Tsukuba Economics Working Papers
No. 2018-003

Did the Presence of Immigrants Affect the Vote Outcome in the Brexit Referendum?

by
Mizuho Asai

and

Hisahiro Naito

May 2018

UNIVERSITY OF TSUKUBA
Department of Economics
1-1-1 Tennodai
Tsukuba, Ibaraki 305-8571
JAPAN

Did the Presence of Immigrants Affect the Vote Outcome in the Brexit Referendum?

Mizuho Asai*
College of International Studies
University of Tsukuba

Hisahiro Naito †
Program of Economic and Public Policy
Graduate School of Humanities and Social Sciences
University of Tsukuba

May 2018

*Address: Tennodai 1-1-1, Tsukuba, Ibaraki, 305-8573; e-mail: s201410344@u.tsukuba.ac.jp
†Address: Tennodai 1-1-1, Tsukuba, Ibaraki, 305-8573; e-mail: naito@dpipe.tsukba.ac.jp

Abstract

This study examines the effect of the presence of immigrants on voters' behaviour, using a data set of the UK referendum on the exit from the European Union and survey data on individuals' attitudes towards accepting immigrants. We apply the instrumental variable estimation to control for the bias due to the endogeneity of the immigrant ratio and omitted variables. To construct the instrumental variable, we use information on past industrial composition, including current industry composition as a control variable. We also instrument the current claimant rate. Contrary to popular media coverage, we find that the effect of the presence of immigrants on the vote outcome is small and not statistically significant. We also show that the survey result on attitudes towards accepting immigrants is consistent with the estimation results based on the vote outcome.

JEL Classification: C25

Keywords: Voting behaviour, immigration, Brexit

1 Introduction

The presence of immigrants and influx of refugees have had a major effect on domestic politics in Europe and the United States. One point of contention for the British referendum on Brexit in June 2016 concerned stopping the influx of immigrants from other EU countries by withdrawing from the Union. In the 2016 US presidential election, then candidate Donald Trump argued for a tough stance on illegal immigrants, with building a wall on the border with Mexico one of his campaign promises. He also suggested that he wanted to restrict visa issuance for legal immigrants and guest workers, including a stop on green cards. Despite being distinctly against immigration, he was nonetheless elected as the 45th President of the United States. In the first round of the French presidential election on 23 April 2017, anti-immigration and anti-EU advocate Marine Le Pen came second, thus advancing to the final round. Similar developments have also unfolded in other European countries.[1]

A natural question here is whether voters' support for anti-immigration ideas stems from the presence of immigrants whose languages and customs are different from their own, the influence of the media or politicians, or the economic difficulties occurring around the same time. If the presence of heterogeneous immigrants itself is causing the anti-immigration behaviour of fellow citizens, then progressive economic globalization should intensify domestic anti-immigration trends. Yet, if anti-immigration voting behaviour stems from the influence of the media and politicians or concurrent economic difficulties, then an alleviation of those difficulties or spread of correct information will reduce anti-immigration sentiment.

This study examines whether an increase in the proportion of immigrants affected Brexit voting behaviour, using both vote outcome data on the referendum and British survey data on people's feelings towards immigrants.

For any empirical study that examines the causal effect of the presence of immigrants on voting behaviour, two issues need careful treatment from the point of view

[1] In Hungary, Prime Minister Orbàn, re-elected in 2010, is using the refugee issue to provoke anti-EU feelings, such as becoming more authoritarian, restricting the right to free speech, and limiting the power of the EU. In the 2015 Polish parliamentary election, the anti-immigrant conservative party Law and Justice (PiS) won an absolute majority. PiS gained control over the Polish Constitutional Court and is turning more authoritarian.

of econometrics. The first issue is omitted variable bias. When a multivariate analysis is applied, the inclusion of a limited set of control variables may be insufficient. In such a case, the estimated coefficient includes not only the effect of an increase in the immigrant ratio but also the effect of omitted variables such as local characteristics.

The second issue is the bias due to the endogeneity of the immigrant ratio. If there is an area where local residents are more tolerant of immigrants, immigrants may inflow to such an area. In this case, if we run an ordinary least squares (OLS) regression and regress the number of approval votes to remain in the EU, which implies not opposing the influx of immigrants, on the immigrant ratio, the estimated coefficient of the immigrant ratio can be positive. However, such a relationship does not necessarily mean that an exogenous increase in the immigrant ratio would increase the approval vote to remain in the EU. An estimated positive coefficient simply reflects the sorting of immigrants through their endogenous location choice.

To address omitted variable bias and endogeneity bias, we employ an instrumental variable (IV) estimation method, using as the IV the predicted immigrant ratio in 2001, which was predicted by using information on past (2001) industry composition, while controlling for current (2011) industry composition. Once we control for current industry composition and past and present demographic characteristics, industry composition in 2001 is unlikely to affect attitudes towards immigrants. On the contrary, past industry composition affects the past immigrant ratio, which then influences the current immigrant ratio because of the slow mobility of immigrants across electoral areas. This finding implies that the predicted past immigrant ratio, which is a function of past industry composition, satisfies the condition of a valid IV. To check the robustness, we conduct various regression estimations by using different sets of control variables and regressing individual attitudes towards accepting immigrants on the immigrant ratio. Our results are found to be stable after these various robustness checks.

In the literature, there is increasing interest in the effect of immigrants on voters' behaviour. Regarding Brexit, Becker et al. (2017) categorize various potential variables that could have affected the vote outcome into four groups. Then, within each group, they regress the vote outcome on the variables in each group by using OLS. Among the variables related to immigration and trade, they show that the immigrant ratio in 2001 is negatively related to the number of votes approving exit from the EU and that

the growth in immigrants from accession countries is negatively related to the vote to approve exit from the EU. Goodwin and Heath (2016) conduct a multivariate analysis and examine factors that might affect the vote count with a limited set of explanatory variables. Since both studies use a simple OLS with limited variables, they are subject to omitted variable bias and endogeneity bias. Curtice (2017) examines how the various perceptions of voters affect the outcome, using a single explanatory model.

For cases other than Brexit, Becker and Fetzer (2016) analyse how the inflow of immigrants to each electoral area affects the vote share of UKIP, Mayda (2006) analyses those against accepting immigration, and Scheve and Slaughter (2001) analyse how labour market competition with immigrants affects attitudes towards immigrants. Facchini et al. (2013) analyse the effect of the skill of natives on attitudes towards immigrants, using data on South Africa. Mendez and Cutillas (2014) analyse the causal relationship between a voter's behaviour and the immigrant ratio in Spain, finding that the inflow of immigrants from Latin America has increased the support for left-wing political parties. Otto and Steinhardt (2014) analyse the effect of the immigrant ratio on voter's behaviour in Germany and Facchini and Mayda (2009) analyse whether the welfare state affects attitudes towards immigrants, using cross-country data.

