Diversity, segregation and support for Brexit

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What effect does local economic inequality and ethnic diversity have on voting behaviour? This question is of increasing importance as many cities in the US, UK and other developed countries experience rising inequality and immigration. Using Brexit as a case study, and exploiting hyper-localised data on economic inequality and migrants, I explore the impact of neighbourhood composition on voting behaviour. I find robust evidence that both economic and ethnic diversity are substantively associated with reduced support for Brexit. However, this effect is mitigated by segregation – neighborhoods that are more highly segregated tend to show greater support for Brexit.

1 Introduction

The UK's decision to leave the EU – to 'Brexit' – in a referendum on 23rd June 2016 is widely considered a by-product of increasing economic and cultural divides. The economic narrative in the emerging academic literature is that Brexit was driven by the people and places 'left behind' (Hobolt 2016; Goodwin and Milazzo 2017; Colantone and Stanig 2018; Rodríguez-Pose 2018). More specifically, those on the losing end of globalisation, i.e. with less education and residing in declining areas, were more likely to support Brexit. To make matters worse, austerity beginning in 2010, which disproportionately affected the people and places most affected by globalisation, 'activated' support for anti-EU politics (Fetzer 2019).

A second, compatible explanation focuses on the growth in cultural divisions. According to this account, long-term cultural changes in the UK (as well as the US and other Western societies), deriving in particular from increased immigration and ethnic diversity, resulted in countervailing conservative and nationalist reactions. In the UK, this has manifested itself as anti-immigrant and 'Eurosceptic' attitudes, leading to the emergence of right-wing populist political parties

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(McLaren 2002; Curtice 2016; Kaufmann 2016; Norris and Inglehart 2019; Carreras, Irepoglu Carreras, and Bowler 2019) and the desire to 'take back control.'

However, a close examination of the data reveals that there is more to the Brexit story. For one, as Dorling (2016) points out, when accounting for differential population size, it becomes apparent that most Leave voters were middle class and from the relatively affluent, populous South of England, a world removed in compositional and contextual terms from the struggling post-industrial areas in Wales and the North of England most affected by globalisation and austerity. In other words, it is not only the places 'left behind' but also many that have done relatively well that voted for Brexit. For example, Upminster in East London voted 63% in favour of Leave with an £81,300 average yearly income in 2016.[2] Conversely, many areas which might reasonably considered to be 'left behind,' for example Tottenham Hale in North East London voted overwhelmingly to Remain (84.5%).[3]

Second, there are some notable inconsistencies in the cultural narrative as well. In particular, studies generally show, with some exceptions (Goodwin and Milazzo 2017), that higher levels or changes in immigrant populations are related to *less* support for Brexit (Becker, Fetzer, and Novy 2017; Colantone and Stanig 2018; Arnorsson and Zoega 2016). This is counterintuitive – we would expect anti-immigrant backlash to be higher in areas which have experienced more immigration.

In this paper, I delve further into the geography of Brexit to address these inconsistencies. In particular, investigate the local contextual drivers of the vote to leave the EU, and shed light on the counterintuitive findings in relation to left behind and anti-immigrant backlash explanations put forward in the literature. In particular, I examine whether important contextual attributes hitherto unexamined – local diversity and segregation – relate to support for Brexit. Diversity refers to compositional variety within a local area (i.e. the variety of different types of economic and social groups), whereas segregation measures its spatial arrangement. To understand what is

[2] Average income figure from ONS small-area (MSOA) estimates for 2016 merged into 2016 electoral wards. Data is available publicly here: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/smallareaincomeestimatesformiddlelayersuperoutputareasenglandandwales.

[3] Data on voting obtained from UK Electoral Commission, available publicly here: https://www.electoralcommission.org.uk/who-we-are-and-what-we-do/elections-and-referendums/past-elections-and-referendums/eu-referendum/results-and-turnout-eu-referendum.

driving differential voting and support patterns with regards Brexit, I examine the effects of diversity and segregation for two different attributes – economic and ethnic.

Why would diversity matter? Academics differ on the answer to this question – diversity is thought to either increase inter-group conflict ('conflict theory') (Blalock 1967) or reduce it ('contact theory') (Allport, Clark, and Pettigrew 1954). On the one hand, proponents of conflict theory argue that ethnic diversity increases the opportunity for inter-group strife. This is a central plank in the cultural narrative around Brexit. From an economic perspective, diverse neighbourhoods are, by definition, economically unequal, and this therefore might make inequalities salient (Smith et al. 2012) and heighten class conflict (Newman, Johnston, and Lown 2015), reducing support for the 'establishment.' On the other hand, contact theory suggests that diversity reduces the distance between different ethnic and economic groups, fostering social networks and mitigating stigmatisation (Allport, Clark, and Pettigrew 1954; Dorling 2017). Taken together, local diversity might affect support for Brexit by heightening economic and cultural tensions (the 'conflict' hypothesis) or by fostering greater cross-group understanding, thereby mitigating the economic and cultural rationales considered to be drivers of Brexit support (the 'contact' hypothesis).

The empirical evidence relating neighbourhood ethnic and foreign composition and political outcomes is mixed. While some find a positive effect between diversity and populist sentiment (Putnam 2007; Newman, Shah, and Collingwood 2018; Reny and Newman 2018; Harmon 2018), other find no impact (Hill, Hopkins, and Huber 2019), or that increased diversity reduces populist support and promotes social cohesion (Kaufmann 2017; Sturgis et al. 2014). Regarding Brexit in particular, one study surveyed 400 UK citizens just prior to the referendum in 2016, finding that inter-group contact was associated with support for Brexit, although the direction depended on whether the contact was subjectively rated as positive or negative (Meleady, Seger, and Vermue 2017). Recent work looking at residential context and far-right voting in France suggests that the chosen geographic scale is important, with positive (negative) effects found for the neighbourhood (department) level (Vasilopoulos, McAvay, and Brouard 2021). This provides motivation to explore the role of ethnic diversity and segregation on support for Brexit, and to explicitly vary the geographic unit of analysis.

In terms of economic diversity, the empirical evidence is limited. In the US, Newman, Johnston, and Lown (2015) finds local inequality increases class awareness and conflict, while in the UK and other European countries there is mixed evidence for the policy of mixed housing conferring benefits (Meen and Gibb 2005; Galster 2007; Cheshire 2007; Ostendorf, Musterd, and De Vos 2001; Arthurson 2002; Bolt, Phillips, and Van Kempen 2010). Granular information on economic heterogeneity in the UK is limited (Suss 2021), which might explain why there is a lack of studies which examine local economic diversity and its impacts.

Importantly, if there is a positive 'contact' effect arising from diversity, it can be undermined by segregation within neighbourhoods, since a more segregated community does not enable the potentially beneficial contact and interaction to occur (Sturgis et al. 2014) and can make it more difficult to escape poverty (see, for example, Massey and Denton 1989; Kearns and Parkinson 2001). So, when evaluating how diversity affects support for Brexit, it is important to also account for the degree of segregation within communities.

The analysis in this paper makes use of fine-grained measures of local economic diversity and segregation based on a large dataset of housing values (Suss 2021), as well as measures of immigration and ethnicity from the 2011 Census. I merge these data with information on the actual Leave vote from the UK Electoral Commission, as well as individuals' stated levels of support for Brexit in Wave 8 of Understanding Society, a large UK household survey.

By way of preview of the results, I find robust evidence to support contact theory, particularly for ethnic diversity. First, using aggregate-level data on the Leave vote, I present between-area regressions and control for a battery of other known determinants of the Leave vote, demonstrating substantive associations for within-area diversity and segregation on the share of Brexit voters. This holds for both economic and ethnic variables, and the estimates are substantive in size – a one standard deviation increase in economic (ethnic) diversity at the Ward level is associated with a 0.81 (5.61) percentage point reduction in the Leave vote. On the other hand, economic (ethnic) segregation is associated with a 0.85 (1.6) percentage point increase in the Leave vote. The same pattern of results, albeit with slightly reduced point estimates, is found at the Local Authority level.

Second, using individual-level data on support for Brexit, I find that greater ethnic diversity within neighbourhoods leads to substantially higher odds of supporting Remain, and this holds

even at more aggregated geographic levels. Segregation has the opposite effect, with more highly segregated neighbourhoods leading individuals to be more supportive of Brexit. Regarding economic diversity and segregation, I find weaker evidence at the individual-level. I also investigate to what extent these contextual effects interact with political orientation, proxied by political party support. The results here are striking and shed light on why Brexit opened up cleavages within established political parties. The segregation effect appears to be operating through supporters of the Labour Party, whereas the diversity effect is broad-based.

While I control for important individual level determinants of pro-Brexit sentiment, and the results are robust to a number of alternative specifications and sub-sample analyses, concerns around endogeneity nevertheless persist, particularly around self-selection – i.e. the possibility that Brexit supporting individuals are more likely to relocate to areas which are less economically and socially diverse. I mitigate this concern by restricting the sample to only those that lived in the same address for 20+ years and to those that live within a 5 mile radius of where they grew up.

This paper proceeds as follows: Section 2 details the data sources and measures; Section 3 describes the methods; Section 4 provides the results and discussion; and Section 5 concludes.

