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On the Causes of Brexit

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Abstract

We analyse the voting pattern in the June 23rdreferendum on the continued participation of the United Kingdom in the European Union and evaluate the reasons for the results. We find that regions where GDP per capita is low, a high proportion of people have low education, a high proportion is over the age of 65 and there is strong net immigration are more likely to be apprehensive of the E.U., consider the enlargement of the E.U. as having gone too far, be suspicious of immigrants and not want them as neighbours and, most importantly, to vote for Brexit. The fear of immigration does not seem to be fully justified in terms of the literature on the labour market effects of immigrants in the UK. Looking at the response of the sterling exchange to poll numbers we find that investors appear to view Brexit as a negative event.

Keywords: Brexit referendum; European Union.
JEL: E24, J6

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1. Introduction

The world witnessed economic and political turmoil in the United Kingdom in the summer of 2016. A country known for the strength of its institutions, the tolerance of its population and an outward looking and measured foreign policy, unilaterally decided to withdraw from the European Union (E.U.) in a close-call referendum. The vote to leave on 23 June subsequently created volatility in financial markets, a political crisis and a possible constitutional crisis caused by the unwillingness of Scotland and Northern Ireland to leave the E.U. World financial markets suffered turbulence with the shares of banks hit particularly hard.[1] There were political consequences for both of the main political parties in the UK as well as for other countries where political parties have demanded referendums. The pattern of voting revealed stark differences between regions, countries and generations within the United Kingdom. Scotland voted with a large majority to remain in the E.U. and there was a majority in Northern Ireland as well as in London while a large majority of electoral districts in provincial England voted to leave.

In this paper, we explore the pattern of voting using data on NUTS 2 regions in the United Kingdom in a search for an answer to the question why a majority of voters wanted to leave the E.U.[2] In particular, we will explain the pattern of voting with variables that measure economic activity and demographic factors, as well as social values. We will first explore the election results briefly and then discuss possible reasons for the leave vote before turning to the statistical analysis. We then evaluate the results in the light of the empirical literature on the effect of immigration on employment and wages in the UK. Finally, we analyse the relationship between the sterling exchange rate and Brexit poll numbers to assess the view of the market on the referendum.

[1] See "Global markets lose record $3tn since Brexit vote" by Nicole Bullock, Financial Times, 27 June, 2016. https://next.ft.com/content/91dd01b6-3caf-11e6-8716-a4a71e8140b0

[2] The NUTS classification system (Nomenclature des unités territoriales statistiques) is a coherent regional breakdown system administrated by Eurostat. Its purpose is to provide stable regional statistics for the European Community. The stability aspect makes sure that published data refers to the same regional unit over a certain period of time. Nevertheless, national interests sometimes require an amendment in the breakdown of a country in order to capture more variety within the country. The amendments to the annexes follow a regulated transmission, which guarantees that data published under an older NUTS version are compatible with the current classification. This accounts for the difference in the number of regions between versions. The values measures in this paper from the European Values Study (2011) follow the 2010 version of the NUTS system albeit the output indicators are published under the current 2013 version, which has been accounted for (History of NUTS, n.d.).

2. The election results

In the days before the election the results were judged to be too close to call. While the leave vote had increased in the *Financial Times* polls in the weeks prior to the vote, it seemed that the remain-side was strengthening in the few days before the referendum.[3] Thus the leave side had 50.6% in the polls taken on 17 June but had weakened to 48.3% on the day before the referendum. The currency markets appeared to expect the remain-side to win since the sterling exchange rate appreciated in the days before the voting. However, the leave side won with 17,410,742 voters, or 51.9% of the total, wanting to leave the E.U. and 16,141,241, or 48.1%, wanting to remain in the E.U. Table 1 has the results by NUTS2 region.

Table 1. Results on referendum on membership of the European Union, 23 June 2016

Region	Leave	Remain	Region	Leave	Remain
England outside London			South Yorkshire	61.56	38.44
Bedfordshire and Hertfordshire	51.93	48.07	Surrey, East and West Sussex	49.29	50.71
Berkshire, Buckinghamshire and Oxfordshire	46.84	53.16	Tees Valley and Durham	60.89	39.11
Cheshire	51.67	48.33	West Midlands	58.64	41.36
Cornwall and Isles of Scilly	56.46	43.54	West Yorkshire	54.78	45.22
Cumbria	56.43	43.57	Average	56.29	43.71
Derbyshire and Nottinghamshire	58.53	41.47			
Devon	55.34	44.66	**London**		
Dorset and Somerset	56.20	43.80	Inner London	28.09	71.91
East Anglia	55.45	44.55	Outer London	43.97	56.03
East Yorkshire and Northern Lincolnshire	64.75	35.25	Average	36.03	63.97
Essex	62.34	37.66			
Gloucestershire, Wiltshire and Bristol/Bath area	49.12	50.88	**Northern Ireland**	44.24	55.76
Greater Manchester	53.46	46.54			
Hampshire and Isle of Wight	54.58	45.42	**Scotland**		
Herefordshire, Worcestershire and Warwickshire	56.56	43.44	Eastern Scotland	36.82	63.18
Kent	59.25	40.75	South Western Scotland	36.78	63.22
Lancashire	59.03	40.97	Highlands and Islands	43.96	56.04
Leicestershire, Rutland and Northamptonshire	59.03	40.97	Average	39.19	60.81
Lincolnshire	65.16	34.84			
Merseyside	48.82	51.18	**Wales**		
North Yorkshire	51.89	48.11	West Wales and The Valleys	53.89	46.11
Northumberland and Tyne and Wear	55.71	44.29	East Wales	50.25	49.75
Shropshire and Staffordshire	62.53	37.47	Average	52.07	47.93

Significant geographical differences emerge in the table. London votes overwhelmingly to remain; in Inner London 72% want to remain. There is also a very large majority for remaining in all three districts in Scotland, including the Orkneys and the Shetland islands.

[3] See FT Brexit poll tracker: https://ig.ft.com/sites/brexit-polling/.

The same can be said of Northern Ireland. In contrast, there is a majority for leaving in Wales, although not a very large one. In East Wales the two sides are almost equal.[4]

It was in England outside London where the decision to leave the E.U. was made. The leave-side won in every district except for Berkshire, Buckinghamshire and Oxfordshire, where the remain-side had a significant majority; Gloucestershire, Wiltshire and Bristol, where there was a narrow majority for remaining; Merseyside, again with a narrow majority; and Surrey, East and West Sussex, where there was also a narrow majority. The first and the last region surround London, the second includes the city of Bristol and surrounding areas and the last includes the city of Liverpool and surrounding areas. The leave camp was strongest in some of the regions that prospered during the industrial revolution in manufacturing and declined due to globalisation at both the end of the 19th and the end of the 20th centuries. The leave vote was close to 65% in Lincolnshire, which had a booming engineering industry in the 19th and the first half of the 20th century; in Yorkshire it was 65% in the East and 61.56% in the South, the source of the coal and iron ore industries, including the centre of the textile industry and the steel industry in the city of Sheffield; the leave vote was 62.53% in Shropshire, which includes the Ironbridge Gorge known as the birthplace of the Industrial Revolution, and Staffordshire, which includes the city of Stoke with its mining industry and iron and steel industries; and the vote was almost 61% in the Tees Valley and Durham, a leading producer of coal in England in the late 19th century. What these areas have in common is that they have declined over the past century relative to London and the South East.[5] However, this pattern is not visible in Scotland and Northern Ireland. Scotland, which prospered during the industrial revolution producing linen and wool and had a strong shipbuilding and steel industry and voted for the remain side, and voters in Northern Ireland, where the industrial revolution transformed the city of Belfast, also voted to remain.

The regions voting to remain have generally prospered in recent decades. The service sector has expanded for decades in London, in particular financial services, and the same applies to a lesser extent to Liverpool in Merseyside. Other regions in England voting to remain were Berkshire, Buckinghamshire and Oxfordshire and Bristol and surrounding areas.

[4] East Wales covers Blaenau Gwent, Caerphilly (eastern half), Monmouthshire, Newport, South Powys and Torfaen.

[5] While memories of a better life in the past may have influenced voting behaviour in these districts, objective accounts describe less than stellar standards of living during the industrial revolution. For example, the town of Wigan northeast of Liverpool voted overwhelmingly for leaving the E.U. Yet the poverty of the town's working class extends into the Industrial Revolution, as described by George Orwell in his book *The Road to Wigan Pier*. See Andres Higgins, "Wigan's Road to "Brexit": Anger, Loss and Class resentments," *The New York Times*, 6 July 2016.

In Bristol, both the IT sector as well as financial services have grown in recent decades and replaced a declining manufacturing sector. Oxford has a growing hi-tech sector and benefits from a supply of well-educated university graduates. Buckinghamshire on the outskirts of London essentially shares the London labour market and Berkshire, which includes the city of Reading, hosts the headquarters of many foreign multinationals. The same applies to Surrey, which has many organisation and company headquarters and a generally a high standard of living.