We contribute to previous studies in three ways. First, we analyse the causal effect of the share of immigrants on voting behaviour. Although several studies analyse the cause of the Brexit referendum, all of them use simple OLS with a limited set of explanatory variables. Thus, they are subject to omitted variable bias and endogeneity bias. By contrast, this study uses the IV estimation method.

Second, we analyse both voting data and survey data. Our analysis based on vote outcome data and individual survey data show the robustness of our estimation results.

In our IV estimation (two-stage least squares, 2SLS), we find that, contrary to the finding by Becker et al. (2017), the immigrant ratio does not affect the vote outcome. The effect is not only not statistically significant, the estimated magnitude is small. We conduct several robustness checks such as changing the dependent variable and investigating individual survey results, and confirm that our estimation result is robust to these robustness checks.

The organization of this paper is as follows. In section 2, we explain how the immigration issue was addressed during the Brexit negotiation process and how it

became an important issue during the referendum. Section 3 discusses the estimation model and identification strategies. Section 4 explains the data sets. Section 5 presents the estimation results and section 6 discusses the implications of the estimation results and concludes.

2 Background of the Brexit Referendum and Immigration Issues

In the Brexit referendum, immigration restrictions from other EU countries were one of the key issues. This issue had existed from the beginning when the negotiations with the EU were discussed in UK politics.

On 22 January 2013, Prime Minister David Cameron announced that if the Conservative party won the next election, it would renegotiate the United Kingdom's relationship with the EU and give the British people the simple choice between staying in the EU under newly negotiated terms or leaving.

In May 2015, the Conservative party unexpectedly won the general election. Soon afterwards, the European Union Referendum Act 2015 was introduced into Parliament to enable the referendum. Among the topics that Prime Minister Cameron sought to renegotiate with other member countries of the EU was restricting EU immigration.

In June 2015, during the EU summit, Cameron started to negotiate the United Kingdom's position in the EU. By February 2016, the outcome of the renegotiations was announced and some limits to in-work benefits for new EU immigrants were agreed. However, before they could be applied, the United Kingdom had to receive permission from the European Commission and European Council. On 20 February 2016, Cameron announced that the United Kingdom's in/out referendum would be held on 23 June 2016.

During the referendum campaign, one of the key issues was restricting immigrants from EU member countries to the United Kingdom. According to a study of the media during the referendum, the economy was the most covered campaign issue, with 7,028 articles compared with 4,383 about immigration; health was the third most reported issue with 1,638 articles (Moore and Ramsay, 2017).

To understand how people voted in the referendum, one post-election survey found that the immigration issue was the second most important. This finding suggests

that it is reasonable to examine how the presence of immigrants in each electoral area affected the vote outcome.

3 Estimation Model and Identification Strategy

WE first estimate the following equation:

$$Remain_j = \beta_0 + \beta_1 \text{ImmigrantRatio}_j + \beta_2 X_j + u_j \tag{1}$$

where j is an index of electoral area. $Remain_j$ is the share of the vote to remain in the EU. ImmigrantRatio_j is the ratio of immigrants in total residents in area j. X_j is a vector of the control variables and β_2 is a vector of the coefficient of X_j. The coefficient of interest is β_1, which measures how an exogenous increase in the current immigrant ratio affects the share of votes to remain in the EU. The error term is an unobserved factor that affects the share of the vote to remain such as the preferences of voters.

It is difficult to estimate β_1 consistently by applying OLS to equation (1) since ImmigrantRatio_j is not randomly assigned and, as a result, it could be correlated with the error term u_j. For example, immigrants may flow into areas where natives are friendly towards them. In such a case, running OLS on equation (1) would generate a positive coefficient of β_1 even when an exogenous increase in immigrants generates a negative effect on voting to remain in the EU.

To discuss how to solve the endogeneity of RatioImmigrant_j, let P_{kj} be the number of residents (including both natives and immigrants) working in industry k in area j. When k=0, P_{kj} indicates the number of residents who are not working. Let M_{kj} be the number of immigrants working in industry k in area j. The immigrant ratio in area j can be written as follows:

$$\begin{aligned} \text{ImmigrantRatio}_j &= \frac{\sum_k M_{kj}}{\sum_k P_{kj}} \\ &= \sum_k \rho_{kj} z_{jk} \end{aligned} \tag{2}$$

where z_{kj} is the current composition of industry k in area j defined as $z_{kj} = P_{kj} / \sum_k P_{kj}$. ρ_{kj} is immigrants' relative share of industry k in area j defined as $\rho_{kj} = \frac{M_{kj}}{P_{kj}}$. z_j

is a vector composed of z_{jk}. Equation (2) suggests that we can predict the current immigrant ratio in area j by using information on z_{jk} assuming that ρ_{kj} is different for different k. The idea that we can use z_{jk} to predict the immigrant ratio comes from the observation that immigrants and natives have different skills and preferences for jobs. Hence, local industry composition, z_k, can be a good predictor of the immigrant ratio.

Our key assumption is that natives and immigrants have different skills and preferences for jobs. Table 1 shows the share of individuals working in several industries who report that their ethnicity is related to the United Kingdom and that their ethnicity is not UK-related. For example, among those who report that their ethnicity is related to

Table 1. Share of Employment in Different Industries for Different Ethnicities

Self-reported ethnicities	Industries						
	Agriculture, energy and water	Manufacturing	Construction	Transport and storage	Accommodation and food service	Public administration	Education
UK related	2.59%	9.37%	8.30%	4.74%	4.73%	6.42%	10.21%
Others	1.25%	7.06%	5.04%	5.88%	9.37%	4.09%	8.54%

Notes: UK-related ethnicities are individuals who reported that their ethnicity is English, Welsh, Scottish, Northern Irish, or British. Others are all other individuals who reported other ethnicities.

the United Kingdom (those who report that their ethnicity is English, Welsh, Scottish, Northern Irish, or British), the percentage of individuals who work in the agriculture, energy, and water industry is 2.59 percent, while among other ethnicities, it is 1.59 percent. Among UK-related ethnicities, the percentage of those working in the accommodation and food service industry is 4.73 percent, while among other ethnicities, it is 9.37 percent. Thus, industry composition is likely to be different for different ethnicities. This implies that local industry composition can be a good predictor of the immigrant ratio.

On the contrary, using information on current industry composition to construct the instrument for the current immigrant ratio is problematic since current industry composition can be correlated with current natives' preferences for immigrants. For example, when immigrants inflow to a certain area because of natives' generosity to im-

migrants, the proportion of a certain industry for which immigrants have more specific human capital will rise. In such a case, information on current industry composition is correlated with natives' preferences for immigrants.

To avoid a correlation between the IV and natives' preferences for immigrants, we use past (2001) industry composition to construct the IV, while including current industry composition as a control variable. More specifically, we divide the cross-sectional variation in past industry composition into two parts: one that can be correlated with current industry composition and one that cannot be explained by current industry composition. Then, it is reasonable to assume that once we control for current industry composition, the variation in past industry composition that cannot be explained by current industry composition is not correlated with current natives' preferences for immigrants. Since this component is not correlated with current industry composition by definition, it is unlikely that this component is correlated with natives' preferences for immigrants.