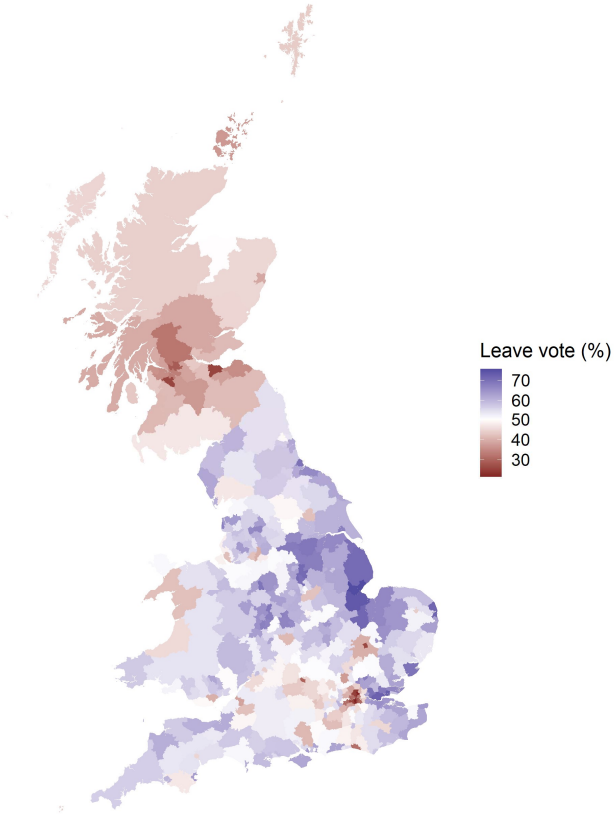
2 Data and Measures

2.1 Brexit

I obtain data on the actual Leave vote from the UK Electoral Commission.[4] Figure 1 provides the breakdown of the vote for Great Britain (Northern Ireland is excluded because vote tallies are not provided at lower geographical levels).

[4] Data available publicly from: https://www.electoralcommission.org.uk/who-we-are-and-what-we-do/elections-and-referendums/past-elections-and-referendums/eu-referendum/results-and-turnout-eu-referendum.

Figure 1: Proportion Leave by LAD



2.2 Diversity and Segregation

For measures of economic diversity and segregation, I use a novel source of highly-granular data on housing values constructed by Suss (2021). This dataset is based on information for approximately 23 million residential addresses from the online property aggregator Zoopla, allowing for statistically reliable measures to be computed at spatially granular levels, down to the Output Area level (the lowest level census geography in the UK). Moreover, Suss (2021) shows that measures of inequality derived from this data are robustly associated with people's subjective perceptions of local economic discrepancies.

For immigration and ethnicity, I use census data from 2011 provided by the ONS. For immigration composition, I take data on country of birth, broken down into the following four categories: UK and Ireland, other EU (not including post-2005 accession countries), EU

accession countries (post-2005), and outside UK and EU. For ethnic groups, I select the broad census categories: White, Black, Asian, Mixed, and Other (ONS 2016).

To measure diversity, I use the reverse of the Herfindahl-Hirschman Index (HHI) concentration index, as follows:

$$HHI = 1 - \sum_{i=1}^{n} s_i^2$$

where s_i is the share of economic or social group i out of the total number of groups in the area n. Higher numbers represent areas that are more diverse. For economic diversity, I discretise the housing value data, rounding all values to the nearest 250k. This results in the possibility of a different number of groups for each area, and so I normalise the score (so that it ranges from 0 to 1). The HHI is often used in studies exploring both economic and ethnic diversity. For example, Minkoff and Lyons (2019) use this measure when examining whether income diversity is related to perceptions of inequality, and Sturgis et al. (2014) when looking at neighbourhood ethnic composition in London.

For segregation, I use the Multigroup Entropy Index (MEI) (Theil 1972; Reardon and Firebaugh 2002; Sturgis et al. 2014). This compares the composition of sub-units within an area to surmise the extent of unevenness. The formula is:

$$MEI = \sum_{j=i}^{m} \frac{t_j}{T} \frac{E - e_j}{E}$$

Where T is the population count for the target area and t_j for its sub-units, E and e_j is the entropy score for the larger area and sub-units respectively, calculated as (for e_j):

$$e_j = \sum_{i=1}^{n} s_{ij}\, ln(\frac{1}{s_{ij}})$$

where s_{ij} is the share of economic or social group i out of the total number of groups n in the sub-unit j. The calculation for E is therefore simply $E = \sum_{i=1}^{n} s_i\, ln(\frac{1}{s_i})$. The MEI ranges from 0 to 1, with higher numbers representing greater segregation.

2.3 Neighbourhood Definition

I take the Middle Super Output Area (MSOA) as neighbourhood boundaries (population M = 7,787, SD = 1,600). MSOAs have a number of properties which are advantageous for approximating neighbourhoods. First, perfectly nested within them are lower level geographies, namely Lower Level Super Output Areas (LSOAs) and Output Areas (OAs), which are in turn built up from postcode blocks. This enables me to easily calculate the MEI by taking the sub-units to be OAs. Second, MSOAs are population-weighted and stable over time. In contrast, other local boundaries, for example electoral Wards, tend to shift boundaries frequently and vary far more in terms of population, and so therefore are not comparable across the UK. I nevertheless measure diversity and segregation at the Ward and LAD levels as well since these are the administrative areas at which the actual referendum vote was counted. I can therefore conduct between-area regressions to examine how the Leave votes relates to the measures of diversity and segregation, whereas for individual-level results I'm confined to self-reported support for Brexit rather than actual voting behaviour.

To provide some indication of the spatial distribution of diversity and segregation, I map out the various measures for select cities in England: Birmingham, Bradford and London (Figures 2, 3 and 4 respectively). Each of these areas were polarised in terms of Brexit: some Wards saw some areas strongly supporting Leave while others strongly supported Remain. A pairwise correlation analysis (Figure 5) reveals that the ethnic measures are highly correlated with their immigrant counterparts, so I drop the latter going forward in favour of diversity and segregation for country of origin given that the topic was more salient in the Brexit referendum (however I refer to country of origin and ethnic interchangeably).

Figure 2: Ward-level Leave vote, diversity, and segregation (Birmingham)

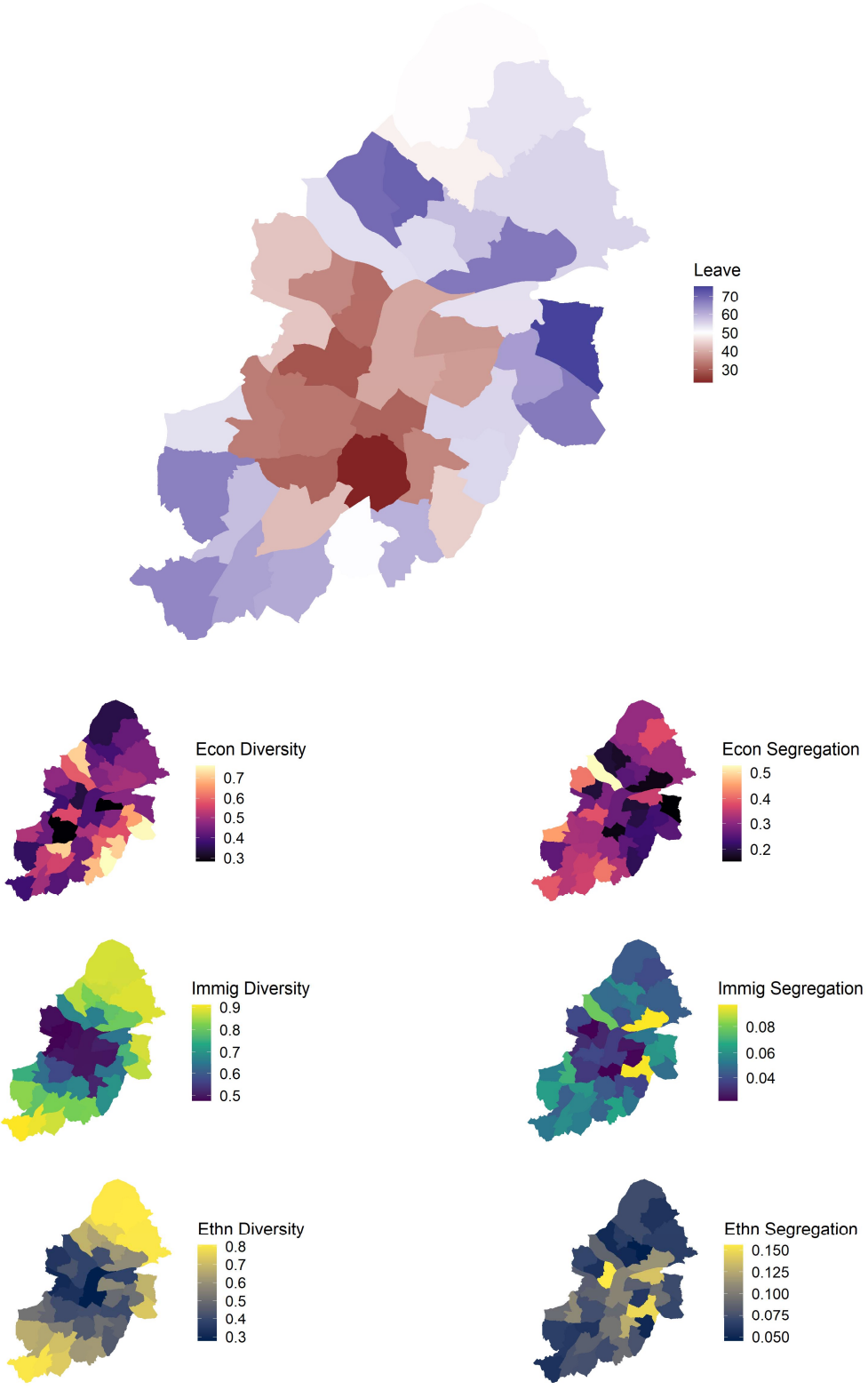


Figure 3: Ward-level Leave vote, diversity, and segregation (Bradford)