3. Reasons for leaving and remaining

We now turn to the possible reasons behind the decision to leave or remain within the E.U. put forth in the debate that preceded the referendum. The arguments made by the advocates for leaving centred on immigration and national autonomy. Thus, the supremacy of European laws over British laws – as exemplified by the European Court of Justice – was deemed unacceptable.[6] Moreover, another related issue is the inability of the UK to stem the flow of immigrants coming from other E.U. countries. One objective of the leave camp appears to be to maintain access to the single European market in goods, services and capital – hence protect the interests of the City and the manufacturing sectors – while reducing the flow of immigrants coming mostly from Eastern Europe.

The counterargument made by those who wished to remain within the E.U. was that free migration was one part of the four freedoms that define the Single Market set up in the Treaty of Maastricht in 1993. The 27 remaining countries within the E.U. would never allow the UK to withdraw from one of the four markets – having access to the common market in goods, services and capital while not being a part of the common labour market. In addition, participation in the Single Market through the European Economic Area would requires the UK to adopt the E.U. rules and legislation that apply to the Single Market without having any say in setting these rules as well as to pay an annual sum to the E.U. Thus, leaving the E.U. would not bring any rewards while increasing uncertainty about future trading arrangements, which would lower investment, employment and growth.[7]

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[6] By passing the European-Communities Act 1973 Parliament recognised the primacy of EU law over UK law. This principle was in the following decades deepened and extended by the decision of the European Court of Justice.

[7] The following quotes are good examples of the arguments for and against leaving the EU :
Napoleon, Hitler, various people tried this out, and it ends tragically. The EU is an attempt to do this by different methods. Boris Johnson, 14 May 2016. http://www.telegraph.co.uk/news/2016/05/14/boris-johnson-the-E.U. -wants-a-superstate-just-as-hitler-did/
So it goes to this argument, as well, about sovereignty. The people who want us to leave, one of their arguments is if we left, we'd have greater sovereignty and a greater ability to write our own laws. Now, that's true in a

These arguments can be framed in the context of the literature on the optimal size of countries. As argued by Alesina and Spolaore (1997), there are economies of scale in country size in that expanding the size of a country reduces the fixed cost per inhabitant of providing public goods, laws and regulations, operating government institutions and, in the absence of trade with other countries, having access to a larger market. The cost of expanding the size of a country, in contrasts, consists of increasing the heterogeneity of the population, making it more difficult for the government to provide the type of goods and services that each ethnic or cultural group demands. But the trade-off is altered by membership in the European Union because free trade reduces the benefits of size by making it possible for a small country to enjoy access to a larger market than its own and enjoy economic integration without political integration.[8] Gancia et al. (2016) argue that the political response to globalization in recent decades is to remove borders by creating economic unions, leading to a reduction in country size. In the context of the European Union, each county has to accept the common rules and regulations that apply in the Single Market.

In the context of the Brexit debate, participation in the European Union and the Single Market has allowed the UK to benefit from access to a large market without giving up political independence as the remain side argued. This applies particularly to Scotland, having only about 5 million inhabitants, and its hopes for future independence. But the leave campaign argues that the rules of the Single Market infringe too much on the UK's sovereignty and ability to satisfy the wishes of its population, in particular when it comes to immigration. Set in this context, the decision by the English regions to leave the E.U. could be explained by their inhabitants having different attitudes towards immigration or facing more immigration than other regions.

technical sense, but is it really true that we'd become more powerful; that we'd be able to get things done? And I think the answer to that is no. Let's take Caterpillar, let's take this great business, right? You're making engines, for instance, which are governed to some extent by single market rules in EU rope. If we were to leave, if you want to sell your engines to EU rope you've still got to meet those rules. The only difference is, today I'm sat round the table helping to write those rules. I can listen to you here at Caterpillar and make sure the rules are written in a way that will help British business. If we're outside the EU , you've got to meet all those rules, but you have absolutely no accountability for what they are. David Cameron, speech at Caterpillar, 28 April 2016. (https://www.gov.uk/government/speeches/pm-speech-at-caterpillar-on-the-E.U. -referendum-28-april-2016).

[8]Alesina et al. (2000) argue that under free trade and global markets even small cultural or ethnic groups can benefit from forming small, more homogeneous, political entities while Alesina and Wacziarg (1998) show that empirically smaller countries are more open to trade.

4. Values, the economy and the Brexit vote

To explain the geographical dispersion in Table 1 we resort to economic variables that measure differences in economic performance, demographic variables that measure differences in the average level of education and the average age, and variables that measure differences in values and attitudes between the regions.

The voting pattern may reflect differences in economic performance between the regions of the UK. For most of the past century the regions in Northern England have been declining relative to London and the South. The same applies to Scotland, which saw most of its manufacturing industries wiped out in the 1980s. The stark difference between vibrant London, which benefits from the financial sector in the City and a booming service economy, and the South East, on the one hand, and the regions in the north of England, Scotland and Northern Ireland may explain differences in the pattern of voting. Thus low income workers in the North may fear immigration and trade more than the high income workers in London and the South. We will use output per capita and the rate of unemployment at the regional level to test for these effects on the pattern of voting. In a later section we discuss the empirical evidence on the effect of immigration.

One important variable is the level of migration in recent years, which could possibly explain the pattern of the leave vote across regions. Migrants have played an important role in the economic recovery that followed the recession caused by the financial crisis of 2008. Thus, economic growth has primarily occurred in London and the South East, powered by the influx of immigrant labour, mostly from other E.U. countries. The capital and the South East have created more than half of all growth from 2009 to 2014 according to Deutsche Bank estimates.[9] These results also suggest that the correlation between growth in London and other regions of England is quite low. In 2014 there were around 3 million people living in the UK who were citizens of another E.U. country, which was about 5% of the UK population at the time, of which 2 million are in work, which is about 7% of the working population.[10] Nevertheless, the employment rate of UK-born citizens was at a record high, and the participation rate has not declined, which does not, *prima facie*, suggest that UK-born individuals were suffering in terms of employment levels as a result of migration.

Thirdly, there is also the possibility that the districts differ in terms of the age profile of the population. We include the proportion of 65 year olds and older of the total population

[9] See Deutsche Bank, markets Research, special report (2016), "Divided nation: Why Britain voted for Brexit and what it means for sterling."
[10]See https://fullfact.org/immigration/E.U. -migration-and-uk/.

among our explanatory variables. The older generation differs from the younger one in remembering the times before the UK joined the then European Community in 1973 and may be driven by better knowledge or nostalgia when voting. In addition they are more likely to turn up at the polls.[11]

Fourthly, we include the proportion of the population who have not completed secondary school. This group may feel more threatened by increased immigration of less-skilled workers coming from the other member states, especially from Eastern Europe, and hence want the UK to "take control" of the number of immigrants arriving in the country. We discuss the empirical evidence in a later section, which does suggest that the low education workers have more to fear from immigration.

Fifth, the values and attitudes of the population may differ between the districts. The districts may be characterised by different sets of values and attitudes or social capital to sue a term from sociology. The social capital of a region may determine its ability to absorb immigrants.[12] Moreover, values and attitudes towards E.U. extension, towards immigration in general and the importance for the UK of not to share political power with other E.U. member states may differ between regions. In essence, values may differ irrespective of the economic situation, education and age structure. These differences may be reflected in responses to questions in value surveys. We include responses from the European Values Study (EVS, 2011) to questions on the attitude to having neighbours who are immigrants, about the effect of immigrants on society, questions about respondents' attitudes towards the European Union, whether the E.U. should take in more member states, and, finally, whether the UK should accept new immigrants from developing countries.[13]

5. Canonical correlations

We will split our variables into two groups. There is a group of variables, summarised by a latent variable *E* that stands for the economy, which are exogenous to voters' decision in the referendum, state variables that cannot be changed by them. These are GDP per capita in each district, the rate of unemployment, the share of the population with low levels of education, the share over 65 years of age, and the rate of net immigration.[14] These variables may then

[11] See http://www.economist.com/blogs/economist-explains/2014/10/economist-explains-24 and https://next.ft.com/content/1ce1a720-ce94-3c32-a689-8d2356388a1f.
[12] See Coleman (1990), Putnam (2000), Knack and Keefer (1997), and Arnorsson and Zoega (2016).
[13] The survey is the European Values Study in 2008 and 2009. It is chosen because it is the only survey on values known to the authors that publishes results using the NUTS classification system.
[14] Unemployment is the rate of unemployment in 2015 for workers aged 15 and over; GDP per capita is measured at current market prices in thousands of euros; education is the percentage of inhabitants, between 25

possibly affect the attitudes of voters, including their voting behaviour. Our values variables fall into several groups, summarised by the latent variable *V*.