Let z^o_{jk} be the past (2001) industry composition of industry k in area j and let z^o_j be a vector composed of z^o_{jk}. As we defined earlier, let z_j be a vector of current industry composition. Our assumptions on z_j and z^o_j can be restated as

$$E[u_j|z^o_j, z_j] = E[u_j|z_j] \tag{3}$$

By using the standard argument of conditional independence, it is straightforward to show that the 2SLS estimator of β_1 using z^o_j while controlling for z_j is consistent.[2]

On the contrary, directly using z^o_j is not an efficient way in which to use information on past industry composition since there are many industries. To use the information of z^o_j effectively, we construct the IV as follows. Let the immigrant ratio in 2001 be $\text{Immigrant Ratio}^o_j$. We estimate the immigrant ratio in 2001 as a function of z^o_j by assuming the following relationship:

$$\text{ImmigrantRatio}^o_j = F(z^o_j, \gamma) + \epsilon_j \tag{4}$$

where γ is a vector of the parameters to be estimated. For a functional form F, we

[2]For example, see the discussion of Stock and Watson (2011) Chapter 12 Appendix 12.6.

find that a logistic function fits very well for predicting the immigrant ratio in 2001 as a function of industry composition in 2001.[3] Let $\hat{\gamma}$ be an estimated parameter of γ by the nonlinear regression. Then, we use $F(z_j^o, \hat{\gamma})$, the predicted immigrant ratio in 2001, as the IV for the current immigrant ratio.

When we use the predicted immigrant ratio in 2001 above, $F(z_j^o, \hat{\gamma})$, as the IV for the current immigrant ratio, we need to include current industry composition as a control variable because without it, z_j^o is correlated with current industry composition and current industry composition is correlated with current natives' preferences for immigrants. For the same reason, we include the current and past demographic characteristics of each electoral constituency. We also control for the current claimant rate, using the past claimant rate as the IVs. In other words, we compare similar electoral areas whose past and present demographic characteristics, current industrial compositions, and past claimant rates are similar, whereas past industry composition, which is not corrected with current industry composition, is different. By comparing the vote outcomes in those areas, we estimate the effect of the immigrant ratio on the vote outcome.

There is one concern about using the predicted past immigrant ratio, which is predicted by past industry composition, as the IV for the current immigrant ratio. The first concern is that once we control for current industry composition, there is little variation in past industry composition. However, this concern is not valid in the data. Table 2 shows industry composition in 2001 and current industry composition. This table shows that industry composition changed at the macro level during these 10 years. For example, in 2001, the share of residents working in the manufacturing sector was 15 percent; however, in 2011 this had decreased to 9 percent. Similarly, the share of residents working in the healthcare industry was 10.8 percent in 2001 but 12.5 percent in 2011. The first-stage results of our 2SLS show that the predicted immigrant ratio, which is constructed by past industry composition, has strong explanatory power for predicting the current immigrant ratio—even if we control for current industry composition.

[3]Since the dependent variable takes a value from 0 to 1, it is natural to use a logistic function. When we apply a linear function to F, the R-squared is 0.7. On the contrary, when we use the logistic function, the R-squared becomes 0.94.

Table 2: Percentage of Top Five industries in 2001 and 2011

2001		2011	
Wholesale and retail trade	16.8%	Wholesale and retail trade	16.0%
Manufacturing	15.0%	Healthcare	12.5%
Real estate	13.0%	Education	9.9%
Human health	10.8%	Manufacturing	8.9%
Education	7.8%	Construction	7.7%

Notes: The data source is the 2001 and 2011 censuses. The number shows the percentage of residents of England and Wales aged 16 to 74 in employment by industry. Industry category is based on the census. Wholesale and retail trade include the repair of motor vehicles. Real estate includes renting business activities. Healthcare includes social work activities.

As a robustness check, we also use individual survey data on attitudes towards accepting more immigrants. By using the index of a respondent's opinion as the dependent variable, we run the same regression as in equation (1) and examine how the immigrant ratio affects natives' opinions about accepting immigrants.

4 Data Set

For the referendum vote counts in each local authority area (district), we obtain information from the UK Electoral Commission (The UK Electoral Commission, 2017). We use the code of the local authority before April 2015 to match the vote data and other economic and demographic data. We select electoral areas in Wales and England and exclude Scotland and Northern Ireland because of the availability of demographic and other economic data. In total, we have 333 electoral areas in our data set.[4] For the current ratio of non-UK-born individuals, we use the annual population survey in 2015. Although previous studies use census data in 2011 to calculate the ratio of non-UK-born individuals, it seems better to use the ratio of non-UK-born individuals just before the referendum since the ratio kept increasing until the referendum. Owing to the sampling design of the annual population survey, there may be a measurement error in the ratio of non-UK-born individuals. The use of IV is likely to solve the problem of bias due to any measurement errors in the ratio of non-UK-born individuals.

[4]In addition, the share of the vote to remain in Scotland is substantially higher than that in England. This fact suggests that the coefficient of immigrants could be different for Scotland and for England and Wales and that the equation should be estimated separately.

We use the claimant rate in 2015 since the claimant rates in 2011 and 2015 differ in many areas. For the age and educational composition of UK-born individuals, we need to use the census data in 2011. For information on past non-UK-born individuals' age and educational composition, we use the census data in 2001. For current and past industry composition, we use the census data in 2011 and 2001, respectively. For the claimant count in 2015 and 2001, we use the database of the Office for National Statistics.[5]

Regarding individual attitudes towards accepting immigrants, we use YouGov's Election Study data set.[6] YouGov, a UK-based company that focuses on consumer surveys, conducts various types of Internet-based surveys almost every day. One such survey is the British Election Study. In the YouGov system, the company's software continuously looks for respondents. When a panel, a group of consumers that represent the nation, is formed, none of the panel knows what kinds of questions will be asked. YouGov asks a variety of questions including on politics, international issues, health, life, and the environment. The YouGov software tries to form a panel that represents the nation's opinion. If people drop out of the panel, the software tries to find a person who has similar demographic characteristics.

In the YouGov data, we use wave 10 of the British Election Study conducted between 24 November 2016 and 12 December 2106. Among wave ten respondents, we exclude those who live in the Isle of Man and Isle of Sicily since there are no corresponding census data with information on demographic characteristics. We also drop individuals aged less than 18 and individuals who stated that their nationality is not British. As a result, we have 10,365 individuals in this YouGov data set.