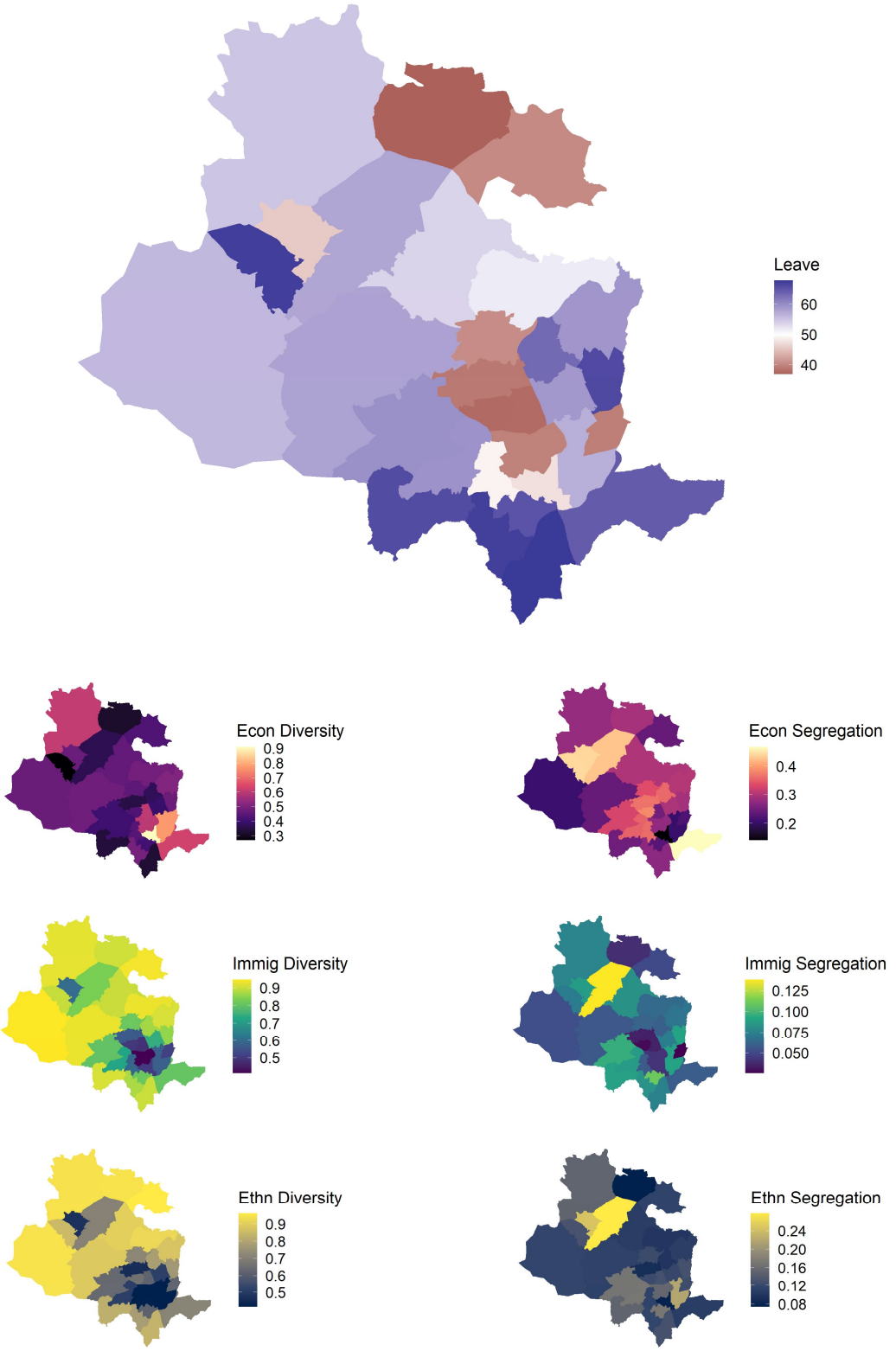


Figure 4: Ward-level Leave vote, diversity, and segregation (London)

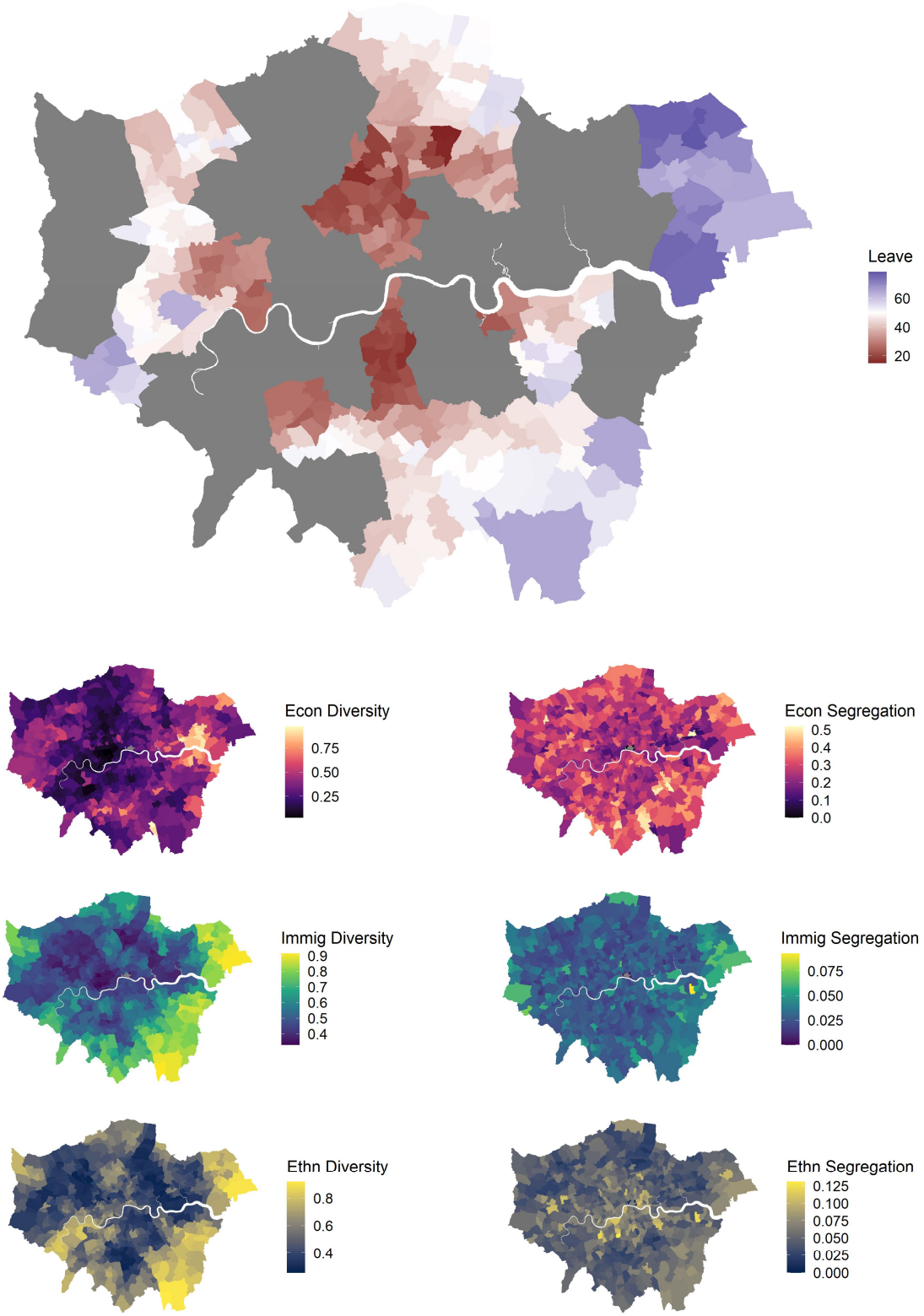
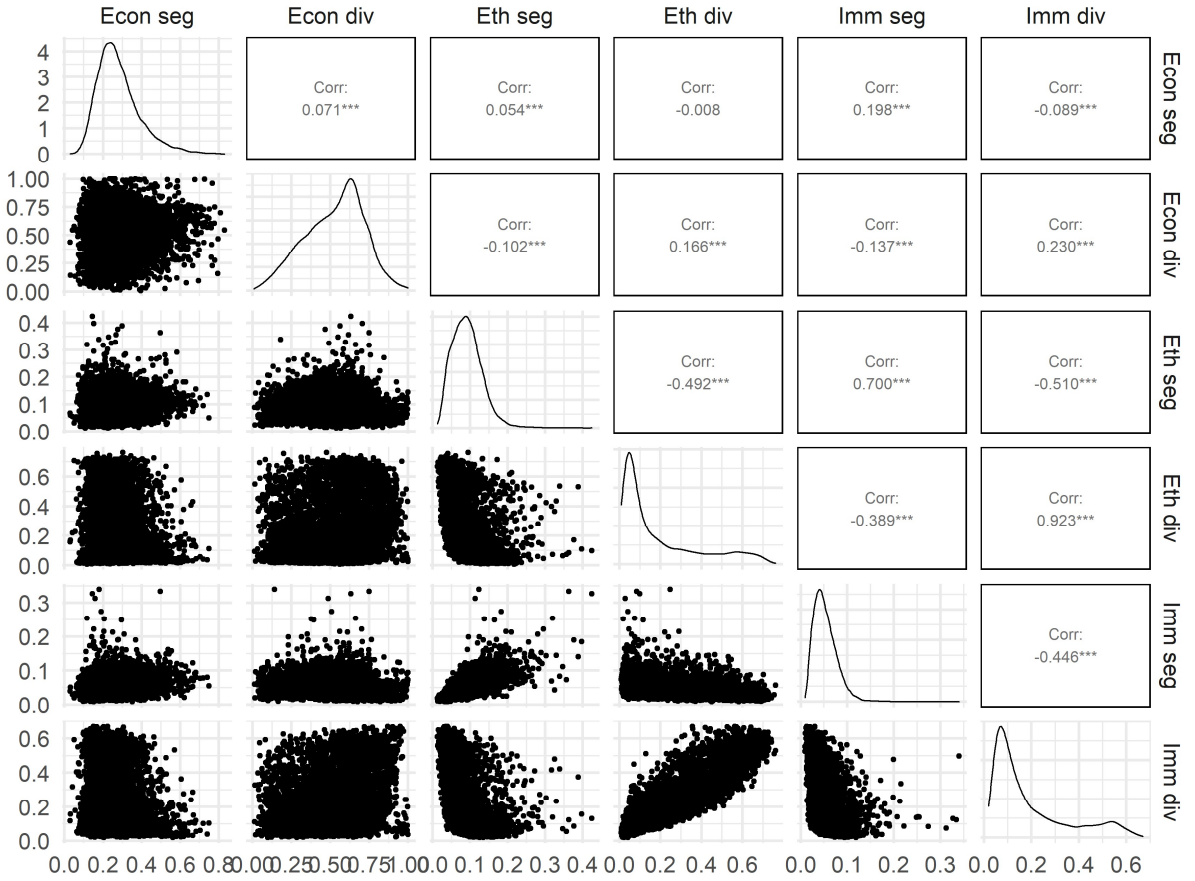