Turning first to values, we summarize the information in *V* by calculating principal components (PC) as shown in Table 2. The first set of variables measure how many are "very afraid" of the E.U. because they will lose social security; lose national identity and culture; end up paying more and more to the E.U.; fear that Britain will lose power in the world; and lose jobs in Britain. The first PC of a matrix of 36 observations (districts) and these five values variables explains 82% of the variation in the matrix. The eigenvector corresponding to the first PC has similar values for all five variables. It follows that people who fear the influence of the E.U. express this fear in all five dimensions. We will include the first PC in the subsequent testing of voting behaviour and label it *Fear of E.U.*

The second group of variables measuring respondents' dislike of having various minority groups as neighbours: These are people of a different race; right-wing extremists; Muslims; immigrants/foreign workers; and homosexuals. The first PC explains 43% of the variation in the matrix and the corresponding eigenvector has positive weights for all groups apart from right-wing extremists. Thus people who dislike the other four groups tend not to dislike the right-wing extremists. We label this PC *Dislike of neighbour*.

The third group of variables measures the extent to which respondents fear the effect of immigrants on society: That immigrants take jobs away from natives; that a country's cultural life is undermined by immigrants; that immigrants make crime problems worse; that immigrants are a strain on a country's welfare system; that in the future the proportion of immigrants will become a threat to society; and that it is better if immigrants maintain their distinct customs and traditions. The first PC explains 69% of the variation in the data and the values in the eigenvector are similar for all six variables. We call this PC *Dislike of immigrants*.

In addition to the *Fear of E.U.*, *Dislike of immigrant* and *Dislike of neighbour* variables we add the share of respondents who agree that E.U. enlargement has already gone too far, labelled *E.U. enlargement* and the share who think that the UK should not receive any more immigrants from less developed countries or *No more immigrants*. We also use the share of voters who wanted the UK to leave the European Union.

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and 64 years of age, with less than primary and lower secondary education in 2015; the share of the elderly is measured as the share of the total population 65 years old or older; immigration is measured as net migration as a share of the population in each district.

Table 2. Eigenvalues, eigenvectors and principal components

Included observations: 36 after adjustments Computed using: Ordinary correlations Eigenvalues: (Sum = 5, Average = 1)						Included observations: 36 after adjustments Computed using: Ordinary correlations Eigenvalues: (Sum = 5, Average = 1)						Included observations: 36 after adjustments Computed using: Ordinary correlations Eigenvalues: (Sum = 6, Average = 1)					
Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion	Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion	Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	4.093	3.682	0.819	4.093	0.819	1	2.172	1.055	0.434	2.172	0.434	1	4.160	3.290	0.693	4.160	0.693
2	0.412	0.168	0.082	4.505	0.901	2	1.117	0.341	0.223	3.289	0.658	2	0.869	0.488	0.145	5.029	0.838
3	0.244	0.089	0.049	4.749	0.950	3	0.776	0.160	0.155	4.065	0.813	3	0.381	0.031	0.064	5.411	0.902
4	0.155	0.059	0.031	4.904	0.981	4	0.616	0.296	0.123	4.680	0.936	4	0.351	0.178	0.059	5.761	0.960
5	0.096	---	0.019	5.000	1.000	5	0.320	---	0.064	5.000	1.000	5	0.173	0.107	0.029	5.934	0.989
Eigenvectors (loadings):						Eigenvectors (loadings):						Eigenvectors (loadings):					
Variable	PC 1	PC 2	PC 3	PC 4	PC 5	Variable	PC 1	PC 2	PC 3	PC 4	PC 5	Variable	PC 1	PC 2	PC 3	PC 4	PC 5
Fear of E.U.						**Dislike of neighbour**						**No more immigrants**					
Loss of identity	0.459	-0.230	-0.399	-0.605	0.459	Different race	0.364	0.447	-0.731	0.331	0.155	Worse crime	0.453	-0.040	0.174	-0.143	-0.855
Job losses	0.457	0.098	-0.634	0.335	-0.518	Homosexuals	0.446	-0.340	0.340	0.752	-0.069	Maintain tradition	0.217	0.953	0.100	0.177	0.058
Loss of power	0.455	-0.364	0.258	0.639	0.430	Immigrants	0.579	0.151	0.063	-0.368	-0.709	Strain on welfare	0.431	-0.199	0.622	0.105	0.406
Paying more to E.U.	0.455	-0.268	0.557	-0.334	-0.547	Muslims	0.574	-0.070	0.205	-0.402	0.680	Take jobs	0.419	-0.223	-0.199	0.755	0.014
Lose social security	0.407	0.856	0.250	-0.034	0.195	Right-wing extremists	-0.072	0.811	0.551	0.167	0.076	Threat to social security	0.450	-0.029	0.061	-0.580	0.269

The table has information on the first five principal components for each of three matrices: the matrix of attitudes towards the E.U., the matrix of attitudes towards having a neighbour belonging to each of five minority groups, and views on the effect of immigrant on society. Each of the matrices has numbers for each of the 36 NUTS2 districts in the UK and each of the five attitude variables generating three 36*5 matrices.

We use canonical correlation analysis, a method proposed by Harold Hotelling in 1936. The observed variables are separated into two groups and the weights chosen so as to maximise the correlation between the two latent variables *E* and *V*, each latent variable summarising the information contained in one group of variables. In our context, we take unemployment, GDP per capita, the share of the population with low education, the share of the older workers and net immigration and summarise these in the latent variable *E* and relate *E* to the latent variable *V* that measures voting for Brexit, and values and attitudes towards the E.U. and immigrants. Thus we hypothesize that there are two latent variables; economic, demographic and migration rates on the one hand and values and attitudes on the other hand, each of which depends on a set of observable variables. We calculate the latent variables by taking a weighted average of the underlying observable variables to maximise the correlation between the two latent variables, which are economic and demographic *E* and values *V*. The canonical correlation is the bivariate correlation between the two variables. The estimated model, shown in Table 3, consists of several observed measures, which are summarized by two different latent variable sets, *E* and *V*.

The results of the analysis report several statistics. These include the *Canonical correlation coefficient*, which measures the correlation between the two latent variables *E* and *V* in a given canonical function; the *Canonical function*, defined as a set of *standardized coefficients* from the observed variable sets; the *Standardized coefficient*, defined as the set of weights attached to observed variables in the two variable sets to yield the linear combinations that maximize the correlation between the two latent variables, i.e. the canonical correlation;[15]and the *Structure coefficient*, defined as the bivariate correlation between an observed variable and a latent variable, *E* or *V*, which help to describe the structure of the latent variable by showing which observed variables contribute to the creation of the latent variable.[16]

[15] They are standardised due to the constraint that the variance of the pair of canonical variables in a canonical function are equal, $var(E_i^*) = var(V_i^*) = 1 \; \forall \; i$ where *i* represents the number of canonical functions. This is vital in order to obtain unique values for the coefficients.

[16]In addition, the *Squared structure coefficient* measures the proportion of variance an observed variable linearly shares with a latent variable and the *Communality coefficient* gives the proportion of variance in each variable that is explained by all the canonical functions that are interpreted. It informs the researcher about the usefulness of the observed variable for the whole model.

Table 3. The economy, values and the leave vote in 36 districts

	Function 1			Function 2			Function 3			Function 4			Function 5			
Variable	*Std. Coef*	*Str. Coef*	*Str. Coef* [2]	*Std. Coef*	*Str. Coef*	*Str. Coef* [2]	*Std. Coef*	*Str. Coef*	*Str. Coef* [2]	*Std. Coef*	*Str. Coef*	*Str. Coef* [2]	*Std. Coef*	*Str. Coef*	*Str. Coef* [2]	*Com. Coef*
Inputs: E																
Unemployment	-0.053	-0.037	0.14%	1.332	0.642	41.17%	0.413	0.408	16.65%	0.188	0.573	32.87%	0.437	-0.303	9.18%	100.00%
GDP	-0.282	-0.783	61.34%	-0.108	0.102	1.03%	1.207	0.141	2.00%	-0.972	-0.502	25.20%	-0.407	-0.323	10.43%	100.00%
Low education	0.660	0.612	37.44%	-0.617	-0.039	0.15%	0.599	0.417	17.36%	-0.276	0.521	27.19%	-1.103	-0.423	17.87%	100.00%
Migration	0.491	0.308	9.46%	0.582	0.304	9.23%	-0.520	-0.519	26.95%	-0.495	-0.733	53.66%	-0.467	-0.084	0.70%	100.00%
Elderly	0.330	0.672	45.14%	0.243	-0.183	3.35%	1.123	0.126	1.59%	-0.644	-0.288	8.31%	0.768	0.645	41.60%	100.00%
Outputs: V																
Fear of E.U.	0.062	0.424	17.97%	1.256	0.190	3.59%	-0.877	-0.616	37.95%	0.937	0.331	10.96%	-0.364	0.525	27.56%	98.03%
Dislike of immigrants	0.086	0.544	29.56%	-1.111	-0.052	0.27%	0.792	-0.082	0.68%	0.056	0.232	5.37%	1.172	0.799	63.78%	99.65%
Dislike of neighbour	-0.090	0.325	10.56%	0.204	0.327	10.70%	0.090	0.317	10.02%	0.619	0.336	11.28%	-0.021	0.185	3.43%	45.98%
Leave	0.920	0.979	95.86%	-0.296	-0.076	0.58%	-0.111	0.042	0.18%	-0.293	0.051	0.26%	-0.568	-0.164	2.69%	99.58%
No more immigrants	0.091	0.310	9.59%	0.969	0.641	41.14%	0.564	0.646	41.71%	0.103	-0.226	5.10%	-0.028	0.156	2.43%	99.96%
E.U. enlargement	0.084	0.324	10.52%	-0.016	0.405	16.38%	-0.475	-0.288	8.29%	-1.151	-0.441	19.43%	0.275	0.621	38.59%	93.21%