5 Results

5.1 Results based on the Vote Outcome

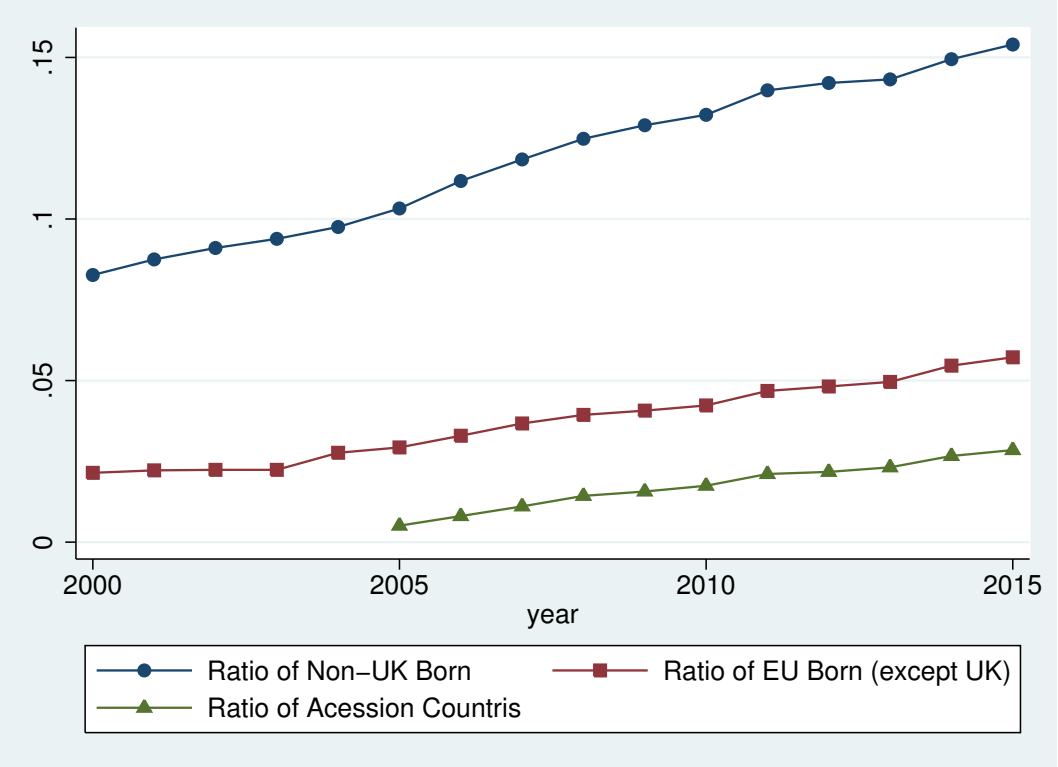
Figure 1 shows the ratio of non-UK-born individuals over UK-born individuals in the past 15 years. It also shows the ratio of EU-born residents (except residents born in the United Kingdom) over UK-born residents and the ratio of residents born in

[5]See `https://www.nomisweb.co.uk/`.

[6]See `https://yougov.co.uk/news/categories/politics/`.

accession countries over UK-born residents. Figure 1 shows that the ratio of non-UK-born individuals to UK-born residents has increased consistently over the past 15 years. It also shows that the increase in non-UK-born individuals is parallel to the increase in residents born in accession countries.

Figure 1: Immigrant ratio



Notes: The source is the National Population Survey from the Office for National Statistics. The ratio of non-UK-born individuals is the number of non-UK-born residents divided by the number of UK-born residents. The other ratios are calculated in a similar way.

Table 3 shows the summary statistics of the main variables used in this study. In our data set, the average share of the vote to remain in the EU is 46 percent and the average ratio of non-UK-born individuals is 12 percent in 2011 and 7.8 percent in xxxx.

Table 4 shows the estimated coefficients of our OLS estimation where the dependent variable is the share of the vote to remain in the EU and the main explanatory variable is the ratio of non-UK-born individuals in each electoral area. Table 4 shows that a higher ratio of non-UK-born individuals leads to a lower share of the vote to remain in the EU when we control for the claimant rate, demographic characteristics in 2011, and

Table 3. Summary Statistics of the Main Variables

Variables	(1) mean	(2) sd	(3) min	(4) max
Ratio of Vote for Remaining in EU	0.457	0.0970	0.244	0.786
Ratio of Non-UK-born individuals in 2015	0.119	0.105	0.00813	0.541
Ratio of Non-UK born-individuals in 2001	0.0775	0.0790	0.0113	0.466
Predicted Ratio of Non-UK born in 2001	0.0758	0.0763	0.00435	0.440
Claimant Rate in 2015	0.0181	0.0104	0.00425	0.0550
Claimant Rate in 2001	0.0217	0.0122	0.00400	0.0600
Ratio of aged ≥ 65 in 2011	0.175	0.0400	0.0613	0.297
Ratio of aged ≥ 65 in 2001	0.165	0.0321	0.0895	0.296
Ratio of Education level 1 and 2 in 2011	0.292	0.0384	0.136	0.361
Ratio of Education level 3 in 2011	0.122	0.0165	0.0916	0.192
Ratio of Education level 4 or more in 2011	0.271	0.0755	0.142	0.536

Notes: N=333. The unit of the sample is the local authority (district) before April 2015 in England and Wales. The sources of the data are the national censuses of 2001 and 2011, Annual Population Survey 2015, and Office for National Statistics database on claimant count.

Table 4: OLS Estimation Results
The Effect of the Immigrant Ratio on the Vote to Remain in the EU

Dependent Variable	Ratio of Vote for Remaining in EU				
	(1)	(2)	(3)	(4)	(5)
Ratio of Non-UK born in 2015	-0.00344	-0.0226	-0.00105	-0.0136	-0.0898**
	(0.0416)	(0.0421)	(0.0409)	(0.0415)	(0.0432)
Claimant rate in 2015		1.161***	1.884***	2.008***	0.928**
		(0.394)	(0.421)	(0.439)	(0.448)
Ratio of Education Level 4			1.209***	1.069***	0.992***
or More in 2011			(0.225)	(0.231)	(0.218)
Ratio of No Qualificaation in 2011				-0.305	0.194
				(0.231)	(0.244)
Ratio of Aged 65 or More in 2011					-0.565***
					(0.103)
2011 industry compostion	yes	yes	yes	yes	yes
2001 educaiton & age composition	yes	yes	yes	yes	yes
R-squared	0.877	0.882	0.894	0.894	0.905
Observations	333	333	333	333	333

Notes: Heteroscedasticity-robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

industry composition in 2011. Column (1) shows that a one percentage point increase in the ratio of non-UK-born individuals decreases the vote to remain in the EU by 0.003 percentage points when no control variable is included in the regression equation; this

is not statistically significant and small. Columns (2)–(4) add control variables such as the claimant rate and demographic characteristics. Column (4) shows that a one