Figure 5: Correlation matrix for diversity and segregation measures, MSOA-level



3 Empirical strategy

I first examine between area relationships using data from the UK's Electoral Commission on the proportion of those voting Leave at the Local Authority District (LAD) level. LADs are relatively large spatial units (population M = 161,138, SD = 109,066), in some cases encompassing both urban and rural areas, and therefore not ideal for representing local contexts. Thankfully, some local authorities have released data on the referendum result for individual electoral Wards (N = 1,283). Wards are often commensurate with the neighbourhood level in terms of size, with the average population close to that of MSOAs (6,658). However, as noted earlier, Wards vary far more than MSOAs in terms of population (SD = 4,467, Min. = 136, and Max. = 33,937) and so do not always equate to the common sense definition of neighbourhoods. For this reason, I turn to MSOAs when looking at the individual-level.

I complement the aggregate-level vote data with a battery of control variables which have been shown to be important in other work on the determinants of Brexit. In particular, the area's average property price, population size, the percent of residents with no educational qualifications, the percent of residents not born in the UK, the change in the percent of residents not born in the UK (2001-2011), the growth in migrants from EU accession countries (2005-2015), the level of austerity cuts per worker, the percentage of residents who are old (60+), and the growth in mean hourly pay (2005-2015) (ONS 2016; Ansell and Adler 2019; Becker, Fetzer, and Novy 2017; Fetzer 2019; Beatty and Fothergill 2018). See Table A.1 and Table A.2 for descriptive statistics at the LAD and Ward levels, respectively. To estimate the relationship between diversity and segregation on aggregate vote Leave, I run simple OLS regressions including region fixed effects. Importantly, group-level behaviour might not correspond with individual behaviour – i.e. it might be subject to the ecological fallacy (see, for example, Kramer 1983; Openshaw 1984). Therefore, I also turn to individual-level data on support for Brexit.

For individual-level data, I use Wave 8 of Understanding Society (University of Essex and Research 2019), the UK's large-scale household longitudinal survey (N = 34,272). Data was collected prior to and after the referendum on June 23rd 2016, and the survey included the exact same question posed in the referendum:

> "Should the United Kingdom remain a member of the European Union or leave the European Union?"

The survey provides relevant demographic information (age, education, gender, ethnicity, housing tenure), and, perhaps most importantly, the political party a respondent feels closest to, which proxies for political orientation and attitudes towards immigration (Kaufmann and Harris 2015). I am therefore able to control for important individual differences that have been linked to support for Leave (see Becker, Fetzer, and Novy (2017) and Ansell and Adler (2019) for the importance of housing tenure). Table A.3 in the Annex provides descriptive statistics for the individual-level dataset. The survey also includes geographic identifiers, allowing me to place each respondent within their respective MSOA neighbourhood.

I model support for Brexit at the individual level using multilevel regression and restricted maximum likelihood estimation (via the `lme4` package in R; Bates et al. (2015)). Individuals are nested within neighbourhoods (defined in the base models as the MSOA-level). I also include fixed effects at the LAD level. This controls for any differences across these areas which might

affect support for Brexit and relate to economic diversity and segregation, for example differences in austerity cuts and public service provision.

One of the major concerns with identifying the causal effect of diversity and segregation on voting behaviour is self-selection. Individuals are free to move to neighbourhoods populated with like-minded or ethnically-similar residents. Kaufmann and Harris (2015) provide an empirical analysis of migration patterns by political orientation using 19 waves of Understanding Society and its predecessor, the British Household Panel Survey. They find that self-selection should not be a concern given that moving to areas of less diversity is no more likely for those who can be considered to be anti-immigration. Other studies similarly find that self-selection is not a major concern, in both the UK (Gallego et al. 2016) and US (Cho, Gimpel, and Hui 2013). On the other hand, work by Lee, Morris, and Kemeny (2018) finds that residential immobility is a factor explaining support for Brexit.

I carry out additional analysis to mitigate selection concerns. Namely, I restrict the sample to those that have not moved for 20 years or more and to those living within a 5 mile radius of where they were living as adolescents (N = 9,210 and 2,312 respectively).

4 Results

4.1 Aggregate-level results

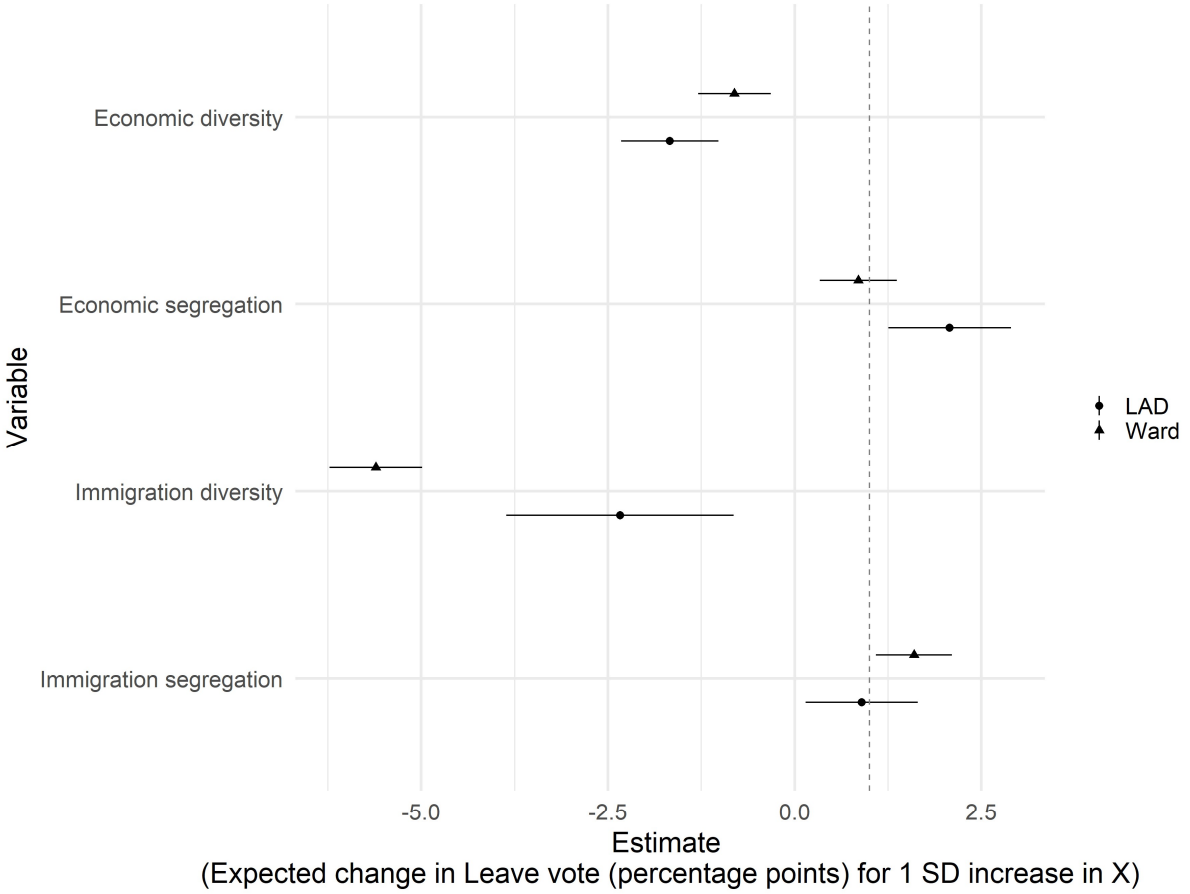
Figure 6 presents the standardised and exponentiated coefficients for the full LAD and Ward-level regressions. Both models include control variables and region fixed effects. The results indicate that diversity, both economic and in terms of country of origin, is statistically significant and negatively related to the Leave vote. Conversely, economic and social segregation is positively associated with the Leave vote. See the full results in Table A.4 of the Annex.