	Canonical correlation coefficients				
	1	2	3	4	5
	0.790	**0.512**	**0.351**	**0.187**	**0.128**
F-statistics	1.5044	0.69	0.4286	0.2462	0.2415
Prob.	0.0685	0.8258	0.947	0.9589	0.787

Squared canonical correlation coefficients				
1	2	3	4	5
0.624	**0.262**	**0.123**	**0.035**	**0.016**

The interpretation of each canonical correlation depends on the sign and size of both the standardized coefficient and the structured coefficient. When they have opposite signs one pays more attention to the structured coefficient because if a given variable is positively correlated with the latent variable but has a negative weight (standardized coefficient) then this implies that there is multicollinearity, i.e. the variable is correlated with some of the other variables that are included.[17]

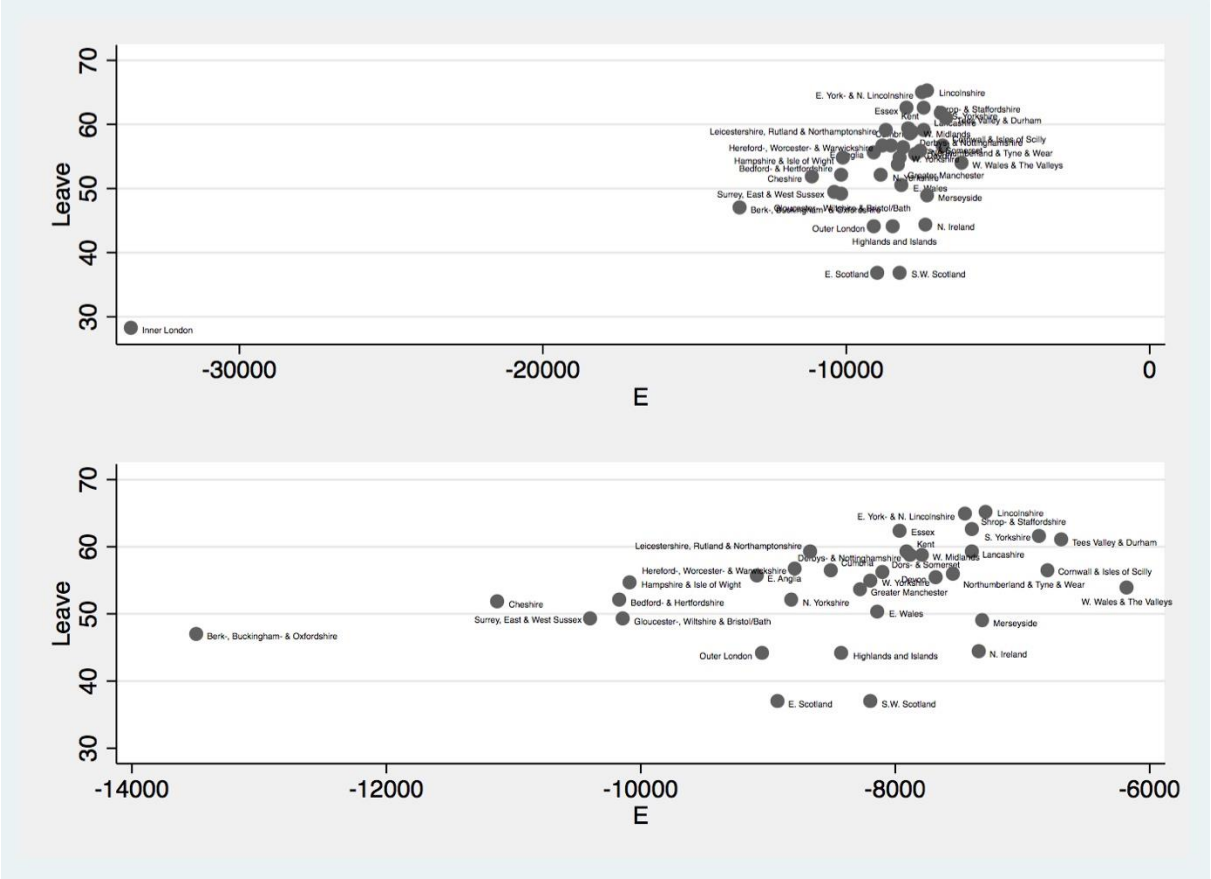
Looking at the first canonical function in Table 3, which is the only one that is statistically significant with F=1.5, shows that low levels of education, a high proportion of people over 65, low GDP per capita and high rates of immigration may create a social climate that fosters fears about the European Union, dislike of neighbours other than right-wing extremists, a negative attitude towards immigrants and a belief that the enlargement of the E.U. has already gone too far in addition to a willingness to prohibit people coming from less developed countries coming into the UK. Most importantly, these feelings go together with voting for leaving the E.U. in the referendum.

A low level of output per capita, a large share of the population lacking education, many over the age of 65 and immigration all contribute positively to *E*. Fear of E.U., dislike of minority group neighbours, being suspicious of foreigners, unwillingness to accept migrants from the less-developed world, not wanting the E.U. to enlarge more, and voting for Brexit contribute positively to the latent variable *V*. The correlation between the two latent variables, *E* and *V*, is then 0.79.

The figure below shows the relationship between the latent variable *E* – measuring economic variables, the extent of low education and the share of those over age 65 – and the share of the leave vote in the referendum.

[17] See Sherry and Henson (2005) and Tacq and Tacq (1997) on interpreting the results of a canonical correlation analysis.

Figure 1. The leave vote and the latent *E* variable (top figure includes inner London, the bottom one does not)



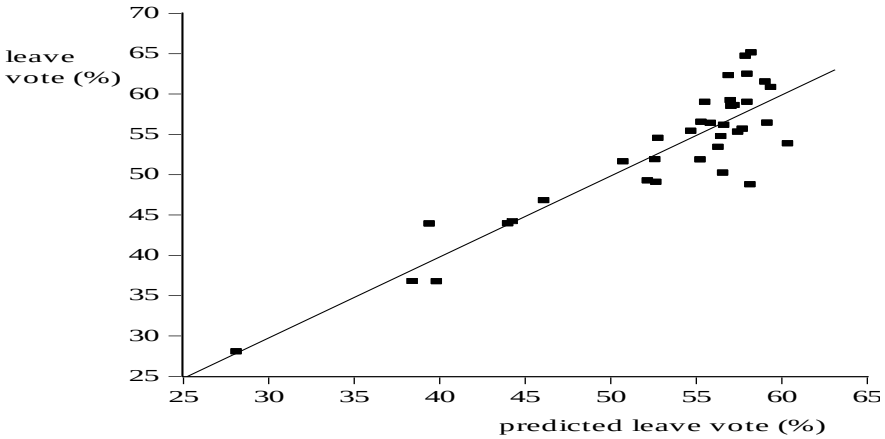
In the top figure Inner London is included while in the bottom figure it is excluded in order to show better the relationship for the other regions. There is an upward-sloping relationship in the top figure but note that Inner London in the lower left-hand corner makes it stronger. There is still an upward-sloping relationship in the lower figure but Scotland, Northern Ireland, West Wales and Merseyside are outliers in having a lower leave vote than their relatively high value of *E* would lead us to expect.

We can estimate this relationship – that is between the leave vote and the latent variable *E* – and include dummy variables for the two London districts, Scotland and Northern Ireland. The estimated equation, shown in the first column of Table 4 below, explains 81% of the variation in the data. The estimated equation has a very significant coefficient for *E* and negative and significant coefficients for London, Northern Ireland and Scotland.[18] We show the relationship between the predicted vote and the actual vote in Figure 2. Note that in the

[18]Without the dummy variables, the coefficient of *E* would be 0.112 and the equation would explain 37% of the variation.

top right-hand corner the observations furthest under the 45% line are for Wales and Merseyside – more for remain that the value of *E* would lead us to predict – while the observations furthest away on the other side – more for leave than the value of *E* would predict – are from Lincolnshire and Yorkshire.