Table 5: First-Stage Results of the 2SLS Estimation

Panel A.					
Dependent Variable	Ratio of Non-UK born in 2015				
	(1)	(2)	(3)	(4)	(5)
Predicted Ratio of	0.951***	0.900***	0.894***	0.868***	0.805***
non-UK born in 2001	(0.107)	(0.107)	(0.113)	(0.120)	(0.116)
Claimant Rate in 2001		0.839	0.816	0.927	0.304
in 2001		(0.583)	(0.586)	(0.570)	(0.552)
F-statistics	79.12	41.12	35.09	29.91	25.21
R-squared	0.843	0.844	0.844	0.846	0.865
Panel B.					
Dependent Variable	Claimant Rate in 2015				
	(1)	(2)	(3)	(4)	(5)
Claimant Rate	0.650***	0.689***	0.650***	0.615***	0.583***
in 2001	(0.0627)	(0.0634)	(0.0611)	(0.0610)	(0.0627)
Predicted Ratio of		-0.0205**	-0.0309***	-0.0228**	-0.0265***
non-UK born in 2001		(0.0103)	(0.00957)	(0.00880)	(0.00916)
F-statistics	149.1	81.51	82.89	96.95	41.88
R-squared	0.840	0.843	0.864	0.878	0.884
Control Variables					
2011 industry compositin	yes	yes	yes	yes	yes
2001 education & age composition	yes	yes	yes	yes	yes
Ratio of Level 4 or More in 2011	no	no	yes	yes	yes
Ratio of No-qualification in 2011	no	no	no	yes	yes
Ratio of aged 65 or more in 2011	no	no	no	no	no
observations	333	333	333	333	333

Notes: Heteroscedasticity-robust standard error in parentheses. F-statistics show the heteroscedasticity-robust F-value of the null hypothesis that the coefficients of the excluded instruments are equal to zero.

percentage point increase in the ratio of non-UK-born individuals decreases the share of the vote to remain in the EU by 0.09 percentage points. Although the coefficient is statistically significant at the 10 percent level, the magnitude is small. For example, a 5 percentage point increase in the ratio of non-UK-born individuals decreases the share of the vote to remain in the EU by only 0.45 percentage points. Given that the average share of the vote to remain in the EU is 46 percent, this effect is small.

In Table 4, we do not control for the endogeneity of the ratio of non-UK-born

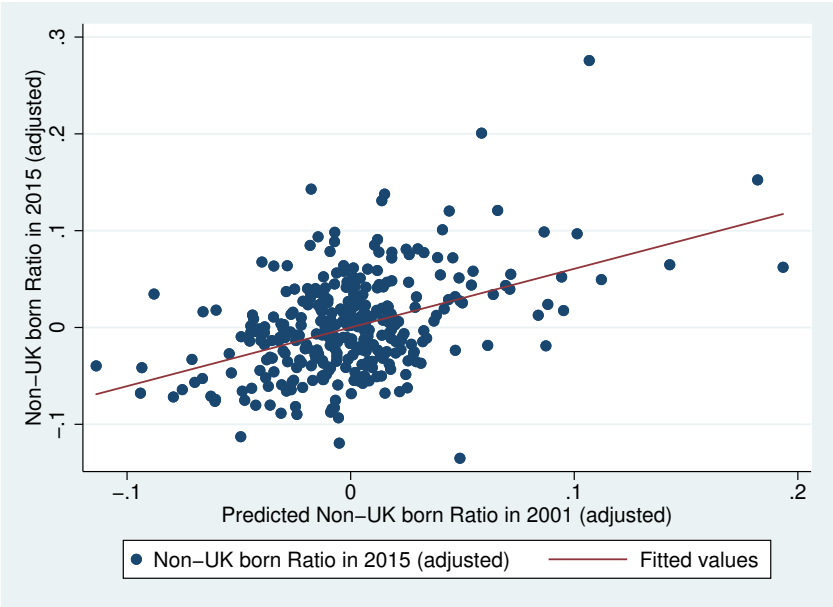
individuals and the claimant rate and do not control for omitted variable bias. In Tables 5–7, we conduct a 2SLS regression to handle those issues where the dependent variable is the share of the vote to remain in the EU and the endogenous explanatory variables are the ratio of non-UK-born individuals in 2015 and the claimant rate in 2015. The IVs are the predicted ratio of non-UK-born individuals in 2001, which was predicted by using information on industry composition in 2001 and the claimant rate in 2001.

Table 5 shows the estimated coefficients of the first-stage 2SLS regression. The ratio of non-UK-born individuals and the claimant rate are denoted in decimal numbers to simplify the comparison. For the regression, we include industry composition in 2011 and the educational and age composition in 2001 as control variables in all cases, since industry composition in 2001 can affect the vote outcome without those control variables. Panel A shows the first-stage result when the dependent variable is the ratio of non-UK-born individuals. The estimated coefficients of the predicted ratio of non-UK-born individuals are around 0.8–0.9 and these are stable under different specifications. The heteroscedasticity-robust F-statistics show that the IVs are strong. In Panel B, the dependent variable is the claimant rate. For comparison purposes, the claimant rate is measured as a decimal number. It shows that the estimated coefficients of the claimant rate in 2001 are stable under various specifications, around 0.58–0.05. The heteroscedasticity-robust F-statistics show that the IV is strong.

Figure 2 presents the relationship between our IV and the ratio of non-UK-born individuals in 2015 after controlling for the effect of industry composition in 2011. It shows that our first-stage result is not driven by outliers and that there is a strong positive relationship between our IV and the ratio of non-UK-born individuals in 2015.

Table 6 shows the second-stage estimation result of our 2SLS estimation. All the specifications in Table 6 control for the past and current industry composition and the age composition. The Kleibergen-Paap Rank Wald F-statistics show that our IVs are not weak. Column (1) shows that a one percentage point increase in the immigrant ratio decreases the share of the vote to remain in the EU by 0.016 percentage points. The effect is not statistically significant and the magnitude is small. Column (2) additionally controls for the claimant rate in 2015. Since the claimant rate can be endogenous, it is instrumented by the claimant rate in 2001. In columns (3)–(5), we

Figure 2: Relationship between Non-UK-born individuals in 2015 and our IV after Controlling for Current Industry Composition



Notes: The vertical axis is the residual after regressing the ratio of non-UK-born individuals in 2015 on the control variables (current industry composition and educational composition in 2001). The horizontal axis is the residual after regressing the IV, the predicted ratio of non-UK-born individuals in 2001, on the same set of control variables. The predicted ratio of non-UK-born individuals in 2001 is constructed by using information on industry composition in 2001.

additionally control for the educational and age composition in 2011. Column (5) shows that a one percentage point increase in the ratio of non-UK-born individuals decreases the share of the vote to remain in the EU by 0.006 percentage points. The effect is not statistically significant and the size of the magnitude is small. On the contrary, Table 6 shows that the effect of the claimant rate in each electoral area is strong. Column (5) shows that a one percentage point increase in the claimant rate in 2015 increases the share of the vote to remain in the EU by 3.6 percentage points.