The coefficients are also substantive in size. A one standard deviation increase in economic diversity at the LAD-level is associated with a 1.67 percentage point decrease in the Leave vote. On the other hand, an increase in within-LAD economic segregation is expected to increase the Leave vote by 2.08 percentage points. In terms of immigrant diversity, a one standard deviation increase is expected to decrease the Leave vote by 2.34, whereas a one standard deviation increase in segregation is expected to increase the Leave vote by 0.9.

I repeat the same OLS between-area regressions at the Ward level. Although the data at the Ward-level is incomplete (not all LADs provide a Ward-level breakdown), the overall number of Wards exceeds that of LADs for a total of 1070. I am still able to control for the median property price (an indicator of average wealth), population size, percent of residents with no qualification, per cent of non-UK born residents and per cent of residents who are over 60 years old, but I can no longer control for hourly pay growth and the growth in migrants from EU accession countries.

The results are presented in Table A.5. I find similar results – more diversity is associated with higher support for Remain, while more segregation the opposite. In terms of substantiveness, the coefficient for immigration diversity is qualitatively larger, with a central estimate of -5.61, whereas the coefficient is equal to 1.6 for within-Ward country of origin segregation.

Figure 6: Standardised and exponentiated regression coefficients, between-area regressions for diversity and segregation on the Brexit vote



Note: OLS regression coefficients the effect of within-area economic and country of origin

diversity and segregation on the Leave vote (%), England and Wales. Control variables include the Ward average property price (log scale), population size (log scale), the percent of adult residents with no qualification, the number of migrants (2011), the change in the number of migrants (2001-2011), the percent of the population aged 60+, and region fixed effects. All coefficients are exponentiated and standardised. Error bars are for 95% confidence level. See Table A.4 and Table A.5 for full results.

4.2 Individual-level results

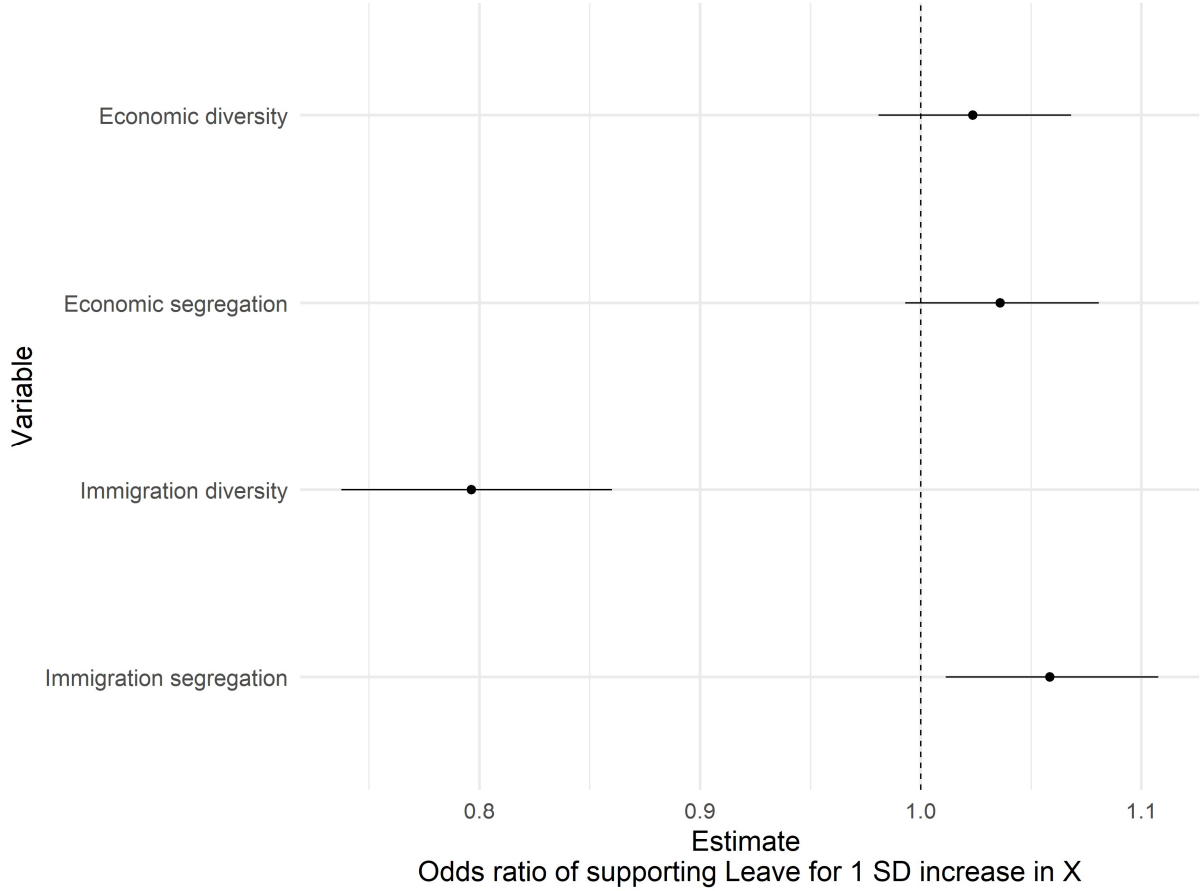
I now turn to evaluating the effect of diversity and segregation on support for Brexit using individual-level data. Figure 7 provides the baseline results for the full model, i.e. including all diversity and segregation variables, controls, and fixed effects at the LAD level (see full results in Table A.6 in the Annex). I find that, as opposed to the between-area regression results, the coefficient on economic diversity and segregation are not significantly different from 0, once immigrant diversity and segregation are controlled for.

Conversely, I find that neighbourhood immigrant diversity and segregation are both significant and substantive in size. A one standard deviation increase in neighbourhood immigrant diversity is associated with an expected 20% reduction in the odds of supporting Brexit. On the other hand, a one standard deviation increase in segregation is associated with a 6% increase in the odds of supporting Brexit.

To verify the robustness of these results, and to mitigate concerns arising from the Modifiable Areal Unit Problem (Wong et al. 2012), I alter the geographical unit of analysis, both more disaggregated than MSOAs (LSOAs) and more aggregated (in alignment with the between-area regressions; Wards and LADs). Figure 8 provides the coefficient plot for these results. At the LSOA level, the estimates for both migrant diversity and segregation are similar, but at the aggregated levels only diversity remains significant, with an estimate that is broadly similar in size. In other words, immigrant diversity appears to reduce support for Brexit regardless of geographical level employed. This is contrary to work which finds that diversity exerts opposing effects at local and aggregated levels (Kaufmann and Harris 2015; Tam Cho and Baer 2011). On the other hand, the coefficient on immigrant segregation is attenuated above the MSOA level, becoming weaker at the Ward level ($\exp(\beta) = 1.04$, $p < 0.1$) and insignificant at the LAD level. While the economic variables were both insignificant at the MSOA level, economic segregation

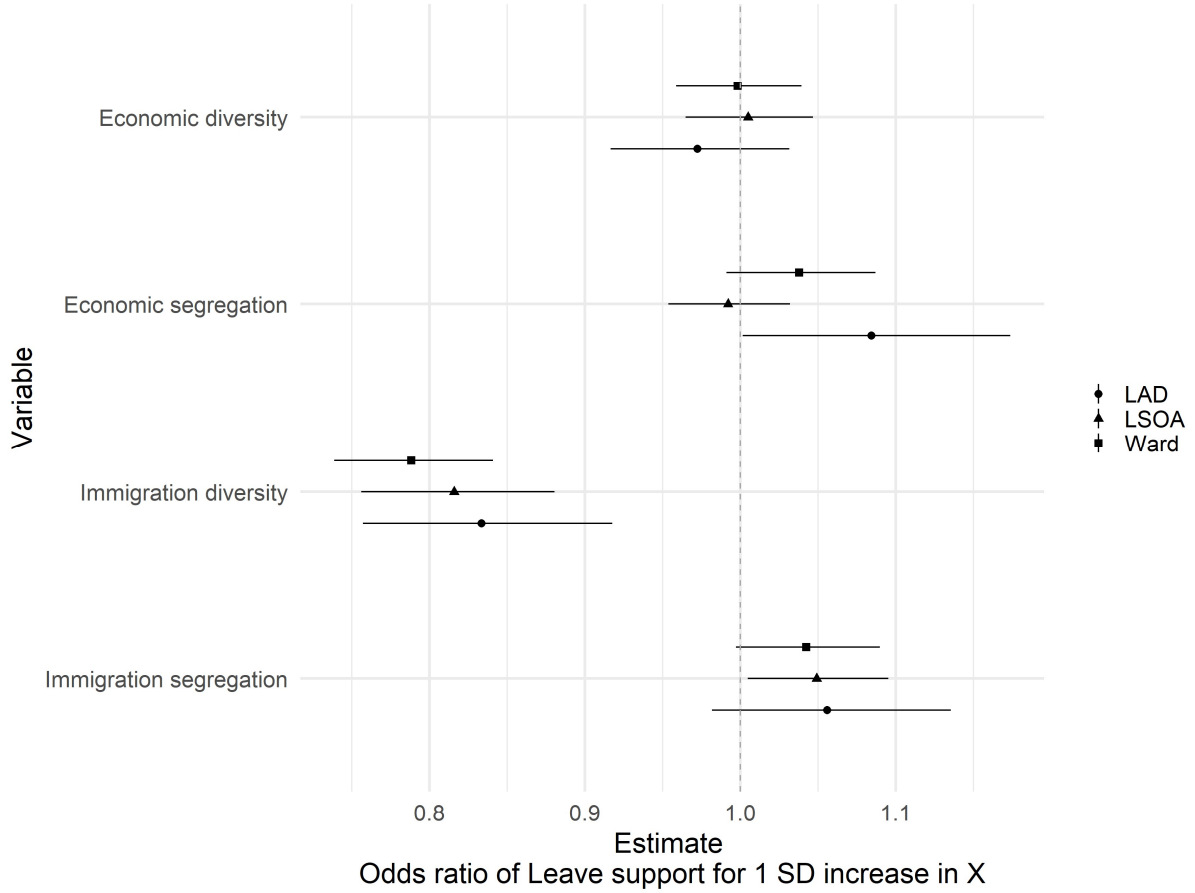
appears to have a negative effect on support for Leave at the LAD level ($\exp(\beta) = 1.08$, $p < 0.05$).