Figure 2. Actual and expected leave vote



We now turn to estimating equations for the leave vote where all other variables in Table 3 are explanatory variables instead of the latent economic variable *E* from the canonical correlation analysis. The results are reported in the second column of Table 4, labelled 2. We first use all the variables in column (2) and then omit all the values variables in column (3). Note that the values and attitude variables are not very significant and when omitted the equation does not lose explanatory power.[19] The results show that a lower GDP per capita, a higher proportion of the over 65 years of age, a higher proportion of people with low levels of education and more immigration make it more likely that voters would like the UK to leave the E.U. Moreover, voters in Scotland and Northern Ireland are less likely to want to leave by a very significant margin. The leave vote is about 14% lower in these areas counties once other variables have been taken into account. The values variables are insignificant except for *Dislike immigrants*, which has a t-ratio of 1.39.[20]

A drawback of the results so far is that only two regions represent London; Inner and Outer London. This was necessary because the values variables from 2008 follow the NUTS 2010 definition that only has these two London regions. However, we do have measures for

[19] R-squared falls from 0.88 to 0.85 and the adjusted R-squared rises from 0.81 to 0.82.
[20] When, based on Figure 1, the London dummy variable is split into Inner London and Outer London in the last regression of Table 4 both dummy variables have insignificant coefficients.

the NUTS 2013 regions for the economic and demographic variables, which has two regions for Inner London – East and West London – while Outer London has three regions – East and North East, South, West and North West. In addition, Eastern Scotland is split into North Eastern Scotland (Aberdeen) and Eastern Scotland. This raises the total number of regions from 36 to 40.[21] The results are shown in column (4) and are similar to those in column (3).

Table 4. The determinants of the leave vote

	1		2		3		4	
Variable	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Constant	63.48	35.60	30.58	3.32	24.78	3.44	24.33	3.40
*E**	0.001	4.90						
Economy and demographics:								
GDP per capita			-0.12	4.37	-0.11	5.57	-0.06	7.23
Unemployment rate			0.02	0.02				
Share with low education			0.90	2.63	0.96	4.98	0.81	4.81
Migration			0.42	1.20	0.31	1.02	0.23	1.15
Share over 65			0.54	1.50	0.66	2.99	0.80	2.85
Country dummies:								
Dummy – Scotland	-16.73	7.50	-14.88	4.29	-14.68	6.66	-12.37	-17.06
Dummy - N. Ireland	-12.72	15.30	-14.81	6.67	-14.12	6.59	-12.89	-8.57
Dummy – London	-8.52	2.59	0.54	1.35	-3.44	1.94	-3.89	-1.70
Values and attitudes:								
Fear of E.U.			-0.55	0.73				
Dislike immigrants			0.94	1.39				
Dislike neighbours			0.45	0.86				
E.U. enlargement			-0.06	1.17				
No more immigrants			-0.06	0.77				
Statistics:								
R-squared	0.76		0.88		0.85		0.82	
Adj. R-squared	0.74		0.81		0.82		0.78	
S.E. of regression	4.70		3.54		3.5		4.13	
F-statistics	25.70		12.61		23.07		21.55	
Observations	36		36		36		40	
Breusch-Pagan F-statistics	0.30		1.45		0.85		1.50	

Dependent variable: The share of the leave votes. Estimated with OLS. White heteroskedasticity-consistent standard errors & covariance. In columns 1-3 we use the NUTS 2010 definition of regions while in column 4 we use the 2013 definition. Economic and demographic variables are measured in 2014 (2015) and values and attitudes variables are measured 2008. GDP per capita is in thousands of euros per capita.

[21] In order to check the robustness of the results we estimated the equation in column (4) with a dummy variable for West London included. This did not change the results qualitatively. The GDP per capita in the region is 173 thousand euros per inhabitant. In comparison, GDP per capita is 30 thousand per inhabitant in Manchester.

Using the estimation (3) in Table 4, an increase in GDP per capita of 5000 euros – such as between the West Midlands and Surrey and Sussex – will lower the share of the leave vote by 0.55%; an increase in the share of the population by 5% over age 65 – such as between West Yorkshire and Herefordshire, Worcestershire and Warwickshire – will increase the leave vote by 3.3%; and an increase in the share of the population with low education by 5% – such as between Inner London and Dorset – will increase the leave vote by 4.8%.The coefficient of the migration variable is less significant (insignificant at the 10% level) but an increase in the rate of immigration by 2% is would raise the leave vote by 1.55%. Thus, the leave vote is more sensitive to changes in the share of the less educated and the share of the old.

The vote for leaving was lowest in Inner London (28.09%) and highest in Lincolnshire (65.16%). We use the equation in column (2) of Table 4 to explain the difference in Table 5 below.

Table 5. Difference between Inner London and Lincolnshire explained

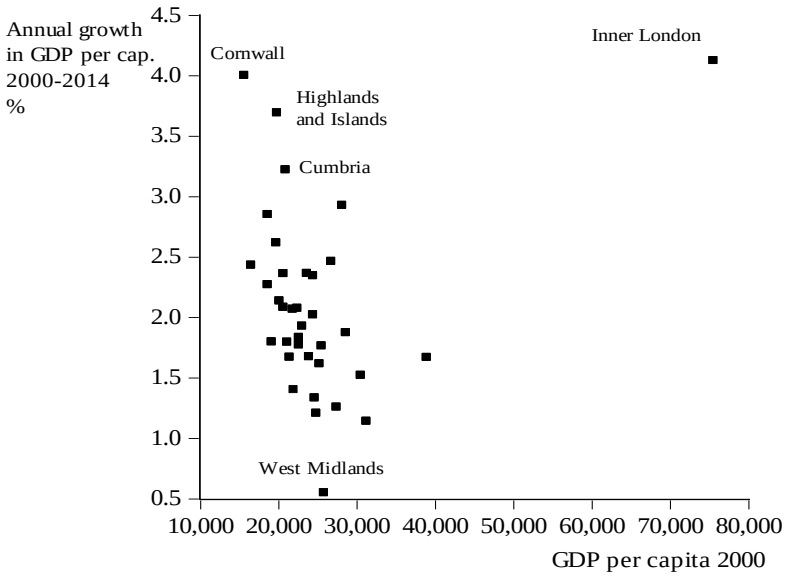
Variable	Inner London	Lincolnshire	Coefficient	Difference
Leave vote %	28.09	65.16		37.07
GDP per capita	119	25.9	-0.11	10.24
Share with low education	12.95	23.9	0.96	10.51
Migration	5.65	8.8	0.31	0.98
Share over 65	8.88	22.64	0.66	9.08
Residual				6.26

The difference in the leave vote is 37.07% with Lincolnshire voting heavily to leave and Inner London to stay. This can be explained by GDP per capita being much higher in London, which leads us to predict that the leave vote would be 10.2% lower there; the share of the population with less education being lower in London, which gives a 10.5% lower leave vote in London; and the share of the over 65 years of age being lower in London, which gives a 9.1% lower leave vote. In contrast, differences in the level of migration do not play a big role. The residual is 6.3%, which is the unexplained leave vote in Lincolnshire.

The difference between the economic fortunes of London and the rest of the country is highlighted in Figure 3, which plots the average annual growth of GDP per capita from 2000 to 2014 against the level of GDP per capita in 2000. Inner London starts out having three times the average level of GDP per capita in 2000 but grows faster than any other region in

the subsequent 14 years.[22] The figure shows that there is a split in the UK between London and the rest of the country and we have shown that this affects the voting pattern. Thus one possible conclusion to be drawn from our results is that globalisation has benefitted the economy of London more than the rest of the UK and that the Brexit vote is a protest by the rest of the country against free trade and free immigration.

Figure 3. Convergence between the regions from 2000 to 2014



Globalisation has had a similar effect before. A similar development occurred in late 19th century and early 20th century. In the earlier period increased imports of agricultural products affected domestic agriculture adversely and reduced the price of land while the cities expanded. In late 20th century, it was increased imports of manufacturing goods that made the manufacturing cities of the north of England fall behind London and the South East where the service sector expanded.[23]

[22] However, the average growth rate from 2000 to 2014 does not explain the voting pattern, the correlation between the growth rate and the share of voters who wanted to leave is only -0.16. Also, adding the average growth rate to the regressions reported in Table 4 yields an estimated coefficient that is statistically insignificant from zero.

[23]Crafts (2005) explored regional convergence and divergence in the UK since 1861. He found that the inequality of regional GDP per capita increased in the second half of the 19th century until WWI, then declined until around 1970 and subsequently increased to end the century at a similar level as at the beginning of it. The increased inequality at the end of both centuries was driven by globalisation, which reduced the price of agricultural products and arable land in the 19th century, while the cities grew rapidly, and reduced manufacturing in late 20th century when the service economy of London and the South East blossomed. He concludes that both episodes of globalization were associated with major changes in regional income differentials with both losers and big winners.

6. Economic interests and the pattern of voting

It is easy to dismiss the leave vote as based on irrational fear of free trade and the free mobility of workers. The currency market seems to view Brexit as a bad event in that it caused capital outflows, not inflows. Data on the contribution of immigrants to the UK economy also suggest that voters made a mistake. In a recent paper, Dustman and Frattini (2013) study the net fiscal contribution of immigrants to the UK. They find that E.U. immigrants have a positive net contribution to the budget, while non-E.U. immigrants and natives have a negative contribution. Thus recent E.U. immigrants (who immigrated since 2000) are more likely to be employed than native workers, less likely to live in social housing and receiving lower benefits. Between 2001 and 2011 the net fiscal contribution of those who arrived after 1999 amounted to 22.1 billion GBP. So did the UK make a mistake by voting to leave?