It is known that the standard error of 2SLS is larger than the standard error of OLS. One might think that the nonsignificant results of Table 6 might come from the nature of 2SLS. Table 7 shows the reduced-form regression where the dependent variable is the vote outcome and the explanatory variable is the IV, the predicted ratio of non-UK-born individuals in 2001. To focus on the coefficient of the effect of the ratio of

Table 6: Second-Stage Results of the 2SLS Estimation
The Effect of the Immigrant Ratio on the Vote to Remain in the EU

Dependent Variable	Ratio of Vote for Remaining in EU				
	(1)	(2)	(3)	(4)	(5)
Ratio of Non-UK born in 2015	-0.0160	-0.0818	0.0322	0.0138	-0.00581
	(0.0739)	(0.0767)	(0.0739)	(0.0739)	(0.0820)
Claimant Rate in 2015		2.924***	3.567***	3.773***	3.598***
		(0.809)	(0.875)	(0.977)	(1.023)
Ratio of Education Level 4			1.610***	1.442***	1.408***
or More in 2011			(0.263)	(0.243)	(0.248)
Ratio of No Qualificaation in 2011				-0.380	-0.289
				(0.297)	(0.313)
Ratio of Aged 65 or More in 2011					-0.356
					(0.335)
2011 industry composition	yes	yes	yes	yes	yes
2001 education & age composition	yes	yes	yes	yes	yes
Kleibergen-Paap Rank Wald	79.12	40.31	33.12	28.85	24.95
R-squared	0.889	0.875	0.887	0.886	0.889
Observations	333	333	333	333	333

Notes: Heteroscedasticity-robust standard errors in parentheses. The endogenous explanatory variables are the ratio of non-UK-born individuals in 2015 and the claimant rate in 2015. The ratio of non-UK-born individuals in 2015 is instrumented by the predicted ratio of non-UK-born individuals in 2001. The claimant rate in 2015 is instrumented by the claimant rate in 2001. The claimant rate is denoted as a decimal number. *** p<0.01, ** p<0.05, * p<0.1

non-UK-born individuals in 2001, we make the other control variables the same as in Table 6 and instrument the claimant rate in 2015 by using the claimant rate in 2001. Thus, the estimated coefficient of the reduced form of the predicted ratio of non-UK-born individuals in 2001 divided by the estimated coefficient of the same variable in the first-stage regression becomes the estimated coefficient of the second-stage equation of the ratio of non-UK-born individuals in 2015. Table 7 shows that even in the reduced form, the effect of the instrument, the predicted ratio of non-UK-born individuals in 2001, is not statistically significant.

One natural question from Table 6 is whether natives respond negatively not to the level of immigrants, but to a change in the level of immigrants. In other words, in an electoral area where the rate of increase in immigrants is high, do natives vote to leave the EU? To check such a hypothesis, we calculate the rate of the inflow of non-

Table 7: Reduced-Form 2SLS Regression
The Effect of the Predicted Ratio of Non-UK-Born Individuals in 2001 on the Vote

Dependent Variable	Ratio of Vote for Remaining in EU				
	(1)	(2)	(3)	(4)	(5)
Predicted ratio of non-UK-born	-0.0152	-0.0672	0.0339	0.0231	-0.000481
individuals in 2001	(0.0729)	(0.0720)	(0.0681)	(0.0670)	(0.0666)
2011 industry compositin	yes	yes	yes	yes	yes
2001 education & age composition	yes	yes	yes	yes	yes
claimant rate in 2015	no	yes	yes	yes	yes
ratio of Level 4 or More in 2011	no	no	yes	yes	yes
ratio of No-qualification in 2011	no	no	no	yes	yes
ratio of aged 65 or more in 2011	no	no	no	no	no
R-squared	0.878	0.868	0.886	0.888	0.896
observations	333	333	333	333	333

Notes: Heteroscedasticity-robust standard errors in parentheses. The table shows the estimated coefficient of the predicted ratio of non-UK-born individuals in 2001 and the claimant rate in 2015. The claimant rate in 2015 is instrumented by the claimant rate in 2001. To see the pure effect of the predicted ratio of non-UK-born individuals in 2001 on the outcome variable, for the other control variables, we use the same set of variables as in Table 6. *** p<0.01, ** p<0.05, * p<0.1

UK-born individuals as follows and use this variable as an endogenous explanatory variable, applying 2SLS:

$$\text{Rate of inflow of non-uk born} = \frac{\text{non-UK born residents}_{2015} - \text{non-UK born residents}_{2001}}{\text{UK-born residents}_{2001}} \tag{5}$$

where Non-UK born residents$_t$ and UK born residents$_t$ are the number of non-UK-born residents and UK-born residents in year t.

We use the same IV, which works well as indicated by the Kleibergen-Papp Rank Wald Statistics in Table 8.[7] This table shows the results of our 2SLS regression.

Table 8 shows that the estimated coefficients of the effect of the rate of the inflow of non-UK-born individuals on the vote outcome are similar to those in Table 7. Column (5) of Table 8 shows that a one percentage point increase in the rate of the inflow of non-UK-born individuals decreases the share of the vote to remain in the EU by 0.0061 percentage points and that the effect is not statistically significant. Thus, by measuring the presence of immigrants in terms of the ratio or rate of inflow, the effect

[7]To save space, the first-stage results are available from the authors upon request.

Table 8: The Effect of the Rate of the Inflow of Non-UK-born Individuals on the Vote to Remain in the EU (2SLS)

Dependent Variable	Ratio of Vote for Remaining in EU				
	(1)	(2)	(3)	(4)	(5)
Rate of the inflow of	0.103	-0.0412	0.0813	0.0495	-0.000631
non-UK-born individuals	(0.0868)	(0.0952)	(0.0823)	(0.0823)	(0.0873)
Claimant Rate in 2015		3.232***	3.502***	3.524***	2.733***
		(0.809)	(0.795)	(0.797)	(0.929)
Ratio of Education Level 4			1.524***	1.328***	1.316***
or More in 2011			(0.264)	(0.248)	(0.237)
Ratio of No Qualificaation in 2011				-0.419*	-0.105
				(0.234)	(0.287)
Ratio of Aged 65 or More in 2011					-0.475
					(0.316)
2011 industry composition	yes	yes	yes	yes	yes
2001 education & age composition	yes	yes	yes	yes	yes
Kleibergen-Paap Rank Wald	48.66	21.11	29.13	23.85	19.19
R-squared	0.875	0.867	0.883	0.886	0.897
Observations	333	333	333	333	333

Notes: Heteroscedasticity-robust standard errors in parentheses. The endogenous explanatory variables are the rate of the inflow of non-UK-born individuals in 2015 and the claimant rate in 2015. The rate of the inflow of non-UK-born individuals in 2015 is instrumented by the predicted ratio of non-UK-born individuals in 2001. The claimant rate in 2015 is instrumented by the claimant rate in 2001. The claimant rate is denoted as a decimal number. *** p<0.01, ** p<0.05, * p<0.1

of immigrants on the vote outcome is virtually zero.