Figure 7: Effect of neighbourhood diversity and segregation on support for Brexit



Note: The figure provides coefficient estimates for a multilevel regression model of diversity and segregation on support for Brexit. Random intercepts are included at the MSOA level. Controls include: age, gender, education, ethnicity, political party support, household income, housing tenure, median housing value, and population density, as well as fixed effects at the LAD-level. All coefficient estimates are exponentiated and standardised. Error bars are for 95% confidence intervals. See full results in Table A.6 of the Annex.

Figure 8: Effect of neighbourhood diversity and segregation at different geographical levels on support for Brexit



Note: The figure provides coefficient estimates for a multilevel regression model of diversity and segregation on support for Brexit. Random intercepts are included at the LSOA, Ward, and LAD levels respectively. Controls include: age, gender, education, ethnicity, political party support, household income, housing tenure, median housing value, and population density, as well as fixed effects at the LAD-level. All variables are exponentiated and standardised. Error bars are for 95% confidence intervals. See full results in Table A.7 of the Annex.

4.3 Diversity, segregation and political party support

Next, I examine whether there is an interaction between party support, ethnic group, and household income and neighbourhood diversity and segregation. Table 1 provides the results. Interestingly, country of origin diversity appears to have a broad based effect, with no statistical difference between supporters of the Labour or Conservative party (the omitted category). Only

the interaction term on the 'Other' party category – comprising the Liberal Democrats, Scottish Nationalist Party, Green Party, and other smaller political parties, is statistically significant and negative. In other words, greater diversity is expected to reduce support for Brexit across all political parties.

On the other hand, neighbourhood immigrant segregation appears to affect supporters of the Labour Party and the Other category. While the main term is indistinguishable from zero, The interaction term for both these categories are positive and statistically significant. At the mean value of segregation, a Labour supporter is expected to be 57% less likely to support Brexit relative to a supporter of the Conservatives, holding all other variables constant. However, if the Labour supporter is living in a neighbourhood that is two standard deviations above the mean in terms of segregation, they are expected to only be 37% less likely to support Brexit.

Table 1: Diversity and segregation interacted, MSOA-level

	Should UK leave EU?	
	Interacted with: Party support	
	(1)	(2)
Migrant Diversity	-0.196*** (0.049)	
Migrant Segregation		0.002 (0.031)
Age	0.329*** (0.018)	0.332*** (0.018)
Male	0.154*** (0.028)	0.152*** (0.028)
Degree	-0.656*** (0.030)	-0.656*** (0.030)
Household Income	-0.148*** (0.017)	-0.149*** (0.017)
Black	-0.180** (0.089)	-0.135 (0.089)
Other	-0.151 (0.103)	-0.102 (0.103)
White	0.253*** (0.062)	0.342*** (0.059)
Own	-0.121*** (0.039)	-0.130*** (0.039)
Rent Private	0.186*** (0.043)	0.160*** (0.043)
Rent Social	0.458*** (0.060)	0.445*** (0.060)
Labour	-0.851*** (0.038)	-0.848*** (0.037)
Other	-0.642*** (0.040)	-0.631*** (0.039)
UKIP	1.802*** (0.096)	1.856*** (0.086)
Median property value	-0.234*** (0.037)	-0.201*** (0.037)
Population density	0.010 (0.029)	-0.027 (0.029)
Migrant Diversity : Labour	-0.003 (0.040)	
Migrant Diversity : Other Party	-0.122*** (0.044)	
Migrant Diversity : UKIP	-0.029 (0.122)	
Migrant Segregation : Labour		0.094*** (0.036)
Migrant Segregation : Other Party		0.124*** (0.038)
Migrant Segregation : UKIP		-0.135 (0.082)
Constant	0.937** (0.454)	1.017** (0.453)
Random Intercept	MSOA	MSOA
Fixed Effects	LAD	LAD
Observations	27,984	27,984
Log Likelihood	-16,059.720	-16,071.910
Akaike Inf. Crit.	32,853.450	32,877.830
Bayesian Inf. Crit.	35,877.300	35,901.680

Note: *p<0.1; **p<0.05; ***p<0.01

Random intercept regression of support for Brexit on diversity and segregation interacted with political party support.

All explanatory variables are standardised. Standard errors are in parentheses.

4.4 Additional robustness checks

I perform a number of additional checks to see whether the results hold. First, in order to mitigate concerns around self-selection into neighbourhoods, I restrict the sample to only those that have lived at the same address for at least 20 years. Second, I saturate the multilevel model with additional controls, in particular I add further contextual variables at the neighbourhood level – the local unemployment rate, the percent of adult residents with no qualification, the percent working in manufacturing industries and financial industries, the concentration of housing tenure (using the HHI), and finally the percent of houses in the local area which are socially rented (Ansell and Adler 2019). None of these additional checks affect the findings with respect to country of origin diversity and segregation – see Table A.8 in the Annex for these additional robustness checks.

5 Discussion and conclusion

The decision by the UK electorate to Leave the EU has had monumental and historic implications. What drove voters to vote in the way they did? The current literature has constructed two narratives to answer this question. First, the 'left behind' narrative suggests that widening economic inequality induced a backlash amongst those on the losing end. Second, the cultural narrative argues that voting Brexit constituted a reaction against increased ethnic diversity and immigration.

In this paper, I dig deeper into these narratives by exploring how local levels of economic and ethnic diversity and segregation affects support for Brexit. In so doing, I build on a growing body of work which explores how neighbourhood composition affects political attitudes, in particular support for far-right or populist parties (see, for example, Evans and Ivaldi 2021; Vasilopoulos, McAvay, and Brouard 2021; Bowyer 2008; Savelkoul, Laméris, and Tolsma 2017). My contributions to this body of work are two-fold. First, I am the first to examine this in relation to Brexit at multiple geographic levels, with a focus on the neighbourhood level. Second, I also explore economic diversity and segregation, exploiting a unique data on housing values at the neighbourhood level in the UK.

Taken together, the findings suggest that if the economic inequality and cultural backlash stories are indeed important drivers of Brexit support, then it appears that this does not result from

within local-area exposure to inequality and immigrants. Rather, the results presented here suggest the reverse. I find that economic and country of origin diversity (segregation) decreases (increases) support for Brexit, albeit the findings for the country of origin diversity are the most consistent, existing at a range of levels and across specifications.

While at a first glance these results might seem inconsistent with the narratives surrounding Brexit, they might instead be compatible and suggest that the backlash is likely operating across geographical areas in the UK rather than within (see Evans and Ivaldi 2021 for evidence of this with populist voting in France). This makes sense from the perspective of contact theory – prejudices against immigrants or the wealthy is harder to sustain if you regularly come into contact with representatives of this category, especially if that contact is in the form of friendships (Brannon and Walton 2013; Pettigrew and Tropp 2006). Enhanced knowledge, reduced anxiety and increased empathy and perspective taking are all understood to represent pathways through which contact reduce prejudice (Pettigrew and Tropp 2006). On the other hand, if you live in areas that are more economically and ethnically homogeneous, and if those areas have seen absolute and relative economic decline and/or socio-cultural degradation (Carreras, Irepoglu Carreras, and Bowler 2019; Bolet 2021), then it might be easier easier to blame the 'elite' or immigrants.

While individuals voted to Leave the EU for a multitude of reasons, it is clear from other research that anti-immigration sentiment was an important determinant (Vlandas 2016; Stockemer et al. 2018). From that perspective, the findings here might suggest that contextual diversity – by promoting positive inter-group contact (Meleady, Seger, and Vermue 2017; Laurence and Bentley 2018) – contributed to reducing anti-immigrant sentiment, and thus support for Brexit along with it. However, given the constraints in the data – I unfortunately do not observe attitudes towards immigrants, instead proxying this by their political party support – future work might delve into the mechanisms behind these findings.

Moreover, contextual exposure to diversity is (obviously) not randomly assigned. I thus stop short of declaring that these relationships are causal, but I note that it does not appear that the results are driven by self-selection – the results hold when restricting the sample to those that are relatively immobile, either living within a short distance of where they grew up or at the same address for over 20 years (see also Kaufmann and Harris 2015). While randomly assigning inter-

group contact in a lab or field setting is unlikely to match real-life inter-group contact, quasi-experimental designs might be able to shed further light on the causal mechanisms at play.

