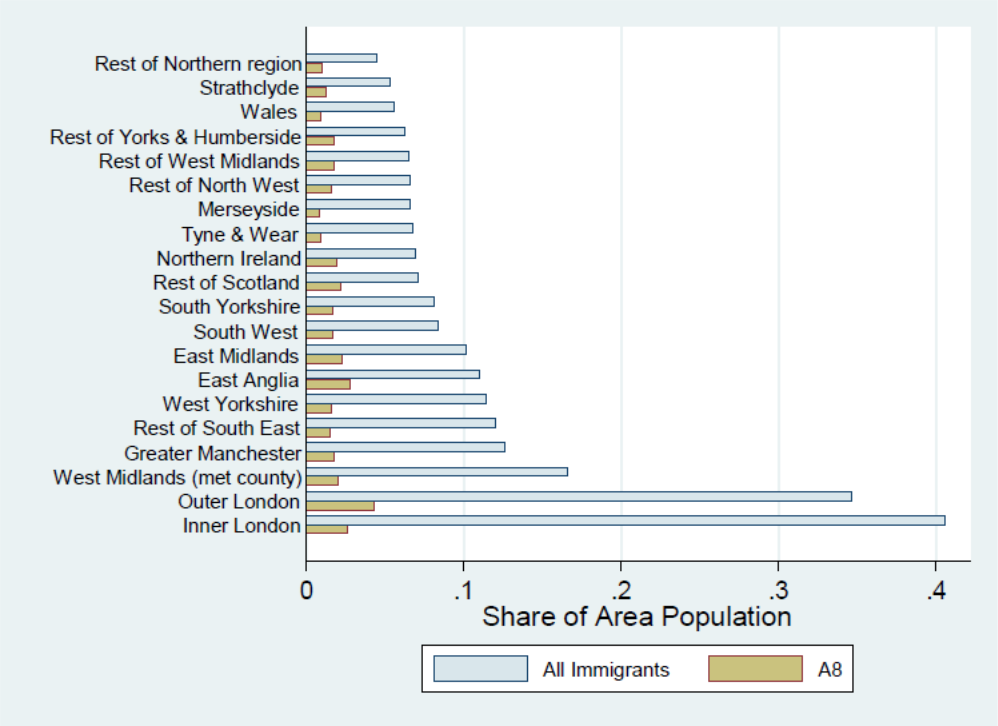

Figure 4: Immigrant Share in Regional Population, UK 2014.

Source: Wadsworth (2015)

Figure 4 shows the geographical distribution of A8 immigrants in the UK across its regions. It shows a relatively dispersed distribution of A8 immigrants compared to the other immigrants in the UK. Even though this is data from 2014, we can still assume this distribution to approximately hold for the years 2001-2011 as for the A2 immigrants. Since ultimately the distribution immigrants is determined by the skill-set of the immigrants, the vast majority of the A8 immigrants then and now still possess low skill sets (Rienzo, 2016). Hence, the skew for the London regions for the non A8 - immigrants, particularly immigrants with a high skill-set are demanded for work there, most presumably in the financial sector.

Moderate magnitudes

In the overall unemployment model we observe a very tiny positive effect of the immigration share on the unemployment in local authorities. Dissecting the data further for the primary, secondary and tertiary sectors, we observe that not all sectors respond to the immigration share the same way as the overall

unemployment model. The transportation sector shows employment *gains*, with higher immigration shares, whereas the agricultural sector shows employment losses. The effect of immigration on manufacturing is ambiguous.

Starting off with the overall unemployment rate model, the model shows that UK labour market does not behave according to the textbook models. The sign of the coefficient of immigration is positive, whereas theory predicts it should be negative. The tiny magnitude of the elasticity of immigration on the unemployment rate can be explained due to the capital stock adjusting even in the short-term, as outlined in the theoretical framework (Baas et al, 2010). An increase of the immigration share by 1% yields an increase of 0.145% in the unemployment rate in the local authority. This is small when offset against the aggregate production gains in the UK due to immigration calculated by (Baas et al, 2010). The European Union enlargement resulted in a short-run effect of a 0.5% increase in British GDP, where short-run is defined in the model as the incomplete adjustment of the physical capital stock.

For the agricultural sector we observe a negative relationship between the immigrant share and agricultural employment. This might be that in most advanced economies agriculture has and is continuing to experience labour substitution for capital, in order to achieve higher productivity rates (Broadberry & Mahony, 2007). Advanced economies simply cannot compete in terms of labour costs in the world economy. The inflow of A8 and A2 immigrants working as seasonal workers cannot offset this trend of reduced employment.

The effect of the immigrant share manufacturing sector ambiguous. The model gives a positive but insignificant coefficient. We should expect that in low-skilled industries, an increase of cheaper low skilled labour would result in an increase in employment in the manufacturing sector. A possible explanation is that the data contains both the high and low skilled manufacturing sector such that the OLS estimates cannot pick up the effect of the immigrant share on the sector they work in i.e. the low-skilled manufacturing.

In the transport sector we observe a positive relationship between the immigrant share and the employment in the transport sector. A 1% increase in the immigration share leads to a 0.282% increase in the employment of the transport

sector. Unlike the agricultural model, the transport model does confirm the literature and theory: the sign of the coefficient is positive. Compared to the agricultural sector, the transport sector did not experience the same extent as labour substitution as the agricultural sector. Lorry's still need to be driven around, parcels need to be sorted and ships still need to be loaded. It also is a relatively homogenous sector in terms of skills-sets contrary to manufacturing which can range from assembling radio controlled toy cars to designing airplane wings. Thus the OLS estimate of transport model does not suffer from the same problems as the manufacturing model hence picks up the effect of the immigrants share on the employment in the transport sector more accurately.

Estimation bias: financial crisis

A source of bias in all the OLS estimates is the financial crises of the late 2000's: the Great Recession (2008) and the Eurozone Debt crisis (2009). This is clearly seen in the descriptive statistics table 1: mean increases of unemployment, mean decreases for agricultural, manufacturing and transport employment. This implies that the OLS estimates of the overall unemployment are biased upwards. Without a financial crises unemployment data would have been lower, resulting in a less steep slope of the regression model. By the same token, the sectoral OLS estimates are biased downwards, without financial crises, employment levels in the three sectors would have been higher, resulting in steeper slopes of the OLS estimates.

V. Conclusion

The labour supply shocks of A8 and A2 immigrants into the UK economy seem to have moderate effects on the labour market. Contrary to what theory predicts, unemployment level tend to increase under increased immigration, but the magnitudes are very small. The capital stock adjusts even in the short term, dampening the effects of the labour supply shock (Baas, Brücker, & Hauptmann, 2010). Dissecting the data further over employment sectors a diverse picture shows up. Employment in the agricultural sector seems to contract with an increase of the immigrant share. However this effect might be confounded by labour substitution in the sector. The effect on manufacturing is ambiguous. Manufacturing employment can include both low skill-sets and high skill-sets, which makes the estimates less reliable. The transportation confirms the theory, an increase in the labour supply leads to an increase in the employment of the transportation sector.

In conclusion, we reject hypothesis 1 and accept hypothesis 2. The results of this paper confirm the magnitudes of the effects of A8 and A2 immigrants on the UK labour market in the literature in the sense that they are generally moderate. Moreover, since the capital stock adjusts even in the short-term, adjustments to the long term scenario in which the effect of immigration on the labour market is nil, might take shorter than expected. Furthermore, in particular the transportation sector has benefited from the inflow in immigrants, hence the additionally generated employment. An immigration stop would deliver a blow for this sector.

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