5.2 Results using Survey Data on Attitudes Towards Immigrants

Tables 6–8 show that contrary to the general perception, the presence of immigrants did not affect the vote outcome once we control for the endogeneity of the immigrant ratio.

To check the robustness of our results, we further examine whether attitudes towards accepting immigrants during the period of the Brexit referendum show a similar pattern. For the regression equation, we use attitudes towards accepting immigrants as the dependent variable. This number takes from 1 to 10 and a higher number implies that the respondent answered more favourably towards accepting immigrants. To compare this result with those in the previous tables, we standardize the answer use that as the dependent variable. The endogenous explanatory variables are the immigrant

Table 9: Second-Stage 2SLS Results (Individual Sample)

The Effect of the Ratio of Non-UK-born Individuals on Attitudes towards Accepting Immigrants

Dependent Variable	How much immigrant should be accepted				
	(1)	(2)	(3)	(4)	(5)
Ratio of Non-UK born individuals in 2015 ×100	-0.00296	-0.00467	-0.00271	-0.00305	-0.00506
	(0.00420)	(0.00450)	(0.00450)	(0.00480)	(0.00540)
Claimant Rate in 2015 ×100		0.084**	0.088**	0.088**	0.062**
		(0.0370)	(0.0380)	(0.0380)	(0.0410)
individual characteristics	yes	yes	yes	yes	yes
2011 industry compositin	yes	yes	yes	yes	yes
2001 education & age composition	yes	yes	yes	yes	yes
Claimant rate in 2015	no	yes	yes	yes	yes
Ratio of Level 4 or More in 2011	no	no	yes	yes	yes
Ratio of No-qualification in 2011	no	no	no	yes	yes
Ratio of aged 65 or more in 2011	no	no	no	no	yes
R-squared	0.152	0.152	0.152	0.152	0.153
Kleinberg-Papp-Stat	105.5	32.92	35.55	34.39	29.06
Observations	9,789	9,789	9,789	9,789	9,789

Notes: Clustered-robust standard errors in parentheses. Individual attitude towards accepting immigrants is standardized. A higher number implies that more immigrants should be accepted. To simplify the comparison with the previous table, we display the effect of non-UK-born individuals and the unemployment rate when those variables are multiplied by 100. Thus, the number measures the effect of one percentage point increase of the corresponding variable on the standardized value of the attitude. Table A1 and Table A2 show the original results.

ratio in 2015 and the claimant rate in 2015. We use the same IVs as in the previous regression (see Tables 5–8) and the F-statistics and KleibergenPaap Rank Wald statistics show that the IVs are strong. Table A1 presents more detailed results of our 2SLS regression. Table 9 reports the estimated coefficient of the ratio of non-UK-born individuals in 2015, which was instrumented by the predicted ratio of non-UK-born individuals in 2001. The estimated coefficients are all nonsignificant and small. Since the ratio of non-UK-born individuals in 2015 is measured as a decimal number, column (5) implies that a one percentage point increase in non-UK-born individuals decreases the standardized opinion by 0.005, which is virtually equal to zero. This result is consistent with our 2SLS results based on the vote outcome reported in Tables 6–8.

6 Discussion and Conclusion

In this study, we examine the causal relationship between the ratio of non-UK-born residents and the vote to remain in the EU. After controlling for endogeneity, we find that the effect of an increase in the ratio of non-UK-born residents is not only not statistically significant, but also small. For example, the estimated coefficient implies that even a 10 percentage point increase in non-UK-born residents decreases the vote to remain in the EU by only 0.05 percentage points, which is small given that the share of the vote to remain in the EU is 47 percent. On the contrary, we find that the effect of an increase in the claimant rate for the vote to remain in the EU is statistically and economically significant. We also confirm that the effect of the rate of increase in non-UK-born individuals displays a similar pattern and does not affect the vote outcome. In addition, we check whether the presence of immigrants affects attitudes towards accepting them. Our analysis shows that the presence of immigrants does not affect individual opinion in this way, which is consistent with our results based on the data on the vote outcome.

One natural question is why the poll after the referendum shows that immigration was an important issue even though the presence of immigrants in each electoral area did not affect the vote outcome and nor did attitudes towards accepting immigrants. One possible hypothesis is that attitudes towards accepting immigrants are determined by predetermined demographic characteristics such as age and education level. Indeed, the more detailed regression results on individual attitudes towards accepting immigrants in Table A1 show that once we control for many individual characteristics, economic factors do not affect such attitudes; on the contrary, demographic characteristics do matter. Table A1 shows that younger and more educated people have a positive attitude towards accepting immigrants, whereas older and less educated individuals have a negative attitude.

Although we do not go further to examine why this is so, it is an important implication if this hypothesis is true. As globalization proceeds, the immigrant ratio might rise in many parts of the world. However, opinions regarding immigrants will be determined more or less by demographic factors, and among demographic characteristics, only education can be influenced by policy. This implies that the role of education will

have an additional role in society, namely understanding globalization and influencing attitudes towards globalization.

References

Becker, S. O. and Fetzer, T. (2016). Does migration cause extreme voting? Technical report, Competitive Advantage in the Global Economy (CAGE).

Becker, S. O., Fetzer, T., and Novy, D. (2017). Who voted for Brexit? A comprehensive district-level analysis. *Economic Policy*, 32(92):601–650.

Curtice, J. (2017). Why leave won the UK's EU referendum. *JCMS: Journal of Common Market Studies*, 55(S1):19–37.

Facchini, G. and Mayda, A. M. (2009). Does the welfare state affect individual attitudes toward immigrants? Evidence across countries. *The Review of Economics and Statistics*, 91(2):295–314.

Facchini, G., Mayda, A. M., and Mendola, M. (2013). What drives individual attitudes towards immigration in South Africa? *Review of International Economics*, 21(2):326–341.

Goodwin, M. J. and Heath, O. (2016). The 2016 referendum, Brexit and the left behind: An aggregate-level analysis of the result. *The Political Quarterly*, 87(3):323–332.

Mayda, A. M. (2006). Who is against immigration? A cross-country investigation of individual attitudes toward immigrants. *The Review of Economics and Statistics*, 88(3):510–530.

Mendez, I. and Cutillas, I. M. (2014). Has immigration affected Spanish presidential elections results? *Journal of Population Economics*, 27(1):135–171.

Moore, M. and Ramsay, G. (2017). *UK media coverage of the 2016 EU referendum campaign*. Centre for the Study of Media, Communication and Power, King's College London. Available at: https://www.kcl.ac.uk/sspp/policy-institute/CMCP/UK-media-coverage-of-the-2016-EU-Referendum-campaign.pdf [Accessed on 10 January 2018].