We must begin by acknowledging that voters differ in terms of the industries that employ them, their level of education and their exposure to international trade and immigration. It is entirely possible that both voters who voted to leave, as well as those who voted to remain, voted in their self-interest. Perhaps the well paid and well educated workers in the financial services and other industries that have flourished in the Single Market voted to remain out of self-interest while the less well paid and less educated workers in non-tradable sectors voted to leave, also out of self-interest. In an interesting study, which is directly comparable to ours, Lars Jonung (2004) studied voting patterns in the 2003 Swedish referendum on whether to adopt the euro or keep the Swedish krona. He used the results of exit polls conducted by the public broadcaster Sveriges Television (SVT), which yielded a response of around 11,000 voters to 38 questions, and found that the pattern of voting was consistent with the self-interest of voters based on the theory of optimum currency areas. Thus the yes vote was strongest among voters in the tradable sector, in high-growth regions, and, as in our results, among high-income workers and the well-educated. In contrast, the no-vote was strongest among workers in the public sector, among workers with low income, the unemployed and the less educated. Political attitudes towards European integration also influenced the voting decision although these may be correlated with income and education, as in our study. In another study yielding similar results, Mayda (2006) studied data from several countries and found that skilled individuals favour immigration when the native workers are more skilled than immigrants and oppose it otherwise. Hellwig and Sinni (2016) conducted a survey in Britain and found that the qualities of different immigrant groups affect the attitude of the public towards them. Thus security fears affect attitudes towards Muslim immigrants while

economic concerns affect attitudes towards Eastern European immigrants. Also, concerns about crime affect attitudes towards the latter groups while cultural threats are more associated with Muslim immigrants.

Immigration may affect average wages in a country and also relative wages across skill and occupational groups. Immigration could be neutral in simply increasing the population of a country if immigrants are no different in their composition across age, education and occupational groups from native workers. But they may differ. An influx of rich millionaires – such as the many "non-doms" (that is people with non-domiciled status) residing in London – will increase demand for output and services and the demand for labour and can thus be expected to raise wages of the working force. In contrast, the immigration of low-wage workers into such occupations as services and construction may add primarily to the potential output of the country and less to aggregate demand. This applies particularly if these workers spend their earnings in their countries of origin. Relative wages may also be affected if the immigrants are primarily low skilled or going into certain professions such as unskilled services. There is also the possibility that immigrants from Eastern Europe may have lower reservation wages because they spend their earning in their countries of origin where prices are lower or because they are used to a lower standards of living. The lower reservation wages may affect average real wages across the economy or relative wages if the immigrant workers are more heavily represented in such sectors as unskilled services and construction.

There is a broad consensus in the literature on UK immigration that the share of immigrants in the labour force has had at most a very small effect on average native wages and employment.[24] In an early paper on the effect of the influx of workers coming from Eastern Europe, Gilpin et al. (2006) fail to find any effect on unemployment. Lemos and Portes (2008) find only a limited effect of the free movement of workers from Central and Eastern Europe on the UK labour market, both wages and unemployment. Wadsworth (2010) reviews the literature on the evidence on the effects of immigration on the UK labour market and finds that immigration has not had a notable effect on employment or wages although there are some indications of downward pressure on wages in the low-skill sector. These downward effects are not large. Reed and Latorre (2009) use LFS data on hourly wages from 2001 to 2007 and subdivide the labour market along occupational and regional lines. They

[24] In the US the results of Card (1990) and Borjas (2003) has created a debate on the effect of immigrants on native wages. In a more recent paper Card (2005) finds no adverse effect on the relative wages of the low skilled in US cities. Ottaviano and Peri (2012) also fail to find an adverse effect on the relative wages of the unskilled.

find that a 1% increase in the share of migrants in the UK working-age population (like from 9% to 10%) would reduce wages by around 0.3%. This effect is only significant at the 10% level. Dustman et al. (2005) found very weak effect on the employment outcomes of native workers in the UK. Interestingly, they found a positive relationship between changes in the share of immigrants and changes in wages for a slightly earlier period although this effect is statistically poorly determined. In a recent government report, Devlin et al. (2014) find that immigration has had very little effect on the employment of the UK work force. In particular, they find that the employment rates among E.E.A. (European Economic Area) immigrants exceed those of the native population and that the inactivity rates among these immigrants have been falling for twenty years. The E.E.A. migrants also have lower unemployment rates than native UK workers. Manacorda et al. (2012) provide one explanation for the limited effect of immigrants on the wages of native workers. They show using a pooled time series of British cross-sectional micro data on male wages and employment from the mid-1970s to the mid-2000s that natives and immigrants are imperfect substitutes, so that an increase in immigration reduces the wages of immigrants relative to natives.

There is some evidence that the lowest skilled workers in the UK may be adversely affected by immigration. Dustman et al. (2013) found that each 1% increase in the share of migrants in the UK-born working-age population caused a 0.6% fall in wages of the 5% lowest paid workers and an increase in the wages of higher paid workers. Nickell and Salaheen (2008) found that a 1% increase in the share of migrants in the unskilled and semi-skilled service sector reduced average wages in that occupation by 0.5%. In a recent paper, Nickell and Saleheen (2015) explore the effect of immigration on average wages (not native wages) while considering different occupational groups at the regional level instead of skill levels. They measure wages by the average hourly wage of full-time employees. The findings suggest that an increase in the immigrant-to-native ratio has a small negative effect on average British wages. Moreover, the results reveal that the effect of immigration on wages is greatest within the semi-skilled and unskilled service occupational group where a 10 percentage point rise in the proportion of immigrants working in the semi/unskilled service sector leads to a 1.8 percent reduction in pay. However, Nickell and Salaheen note that part of this decrease can be due to a compositional effect since immigrants tend to earn less than natives and estimate this compositional effect to account for a 0.54% fall in wages. Finally, these authors find that there is no difference between the effect of E.U. and non-E.U. immigrants on native wages in the UK.

We have found that the leave vote is concentrated in provincial England and is positively correlated with the share of the less educated and the over 65 years of age group and negatively correlated with the GDP per capita. But in our regressions the rate of immigration did not come out strongly. We have seen that the literature on the labour market effect of immigration suggests a weak, possibly non-existent, effect on average wages and slightly stronger but still a weak effect on the wages of unskilled service-sector workers. Moreover, the data show that the remain-vote was strong in London and the South East where immigrants are a large share of the labour force.[25] So how do we fit the poll results with the empirical evidence on the effect of immigration if the regions that voted most strongly for leaving are neither the regions where the share of immigrants in the labour force is high nor the regions having large flows of immigration from the E.U.? A likely answer is that voters perceive the numbers and effects of immigrants as being much greater than they actually are. In a Mori poll published a couple of weeks before the referendum on 9 June 2016 responders thought on average that E.U. citizens made up 15% of the total UK population (around 10.5 million people) when in reality it is 5% (3.5 million people).[26] Moreover, people also underestimated the volume of foreign direct investment by other E.U. countries in the UK; they overestimated the net financial contribution the UK makes to the E.U. budget (half of that of Germany, and less than the contributions of France, Italy and Spain).

An exaggerated fear of immigration in public debate may have caused voters to want to leave the E.U., driven by anxiety about their economic security.[27] One can also argue that voting to leave may be justified by immigration having a small negative effect on the lowest wages. Clearly, the act of voting costs a voter only a few minutes of his time but may prevent his wages from falling slightly due to future immigration. This may be a rational thing to do from a pure self-interest in spite of the indications of a weak effect of immigration on native wages.

[25] See Reed and Latorre (2009).
[26] See www.ipsos-mori.com/researchpublications/rese.
[27] A striking example is provided by *The Telegraph* newspaper on 27 July 2016. This is the strong leave vote in some regions where industries dependent on the UK remaining in the Single Market are significant employers. For example, the leave vote was strong in the English towns of Dagenham and Bridgehead where Ford produces car engines and then ships them to its plants on the Continent. Many of the cars are subsequently sold in the UK. *The Telegraph* reports that Ford is considering closing both plants because of the decision of the UK to leave the EU and firing 3,800 workers.

7. Brexit and Sterling

We turn to the currency markets to analyse whether the currency traders anticipated the Brexit vote, whether they thought it was good for the currency, and what was the effect of changes in the poll numbers from one poll to another on the sterling exchange rate if not fully anticipated. The UK's departure from the E.U. could affect the fundamentals of the sterling exchange rate. For example, the UK may no longer be a good place for foreign direct investment in production facilities aimed at the E.U. market and the price of credit default swaps for UK banks may increase. Conversely, if the markets expect post-Brexit UK to flourish outside the E.U., forming trade relationships with countries outside the E.U. and passing laws and regulations that make the business sector more flexible and dynamic, then sterling might actually appreciate.