Overall, the work presented here provides insight into the role of neighbourhood composition in shaping support for Brexit. These insights not only help to uncover the drivers of the outcome of this important referendum, but also might shed light on how place feeds into political behaviour more broadly. Future research might seek to advance our understanding of how local diversity and segregation affect populist sentiment and voting for far right parties.

Annex

Table A.1: Descriptive statistics, LAD-level

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Leave (%)	380	53.141	10.416	21.380	47.158	60.360	75.560
Economic Diversity	380	0.532	0.117	0.243	0.452	0.594	0.923
Economic Segregation	380	0.369	0.090	0.082	0.304	0.422	0.644
Immigrant Diversity	348	0.177	0.132	0.039	0.086	0.208	0.618
Immigrant Segregation	348	0.088	0.037	0.032	0.061	0.108	0.233
Average Property Price	380	296,763.600	183,624.600	102,347.600	178,685.900	352,005.000	2,018,094.000
Population	348	161,112.900	109,013.900	2,203.000	93,888.000	199,823.200	1,071,722.000
No qualifications %	380	20.579	7.835	0.171	17.600	25.400	36.000
Non-UK born %	380	0.115	0.033	0.065	0.094	0.123	0.260
Non-UK born change	348	-4.684	11.396	-39.575	-12.235	1.759	33.010
Migrant EU Accession growth	380	0.017	0.017	-0.004	0.007	0.020	0.121
Austerity cuts / worker	378	447.780	121.925	177.000	340.000	534.500	914.000
Over 60 %	380	0.240	0.050	0.084	0.214	0.274	0.380
Mean hourly pay growth	380	0.231	0.161	-0.238	0.177	0.275	2.899

Table A.2: Descriptive statistics, Ward-level

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Leave (%)	1,283	52.34	14.30	12.16	43.09	63.83	82.51
Economic Diversity	8,334	0.53	0.18	0.004	0.39	0.66	1.00
Economic Segregation	8,334	0.25	0.12	0.00	0.16	0.31	0.76
Immigrant Diversity	7,981	0.15	0.14	0.02	0.06	0.18	0.67
Immigrant Segregation	7,981	0.05	0.03	0.00	0.03	0.07	0.36
Average Property Price	8,350	298,251.80	198,610.20	58,809.79	173,210.60	365,321.70	3,547,146.00
Population	7,981	6,657.93	4,467.15	136.00	3,294.00	8,971.00	33,937.00
No qualifications %	6,499	21.47	8.83	0.06	16.50	27.00	54.80
Non-UK born %	8,334	0.11	0.06	0.04	0.08	0.12	0.71
Non-UK born change	7,981	-2.27	23.16	-83.96	-16.56	10.51	297.83
Over 60 %	6,499	0.25	0.08	0.01	0.20	0.30	0.68

Table A.3: Descriptive statistics, individual-level

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Leave support	34,272	0.42	0.49	0.00	0.00	1.00	1.00
Economic Diversity	36,724	0.52	0.18	0.01	0.39	0.65	1.00
Economic Segregation	36,724	0.27	0.10	0.03	0.20	0.32	0.83
Migrant Diversity	33,526	0.21	0.18	0.02	0.07	0.33	0.66
Migrant Segregation	33,526	0.05	0.03	0.01	0.03	0.06	0.34
Age	39,275	48.78	18.73	16.00	34.00	63.00	102.00
Male	39,289	0.46	0.50	0	0	1	1
Degree	38,431	1.38	0.49	1.00	1.00	2.00	2.00
Household Income	38,769	4,062.53	2,912.84	0.00	2,029.16	5,338.17	86,065.62
White	38,970	0.81	0.39	0.00	1.00	1.00	1.00
Own	38,488	0.71	0.45	0.00	0.00	1.00	1.00
Labour	22,670	0.57	0.50	0.00	0.00	1.00	1.00
Median property value	36,715	251,370.90	150,880.60	52,997.81	140,974.10	322,997.50	2,197,955.00
Ln(Population density)	36,724	2.75	1.62	-3.90	1.90	3.85	5.51

Table A.4: Between LAD regression

	Leave vote (%)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Economic Diversity	-1.278***		-1.665***				-1.673***
	(0.338)		(0.336)				(0.330)
Economic Segregation		1.622***	2.103***				2.076***
		(0.423)	(0.420)				(0.417)
Immigrant Diversity				-1.687**		-2.183***	-2.339***
				(0.803)		(0.818)	(0.774)
Immigrant Segregation					0.801**	1.049***	0.897**
					(0.394)	(0.402)	(0.381)
Average Property Price	0.007	-0.727	0.492	-0.547	-0.866*	-0.415	0.997*
	(0.514)	(0.457)	(0.505)	(0.490)	(0.463)	(0.489)	(0.524)
Population	-1.317***	-1.564***	-1.490***	-1.298***	-1.504***	-1.389***	-1.438***
	(0.286)	(0.288)	(0.279)	(0.294)	(0.294)	(0.294)	(0.280)
No qualifications %	11.384***	11.220***	10.938***	11.381***	10.739***	10.301***	9.851***
	(0.987)	(0.989)	(0.957)	(1.004)	(1.075)	(1.077)	(1.020)
Non-UK born %	-2.438***	-1.946***	-2.213***	-1.893***	-2.306***	-1.974***	-1.962***
	(0.356)	(0.355)	(0.347)	(0.380)	(0.360)	(0.378)	(0.367)
Non-UK born change	-0.724**	-0.971***	-0.792***	-0.854***	-0.868***	-0.828***	-0.736**
	(0.316)	(0.314)	(0.305)	(0.318)	(0.318)	(0.315)	(0.301)
Migrant EU Accession growth	0.591*	0.841***	0.734**	1.186***	0.645**	1.251***	1.333***
	(0.322)	(0.323)	(0.312)	(0.398)	(0.327)	(0.396)	(0.377)
Austerity cuts / worker	-1.357***	-1.600***	-1.641***	-1.289**	-1.235**	-1.076**	-1.355***
	(0.517)	(0.520)	(0.502)	(0.527)	(0.530)	(0.528)	(0.503)
Over 60 %	-0.122	0.664	0.686*	-0.416	0.133	-0.382	0.219
	(0.369)	(0.405)	(0.391)	(0.424)	(0.378)	(0.421)	(0.425)
Mean hourly pay growth	-0.884*	-0.904*	-1.104**	-0.793	-0.606	-0.599	-0.972**
	(0.501)	(0.501)	(0.486)	(0.508)	(0.514)	(0.509)	(0.485)
Constant	52.217***	53.347***	52.867***	52.728***	53.179***	53.322***	53.362***
	(0.825)	(0.829)	(0.807)	(0.826)	(0.856)	(0.850)	(0.819)
Region fixed effects	Y	Y	Y	Y	Y	Y	Y
Observations	346	346	346	346	346	346	346
R^2	0.817	0.817	0.830	0.811	0.811	0.815	0.836
Adjusted R^2	0.806	0.806	0.819	0.800	0.800	0.804	0.825
Residual Std. Error	4.315 (df = 326)	4.313 (df = 326)	4.164 (df = 325)	4.379 (df = 326)	4.381 (df = 326)	4.340 (df = 325)	4.101 (df = 323)
Note:	*p<0.1; **p<0.05; ***p<0.01						

Table A.5: Between Ward regression

	Leave vote (%)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Economic Diversity	-0.582**		-0.808***				-0.806***
	(0.288)		(0.289)				(0.248)
Economic Segregation		1.282***	1.425***				0.852***
		(0.302)	(0.306)				(0.264)
Immigrant Diversity				-5.991***		-5.685***	-5.607***
				(0.320)		(0.318)	(0.316)
Immigrant Segregation					2.345***	1.639***	1.598***
					(0.292)	(0.259)	(0.259)
Average Property Price	-4.935***	-5.111***	-4.648***	-4.366***	-5.094***	-4.298***	-3.771***
	(0.392)	(0.358)	(0.393)	(0.315)	(0.349)	(0.309)	(0.339)
Population	-2.601***	-2.787***	-2.767***	-1.839***	-2.360***	-1.692***	-1.774***
	(0.256)	(0.256)	(0.256)	(0.226)	(0.251)	(0.223)	(0.224)
No qualifications %	6.280***	6.276***	6.262***	6.552***	5.561***	6.029***	6.017***
	(0.382)	(0.380)	(0.379)	(0.332)	(0.383)	(0.337)	(0.334)
Non-UK born %	-1.216***	-1.226***	-1.205***	-0.270	-1.687***	-0.639**	-0.620**
	(0.318)	(0.316)	(0.315)	(0.281)	(0.315)	(0.282)	(0.280)
Non-UK born change	-1.088***	-0.976***	-0.952***	-0.681***	-1.078***	-0.689***	-0.604**
	(0.292)	(0.291)	(0.290)	(0.254)	(0.284)	(0.250)	(0.249)
Over 60 %	4.364***	4.200***	4.231***	0.475	3.934***	0.395	0.411
	(0.409)	(0.407)	(0.406)	(0.410)	(0.400)	(0.403)	(0.400)
Constant	53.348***	53.180***	53.079***	54.190***	54.334***	54.800***	54.549***
	(0.705)	(0.701)	(0.700)	(0.613)	(0.695)	(0.609)	(0.608)
Region fixed effects	Y	Y	Y	Y	Y	Y	Y
Observations	1,070	1,070	1,070	1,070	1,070	1,070	1,070
R^2	0.743	0.746	0.748	0.806	0.757	0.813	0.816
Adjusted R^2	0.739	0.743	0.744	0.803	0.753	0.810	0.813
Residual Std. Error	7.396 (df = 1054)	7.348 (df = 1054)	7.324 (df = 1053)	6.420 (df = 1054)	7.194 (df = 1054)	6.304 (df = 1053)	6.257 (df = 1051)