Otto, A. H. and Steinhardt, M. F. (2014). Immigration and election outcomes: Evidence from city districts in Hamburg. *Regional Science and Urban Economics*, 45:67–79.

Scheve, K. F. and Slaughter, M. J. (2001). Labor market competition and individual preferences over immigration policy. *The Review of Economics and Statistics*, 83(1):133–145.

Stock, J. H. and Watson, M. W. (2011). *Introduction to econometrics: 3rd Edition*. Pearson Education Boston, MA.

The UK Electoral Commission (2017). *UK Referendum 2017 data*. Available at: https://www.electoralcommission.org.uk/our-work/our-research/electoral-data/electoral-data-ne [Accessed on 10 January 2018].

Appendices

Table A1 (1): The Detailed Results of Table 9 (Individual Sample 2SLS)

The Effect of the Ratio of Non-UK-born Individuals on Attitudes towards Accepting Immigrants

VARIABLES	How much immigrant should be accepted				
	(1)	(2)	(3)	(4)	(5)
Ratio of Non-UK born individuals in 2015	-0.296	-0.467	-0.271	-0.305	-0.506
	(0.421)	(0.455)	(0.447)	(0.477)	(0.538)
Claimant Rate in 2015		8.405**	8.844**	8.817**	6.198
		(3.732)	(3.783)	(3.782)	(4.163)
Ratio of Education level 4 ore more in 2011			3.060**	2.702*	2.320
			(1.355)	(1.464)	(1.530)
Ratio of Noqualification in 2011				-0.636	0.270
				(1.402)	(1.447)
The ratio of aged 65 ore more in 201					-1.136
					(0.862)
Indivdaul Characteristics					
Gender		0.0281	0.0276	0.0278	0.0276
		(0.0210)	(0.0210)	(0.0211)	(0.0210)
Age group = 2, 18-25		0.367***	0.368***	0.368***	0.369***
		(0.0515)	(0.0515)	(0.0516)	(0.0516)
Age group = 3, 26-35		0.130***	0.132***	0.132***	0.133***
		(0.0478)	(0.0479)	(0.0480)	(0.0480)
Age group = 5, 46-55		-0.0664*	-0.0664*	-0.0665*	-0.0661*
		(0.0342)	(0.0342)	(0.0342)	(0.0341)
Age group = 6, 56-65		-0.142***	-0.142***	-0.142***	-0.140***
		(0.0350)	(0.0351)	(0.0351)	(0.0350)
Age group = 7, 66+		-0.158***	-0.157***	-0.157***	-0.155***
		(0.0353)	(0.0354)	(0.0353)	(0.0351)

Continued on the next page

Table A1 (2): The Detailed Results of Table 9 (Individual Sample 2SLS)

The Effect of the Ratio of Non-UK-born Individuals on Attitudes towards Accepting Immigrants

(continued from the previous page)					
Highest Qualification = 2,		0.488*	0.491*	0.491*	0.486*
Youth training certificate/skillseekers		(0.267)	(0.267)	(0.267)	(0.268)
Highest Qualification = 3,		0.207**	0.208**	0.208**	0.210**
Recognised trade apprenticeship completed		(0.104)	(0.104)	(0.104)	(0.104)
Highest Qualification = 4,		0.142*	0.141*	0.142*	0.143*
Clerical and commercial		(0.0855)	(0.0854)	(0.0857)	(0.0858)
Highest Qualification = 5,		0.0694	0.0684	0.0685	0.0713
City and Guild certificate		(0.0617)	(0.0616)	(0.0616)	(0.0615)
Highest Qualification = 6,		0.214***	0.217***	0.217***	0.220***
City and Guild certificate - advanced		(0.0768)	(0.0763)	(0.0762)	(0.0764)
Highest Qualification = 7,		0.238**	0.242**	0.242**	0.243**
onc		(0.102)	(0.102)	(0.102)	(0.102)
Highest Qualification = 8,		-0.0619	-0.0615	-0.0605	-0.0573
CSE grades 2-5		(0.0729)	(0.0726)	(0.0724)	(0.0723)
Highest Qualification = 9, CSE grade 1,		0.0925**	0.0907**	0.0908**	0.0938**
GCE O level, GCSE, School Certificate		(0.0431)	(0.0431)	(0.0432)	(0.0431)
Highest Qualification = 10,		-0.00577	-0.0108	-0.00793	-0.0109
Scottish Ordinary/ Lower Certificate		(0.177)	(0.175)	(0.174)	(0.174)
Highest Qualification = 11,		0.327***	0.326***	0.327***	0.329***
GCE A level or Higher Certificate		(0.0472)	(0.0471)	(0.0472)	(0.0471)
Highest Qualification = 12,		0.695***	0.689***	0.690***	0.692***
Scottish Higher Certificate		(0.222)	(0.223)	(0.223)	(0.223)
Highest Qualification = 13,		0.408***	0.405***	0.406***	0.407***
Nursing qualification (eg SEN, SRN, SCM, RGN		(0.0995)	(0.0995)	(0.0995)	(0.0998)
Highest Qualification = 14,		0.521***	0.523***	0.523***	0.528***
Teaching qualification (not degree)		(0.0725)	(0.0726)	(0.0726)	(0.0721)
Highest Qualification = 15,		0.492***	0.491***	0.492***	0.494***
University diploma		(0.0664)	(0.0663)	(0.0663)	(0.0662)
Highest Qualification = 16,		0.717***	0.715***	0.715***	0.716***
University or CNAA first degree (eg BA, B.Sc)		(0.0443)	(0.0443)	(0.0443)	(0.0442)
Highest Qualification = 17,		0.865***	0.865***	0.865***	0.864***
University or CNAA higher degree (eg M.Sc, Ph.I		(0.0526)	(0.0523)	(0.0523)	(0.0523)
Highest Qualification = 18,		0.401***	0.399***	0.399***	0.402***
Other technical, professional or		(0.0449)	(0.0449)	(0.0449)	(0.0450)
individual characteristics	yes	yes	yes	yes	yes
2011 industry compositin	yes	yes	yes	yes	yes
2001 education & age compositior	yes	yes	yes	yes	yes
Unemployment rate in 2015	no	yes	yes	yes	yes
Ratio of Level 4 or More in 2011	no	no	yes	yes	yes
Ratio of No-qualification in 2011	no	no	no	yes	yes
Ratio of aged 65 or more in 2011	no	no	no	no	yes
R-squared	0.152	0.152	0.152	0.152	0.153
Kleinberg-Papp-Stat	105.5	32.92	35.55	34.39	29.06
Observations	9,789	9,789	9,789	9,789	9,789

Notes: Clustered-robust standard error in parentheses. Individual attitude towards accepting immigrants is standardized. A higher number implies that more immigrants should be accepted. The ratio of non-UK-born individuals and unemployment rate are in decimal numbers. Thus, the estimated coefficients measure a 100% increase in the ratio of non-UK-born individuals and the claimant rate.