We start in Figure 4 by showing the movement of the sterling-euro exchange rate since shortly before the announcement that there would be a referendum in early 2013 (defined as the price of the pound measured in euros). The price of sterling fell in the first couple of months of 2013, increased gradually throughout the remainder of 2013 and 2014, and then more steeply in early 2015. The initial fall in 2013 started before the announcement of a referendum so cannot be attributed to the announcement. Sterling appreciated in the immediate aftermath of the General Election victory of the Conservative Party, which made the referendum a likely event. It then fell in value after the referendum bill was unveiled. The announcement that Tory ministers would be allowed to campaign for the leave side was followed by the depreciation of sterling and the same occurred after the draft renegotiation. Throughout this period there is no clear effect in either direction from news that should have made Brexit more or less likely. However, in the days before the referendum on 23 June the movements of sterling appear to reflect changes in the probable outcome of the referendum. Thus polls that gave the leave campaign a majority were followed by a large depreciation of the currency and the tragic murder of an MP only a week before the referendum, which may have convinced some that the remain side would come out on top, was followed by an appreciation. Finally, the referendum outcome caused a sudden depreciation.

Table A2 in the appendix documents some of the news events that may be expected to have impacted the sterling exchange rate. Visual inspection suggests that the political events in the two to three years prior to the referendum had a modest impact on the sterling exchange rate. However, there is some indication that events in the days before had an effect and certainly the referendum outcome did make sterling depreciate.

Table 7 has the results of the estimation of two equations that treat the results of polls on whether to leave the European Union as a function of predetermined variables, which then affect changes in the current exchange rate. The first has the change in the poll numbers (defined as the change in the proportion of responders who want the UK to leave the E.U. where the leave vote measures the share of decided voters who voted to leave, measured in from 0 to 1) – from one poll to the next – as the dependent variable and the lagged change in the value of sterling on the preceding day as well as the value of sterling on the day before in addition to the results of the last poll. The equation tests to what extent the currency market anticipated the poll numbers. The second equation has the change of the log of the exchange rate as a dependent variable and the current change in the poll numbers, the lagged results of the polls and the lagged log exchange rate on the right-hand side of the equation.

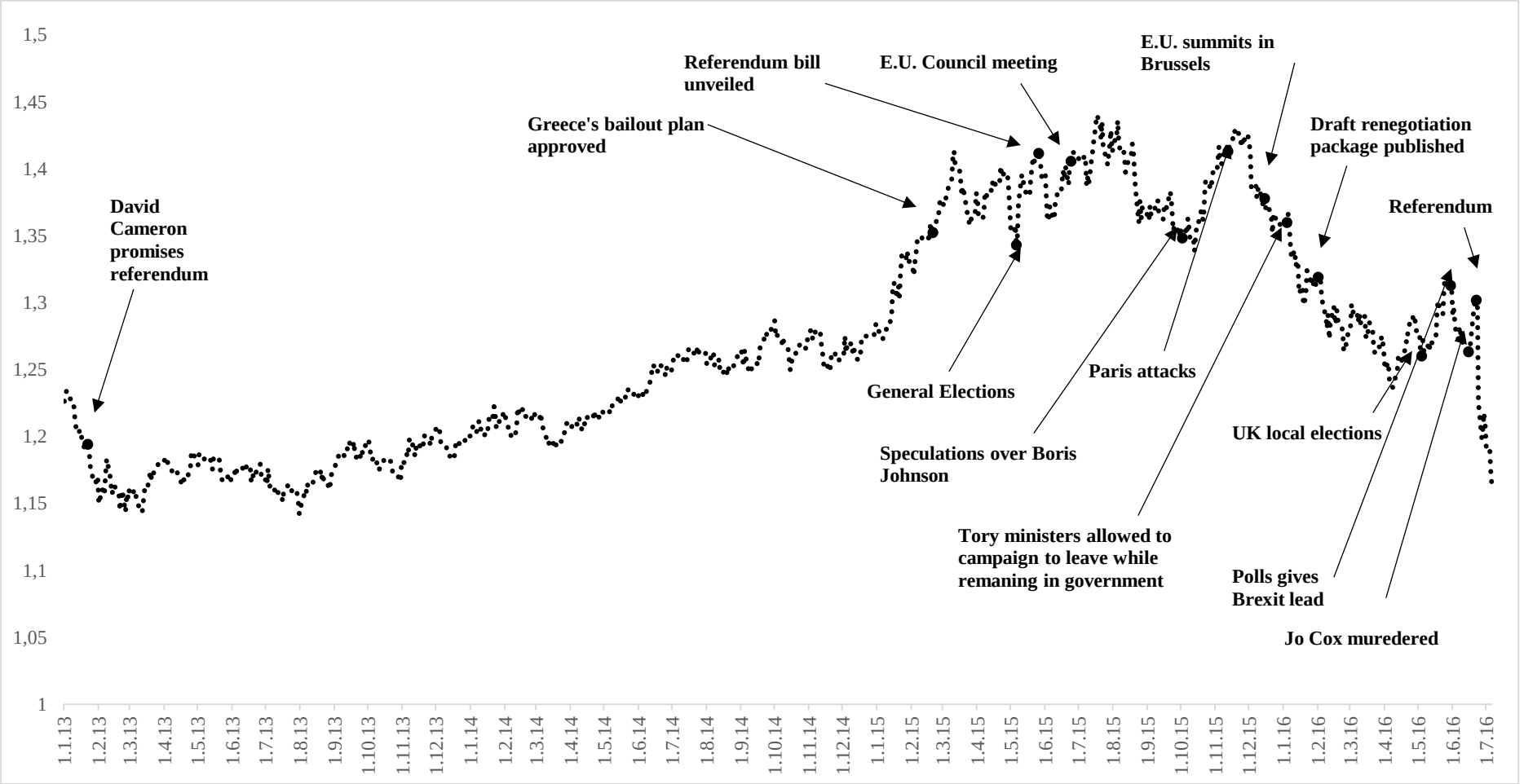
Table 7. Sterling and the opinion polls

Dependent variable	ΔL_t			$\Delta log(E_t)$	
	Estimate	t-ratio		Estimate	t-ratio
Constant	0.062	5.36	Constant	0.005	3.09
$\Delta \log(E_{t-1})$	0.165	1.36	ΔL_t	-0.011	1.99
$\log(E_{t-1})$	-0.057	4.13	L_{t-1}	-0.007	2.72
L_{t-1}	-0.096	5.41	$\text{Log}(E_{t-1})$	-0.007	2.68
R-squared	0.05			0.01	
Adjusted R-squared	0.05			0.01	
F-statistic (prob.)	25.51 (0.000)			3.54 (0.014)	
DW	2.11			2.05	
Observations	1508			1509	
Time period	13. Sep.2010-22. June 16			10. Sept. 2010– 22. June 16	

White heteroskedasticity-consistent standard errors & covariance. The leave vote is measured in as a fraction of one.

The first equation shows that the change in the poll numbers depends on the lagged exchange rate. Thus, the higher the value of sterling on the day before the poll is taken, the smaller is the increase in the proportion wanting to leave the E.U. There is also some mean reversion in the poll numbers, so that following an increase in the leave vote it falls back by about 10% for every poll conducted. The second equation shows that an increase in the share of voters wanting to leave coincides with a depreciation of sterling. The same applies to a large share of voters wanting to leave. Moreover, the lower the level of the exchange rate the bigger the increase in the leave vote.

Figure 4. The Sterling-euro exchange rate



The fact that an increase in the leave vote makes sterling depreciate suggests that the currency market does not anticipate the poll numbers fully. Note that the explanatory power of both equations is very weak: Sterling movements explain only 5% of the variation of the poll numbers and the changes in the poll results explain only 1% of the sterling movements.

Finally, the numerical values of the estimates suggest that a 1% increase in the proportion of respondents who want the UK to leave the European Union leads to a 1% decline in the exchange rate. This is a very strong long-term effect on sterling. Since about 50% of voters wanted to leave the E.U. according to poll numbers the days before the referendum, the effect of the result of the referendum could be calculated by setting the leave side at 100%. This would make sterling depreciate by about 50% in steady state. In contrast, the short term effect would be small.

8. Concluding remarks

The pattern of voting in the referendum reflects differences in the age composition of the population and the share of the less educated, with the older generation and the less educated voting for Brexit, in addition to a low level of per capita income having the same effect. These variables not only explain the voting patterns but also the attitude towards immigrants as neighbours, the dangers posed by immigrants to society and feelings of apprehension towards the European Union. The less educated may have more to fear from immigration and free trade and for that reason want to leave the E.U. The reasons why the old would want to leave are more difficult to decipher. These individuals may have good memories of life without the E.U. or be driven by nostalgia. The importance of GDP per capita would lead us to think that low income makes people more willing to upend the status quo, but reading economic history would tell us that the relative poverty in provincial England does not have much to do with the membership of the E.U. since the decline of northern England in comparison to London and the South East is a long-term evolution driven by the decline of manufacturing and the rise of a service economy.