Note: *p<0.1; **p<0.05; ***p<0.01

Table A.6: Effect of neighbourhood diversity and segregation on support for Brexit, individual-level

	Should UK leave the EU?				
	(1)	(2)	(3)	(4)	(5)
Economic Diversity	0.027	0.017			0.023
	(0.020)	(0.020)			(0.022)
Economic Segregation		0.060***			0.035
		(0.020)			(0.022)
Migrant Diversity			-0.235***	-0.233***	-0.228***
			(0.039)	(0.039)	(0.039)
Migrant Segregation				0.062***	0.057**
				(0.023)	(0.023)
Age	0.323***	0.323***	0.329***	0.329***	0.328***
	(0.017)	(0.017)	(0.018)	(0.018)	(0.018)
Male	0.177***	0.177***	0.153***	0.154***	0.154***
	(0.026)	(0.026)	(0.028)	(0.028)	(0.028)
Degree	-0.638***	-0.638***	-0.655***	-0.654***	-0.654***
	(0.029)	(0.029)	(0.030)	(0.030)	(0.030)
Household Income	-0.152***	-0.153***	-0.148***	-0.149***	-0.149***
	(0.016)	(0.016)	(0.017)	(0.017)	(0.017)
Black	-0.154*	-0.160*	-0.180**	-0.181**	-0.185**
	(0.088)	(0.088)	(0.089)	(0.089)	(0.089)
Other	-0.125	-0.128	-0.161	-0.165	-0.166
	(0.102)	(0.102)	(0.103)	(0.103)	(0.103)
White	0.329***	0.319***	0.248***	0.239***	0.236***
	(0.058)	(0.058)	(0.061)	(0.061)	(0.061)
Own	-0.122***	-0.122***	-0.123***	-0.121***	-0.122***
	(0.037)	(0.037)	(0.039)	(0.039)	(0.039)
Rent Private	0.166***	0.169***	0.183***	0.183***	0.183***
	(0.041)	(0.041)	(0.043)	(0.043)	(0.043)
Rent Social	0.443***	0.440***	0.456***	0.458***	0.456***
	(0.056)	(0.056)	(0.060)	(0.060)	(0.060)
Labour	-0.860***	-0.860***	-0.838***	-0.838***	-0.838***
	(0.036)	(0.036)	(0.037)	(0.037)	(0.037)
Other	-0.607***	-0.606***	-0.622***	-0.621***	-0.621***
	(0.037)	(0.037)	(0.039)	(0.039)	(0.039)
UKIP	1.794***	1.794***	1.809***	1.810***	1.810***
	(0.082)	(0.082)	(0.083)	(0.083)	(0.083)
Median property value	-0.218***	-0.203***	-0.231***	-0.218***	-0.225***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.039)
Population density	-0.006	-0.017	0.011	0.019	0.015
	(0.025)	(0.025)	(0.029)	(0.030)	(0.030)
Constant	1.069**	1.032**	0.915**	0.855*	0.834*
	(0.454)	(0.454)	(0.454)	(0.454)	(0.454)
Random Intercept	MSOA	MSOA	MSOA	MSOA	MSOA

Fixed Effects	LAD	LAD	LAD	LAD	LAD
Observations	30,842	30,842	27,984	27,984	27,984
Log Likelihood	-17,682.820	-17,677.870	-16,065.990	-16,062.180	-16,059.830
Akaike Inf. Crit.	36,157.650	36,149.740	32,859.970	32,854.360	32,853.670
Bayesian Inf. Crit.	39,458.950	39,459.380	35,859.110	35,861.740	35,877.520
Note:	*p<0.1; **p<0.05; ***p<0.01				

Table A.7: Effect of neighbourhood diversity and segregation at different geographic levels on support for Brexit

	Should UK leave EU?		
	LSOA	Ward	LAD
	(1)	(2)	(3)
Economic Diversity	0.005 (0.021)	-0.002 (0.021)	-0.028 (0.030)
Economic Segregation	-0.008 (0.020)	0.037 (0.024)	0.081** (0.040)
Migrant Diversity	-0.203*** (0.039)	-0.238*** (0.033)	-0.182*** (0.049)
Migrant Segregation	0.048** (0.022)	0.042* (0.023)	0.054 (0.037)
Age	0.346*** (0.019)	0.328*** (0.018)	0.316*** (0.017)
Male	0.168*** (0.029)	0.154*** (0.028)	0.144*** (0.027)
Degree	-0.639*** (0.032)	-0.666*** (0.030)	-0.690*** (0.029)
Household Income	-0.157*** (0.019)	-0.145*** (0.017)	-0.157*** (0.016)
Black	-0.177* (0.096)	-0.196** (0.087)	-0.102 (0.082)
Other	-0.171 (0.110)	-0.181* (0.102)	-0.124 (0.097)
White	0.222*** (0.068)	0.205*** (0.059)	0.343*** (0.052)
Own	-0.129*** (0.043)	-0.126*** (0.039)	-0.150*** (0.036)
Rent Private	0.193*** (0.048)	0.186*** (0.043)	0.160*** (0.040)
Rent Social	0.475*** (0.066)	0.450*** (0.059)	0.453*** (0.055)
Labour	-0.848*** (0.040)	-0.848*** (0.036)	-0.827*** (0.034)
Other	-0.636*** (0.041)	-0.633*** (0.038)	-0.615*** (0.036)
UKIP	1.793*** (0.087)	1.793*** (0.083)	1.825*** (0.081)
Median property value	-0.161*** (0.033)	-0.199*** (0.032)	-0.075 (0.053)
Population density	0.010 (0.026)	0.026 (0.027)	0.007 (0.044)
Constant	1.043** (0.478)	0.174** (0.086)	0.119 (0.090)
Random Intercept	LSOA	Ward	LAD
Fixed Effects	LAD	Region	Region
Observations	27,970	27,984	27,992
Log Likelihood	-15,881.790	-16,309.460	-16,509.410
Akaike Inf. Crit.	32,497.580	32,678.910	33,078.820
Bayesian Inf. Crit.	35,521.250	32,926.090	33,326.010
Note:	*p<0.1; **p<0.05; ***p<0.01		

Table A.8: Additional robustness checks

	Should UK leave the EU?		
	Lived in address 20+ years	Live within 5 miles of where grew up	Additional contextual controls
	(1)	(2)	(3)
Economic Diversity	-0.067	-0.086	0.023
	(0.041)	(0.093)	(0.022)
Economic Segregation	0.016	-0.027	0.030
	(0.041)	(0.078)	(0.022)
Migrant Diversity	-0.201***	-0.265*	-0.190***
	(0.076)	(0.143)	(0.046)
Migrant Segregation	0.096**	0.047	0.047**
	(0.044)	(0.113)	(0.023)
Age	0.224***	0.511***	0.328***
	(0.045)	(0.096)	(0.018)
Male	0.176***	0.205	0.155***
	(0.057)	(0.129)	(0.028)
Degree	-0.733***	-0.179	-0.640***
	(0.064)	(0.142)	(0.030)
Household Income	-0.122***	-0.201**	-0.148***
	(0.037)	(0.083)	(0.017)
Black	-0.126	-0.375*	-0.163*
	(0.197)	(0.199)	(0.089)
Other	0.097	-0.396	-0.140
	(0.253)	(0.264)	(0.103)
White	0.333**	-0.320	0.271***
	(0.138)	(0.212)	(0.062)
Own	-0.135	-0.201	-0.123***
	(0.083)	(0.183)	(0.039)
Rent Private	0.299**	0.282	0.186***
	(0.123)	(0.184)	(0.043)
Rent Social	0.344**	-0.149	0.431***
	(0.138)	(0.218)	(0.060)
Labour	-0.969***	-0.287	-0.842***
	(0.072)	(0.198)	(0.037)
Other	-0.705***	-0.329	-0.623***
	(0.083)	(0.229)	(0.039)
UKIP	1.958***	2.435***	1.803***
	(0.176)	(0.635)	(0.083)
Median property value	-0.070	-0.309**	-0.126**
	(0.069)	(0.156)	(0.049)
Population density	0.071	-0.061	-0.003
	(0.058)	(0.227)	(0.031)
Unemployed (%)			2.142
			(2.171)
No Qualification (%)			1.717***
			(0.425)

Manufacturing (%)			0.151
			(0.929)
Finance (%)			1.081
			(1.263)
Tenure Concentration (HHI)			0.057**
			(0.027)
Social Rented (%)			-0.0002
			(0.0005)
Constant	2.635**	19.831	0.040
	(1.157)	(10,754.150)	(0.492)
Random Intercept	MSOA	MSOA	MSOA
Fixed Effects	LAD	LAD	LAD
Observations	6,877	1,585	27,984
Log Likelihood	-3,904.419	-784.787	-16,040.080
Akaike Inf. Crit.	8,534.838	2,027.573	32,826.160
Bayesian Inf. Crit.	11,016.280	3,256.923	35,899.450
Note:	*p<0.1; **p<0.05; ***p<0.01		

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