What remains to explain is the strong remain vote in Scotland and Northern Ireland. There is an obvious reason why more people in Northern Ireland voted to remain in the E.U. than our model would predict. With Ireland and the UK being members of the European Union, both have a common labour market. The authorities abolished systematic customs checks between the two regions in 1993. Brexit spells the end of the common labour market and the beginning of formal border controls, which will aggravate problems in Northern Ireland and may endanger the 1998 peace accord, the so-called Good Friday Agreement. Thus it could be

said that the UK's departure from the European Union will affect Northern Ireland more than any other part of the UK.[28]

The reasons why Scotland voted solidly to remain are less obvious. One possible reason is that its leaders see E.U. membership as important for their future as an independent state. With only 5.3 million in 2016, they may want to outsource some of the functions of the state. There are clearly fixed costs in being an independent state and these fixed costs may make full independence impossible unless they can outsource some of the tasks of the state. But why not use the United Kingdom to outsource some of the functions to England? One possible reason is that the Scotland may find England more intrusive in their internal affairs than the European Union. Alesina et al. (2000) show how openness and economic integration allow small cultural or ethnic groups to form small, homogeneous political jurisdictions while enjoying the economic benefits of access to a large market.

So what can we conclude from these results? While the benefits of free trade and the mobility of labour can be shown using economic theory, it is clear both from theory and the data that not everyone gains equally. There are winners and losers. And if the losers are sufficiently many, they may vote for nationalist political parties or against free trade and the free mobility of workers in a referendum. One interpretation would be that what happened in the UK is also happening in many other western countries where nationalist sentiments are on the rise. Sufficiently many people are disappointed that their living standards have not improved in recent years and decades and blame it on foreigners, either because of imports from low-cost countries or migrants coming from these countries. But nationalist sentiments may not provide the answers or solutions these people are looking for. Instead, economists and politicians should focus more on making capitalism inclusive so that a large majority of voters feel that they are part of it, benefiting from it and voting for politicians and policies that emphasize free trade and free migration within the E.U.

[28] See Bolton et al. (1996) on the role of factor mobility in determining the incentives towards separation or integration.

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Table A1. European Values Study (EVS, 2011)

Variable	**Dislike of neighbour**
Question	On this list are various groups of people. Could you please sort out any that you would not like to have as neighbours?
Values in dataset	The percentage of how many listed each of the following: *People of different race* *Right wing extremist* *Muslims* *Immigrants/foreign workers* *Homosexuals*
Variable	**Fear of E.U.**
Question	Some people may have fears about the building of the European Union. I am going to read a number of things which people say they are afraid of. For each tell me if you - personally - are currently afraid of:

very much afraid									not afraid at all
1	2	3	4	5	6	7	8	9	10

Value in dataset	The percentage of those who answered'1' for the following *The loss of social security* *The loss of national identity and culture* *Our country paying more and more to the European Union* *A loss of power in the world for Great Britain* *The loss of jobs in Great Britain*
Variable	**E.U. enlargement**
Question	Some say that the European Union enlargement should go further. Others say it has already gone too far. Using this card, which number best describes your position, where '1' means "should go further", and '10' means "has already gone too far"?

should go further									has already gone too far
1	2	3	4	5	6	7	8	9	10

Value in dataset	The percentage of those who answered '10'
Variable	**No more immigrants**
Question	How about people from less developed countries coming here to work? Which one of the following do you think the government should do?

1	let anyone come who wants to
2	let people come as long as there are jobs available
3	put strict limits on the number of foreigners who can come here
4	prohibit people coming here from other countries

Values in dataset	The percentage of those who answered'4'
Variable	**Dislike immigrants**
Question	Please look at the following statements and indicate where you would place your views on this scale?

Immigrants take jobs away from natives in a country									Immigrants do not take jobs away from natives in a country
1	2	3	4	5	6	7	8	9	10

A country's cultural life is undermined by immigrant									A country's cultural life is not undermined by immigrants
1	2	3	4	5	6	7	8	9	10

Immigrants make crime problems worse									Immigrants do not make crime problems worse
1	2	3	4	5	6	7	8	9	10

Immigrants are a strain on a country's welfare system									Immigrants are not a strain on a country's welfare system
1	2	3	4	5	6	7	8	9	10

In the future the proportion of immigrants will become a threat to society									In the future the proportion of immigrants will not become a threat to society
1	2	3	4	5	6	7	8	9	10

For the greater good of society it is better if immigrants maintain their distinct customs and traditions									For the greater good of society it is better if immigrants do not maintain their distinct customs and traditions but adopt the customs of the country
1	2	3	4	5	6	7	8	9	10

Value in dataset The percentage of those who answered '1'

Other Sources

Variable	Description	Source
Unemployment	Unemployment percentage, age 15 or over in 2015	Eurostat (n.d.), Your key to European statistics, Retrieved June 28, 2016, from http://ec.Europa.E.U. /Eurostat/web/products-datasets/-/lfst_r_lfu3rt
GDP	GDP at current market prices. Measured in euros per inhabitant in 2014	Eurostat (n.d.), Your key to European statistics, Retrieved June 28, 2016, from http://ec.Europa.E.U. /Eurostat/web/products-datasets/-/nama_10r_2gdp
Low Education	The percentage of inhabitants, between 25 to 64 years old, with less than primary, primary and lower secondary education in 2015	Eurostat (n.d.), Your key to European statistics, Retrieved June 28, 2016, from http://ec.Europa.E.U. /Eurostat/web/products-datasets/-/edat_lfse_04
Migration	Crude rate of net migration plus statistical adjustment in 2014	Eurostat (n.d.), Your key to European statistics, Retrieved June 28, 2016, from http://ec.Europa.E.U. /Eurostat/web/products-datasets/-/demo_r_gind3*
Elderly	Population 65 years and older as percentage of total population 2015	Eurostat (n.d.), Your key to European statistics, Retrieved June 28, 2016, from http://ec.Europa.E.U. /Eurostat/web/products-datasets/-/demo_r_pjanaggr3
Leave	Local results from the EU Referendum held in 23 June 2016 by UK Administrative Geographies. Then transformed into NUTS 2 Regions	Relationship of NUTS Areas to UK Administrative Geographies (n.d.), and E.U. Referendum local results (2016, June 24)

* The indicator is defined as the ratio of net migration (including statistical adjustment) during the year to the average population in that year. The value is expressed per 1000 persons. The net migration plus adjustment is calculated as the difference between the total change and the natural change of the population.

Table A2. E.U. referendum timeline

23 January 2013 - David Cameron promises an in/out referendum on E.U. membership
23 February 2015 - Greece's bailout plan approval The sterling index fell after the Greece bailout plan approval
7 May 2015 - General Elections: The Conservative party wins 12 seat majority
27 May 2015 - The European Union Referendum Bill was unveiled in the Queen's Speech.
25-26 June 2015 - European Council meeting The first EU summit after David Cameron's unexpected victory in the UK general election. The summit ended up being dominated by the migrant crisis and Greek debt crisis. Cameron used the meeting - otherwise dominated by the Greek debt crisis and European migrant crisis - to formally set out his aims. Speaking after it, he said he was delighted the process of "reform and renegotiation" of the UK's membership of the EU was "properly under way".
3 October 2015 - Speculations over whether Boris Johnson will break from the pack to lead the Brexit campaign?
13 November 2015 - Paris attacks
17 December 2015 -E.U. summits in Brussels David Cameron attempts to renegotiate the terms of Britain's membership of the E.U.
5 January 2016 - Cameron says Conservative ministers will be able to campaign to leave the E.U. while remaining in the government.
2-3 February 2016 - Draft renegotiation package published and Cameron sets out plans to Parliament
18-19 February 2016 - Cameron gets a deal at E.U. summit
20 February 2016 - Referendum date is announced
22 February 2016 - Commons debate
5 May 2016 - Elections to devolved parliaments in Scotland, Wales and Northern Ireland plus for London's mayor
May 23 2016 - E.U. Finance Services Chief Says Britain Faces Barriers if Quits E.U.
May 31 2016 - Pound slides sharply against US Dollar after poll gives Brexit lead ICM poll found the Leave campaign leading with 52 percent to 48. This was the first a normal-methodology phone poll gave such results. http://www.independent.co.uk/news/uk/politics/the-pound-slides-sharply-against-the-us-dollar-after-poll-showing-brexit-ahead-a7058021.html
1 June 2016 - Boris and Gove promise tough Australian-style immigration points system after Brexit This indicates that the Leave campaign does not intend to become member of the European Economic Area should the referendum results be in their favour.
16 June 2016 - Jo Cox Labour MP shot dead
23 June 2016 - Referendum date

References without links are based on E.U. referendum timeline: Countdown to the vote http://www.bbc.com/news/uk-politics-33141819