Great or Grim? Disagreement about Brexit, Economic Expectations, and Spending*

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Abstract

Utilizing British household surveys and administrative data, we find a strong political polarization in economic expectations and behavior in the wake of the once-in-a-lifetime EU referendum. The Brexit vote had immediately led to large and long-lasting divergence between pro- and anti-Brexit voters in assessing general and personal economic situation and spending intentions, even after controlling for individual socio-economic characteristics. On average, a 10% difference in the share of leave voters across local authorities is associated with a 5.98% and 0.78% increase in the gap of housing transaction volume and licensed automobile stock per capita after the referendum, respectively.

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1 Introduction

Expectations play a central role in shaping eonomic behavior in most economic models (e.g., Barsky and Sims, 2012; Lorenzoni, 2009; Angeletos and La'O, 2013; Adam, Kuang and Marcet, 2012). In the recent decade, there is a fast-growing literature which analyzes survey expectations data and the relation between expectations and economic behavior. Expectations usually display substantial heterogeneity within and across households, firms, and experts (e.g., Coibion and Gorodnichenko, 2015; Sapienza and Zingales, 2013; Andre et al., 2022; Kuang et al., 2022). The literature has shown that survey expectations data has significant explanatory power for economic decisions both at the aggregate and individual level (e.g., Greenwood and Shleifer, 2014; Gennaioli, Ma and Shleifer, 2016; Das, Kuhnen and Nagel, 2020; Giglio et al., 2021).

Following the recent surge of populism in the US and Europe, there have been renewed interests in studying political polarization as an important source of heterogeneous expectations among households. Partisan bias is found to be pervasive in survey-based measures of economic beliefs (e.g., Mian, Sufi and Khoshkhou, 2021; McGrath, 2016; Gerber and Huber, 2010). Partisan voters tend to rate the economy more favorably if their partisanship matches the winning party in the elections, as documented in the studies on American and Australian elections (e.g., Gerber and Huber, 2009; Gillitzer and Prasad, 2018; Benhabib and Spiegel, 2019; Bartels, 2002; Coibion, Gorodnichenko and Weber, 2020). However, the polarization may not influence economic behaviour because of partisan cheerleading – voters feel elation when their "team" wins the elections but do not seriously consider future income growth (Mian, Sufi and Khoshkhou, 2021). Moreover, these studies on political polarization of economic beliefs primarily focus on partisanship. But does the polarization of beliefs arise beyond partisanship and in a non-election vote? If the vote is a once-in-a-lifetime political event, will voters take more serious attitudes?

In this paper, we study the political polarization in economic beliefs and behavior in the context of the Brexit referendum, probably the most prominent event in European politics in the past three decades. On 23 June 2016, the United Kingdom (UK) voted to leave the European Union (EU) by 52% to 48% in an EU referendum. The UK subsequently invoked Article 50 of the Treaty on European Union and began the withdrawal process on 29 March 2017. The UK formally exited from the EU on 31 January 2020.

We ask two questions. Did the Brexit vote engender polarization in economic expectations and spending intentions between pro- and anti-Brexit voters? If so, did the relative movements in economic expectations and spending intentions influence actual economic behavior? Using

British household surveys and administrative data, we find a strong political polarization in economic expectations and behavior in the wake of the once-in-a-lifetime EU referendum. To the best of our knowledge, this paper is the first study on the impact of the Brexit vote on households' economic beliefs.

We exploit the announcement of the Brexit vote outcome as an exogenous shock to identify causal effects on the divergence in economic beliefs and actual behavior between pro- and anti-Brexit voters. In the week before the referendum, the polls consistently found a lead for a Remain vote outcome.[1] Also, the odds-implied probability of a Remain vote outcome reached close to 90% just before the vote (Broadbent, 2017).[2] Since the leave outcome came out as a large surprise (Born et al., 2019), this shock is arguably orthogonal to contemporaneous macro and individual factors that can affect economic beliefs and behavior. In the meanwhile, as we trace economic beliefs and behavior over time and the shock for sure could continuously exert influence via changing economic fundamentals. Consequently, part of the variation in economic beliefs and behavior could be caused by the mediation effects, but others might be owing to confounding effects. We thus also control for locality-specific time-varying variation in economic fundamentals to examine the direct effects of the vote, on the assumption that voters living in the same locality should be similarly affected by whatever economic fundamentals.

Another unique feature of our context compared to the studies on general elections is that there were no real policy changes following the vote. The Brexit vote did not instantly change the relationship between the UK and the EU. The UK continued to be a member state of the EU Customs Union and Single Market until the end of a transition period (31 December 2020). This feature can mitigate the confounding effects induced by changes in policies targeted at particular voters following the vote.

To answer the first question, we utilize two nationally representative household surveys carried out over the period from early 2015 to late 2019. We separately pool nine waves of British Election Study 2014–2019 (BES) and five waves of Bank of England/NMG Household Survey (NMG) to examine household economic expectations about the general economy and personal economic situation as well as spending intentions on major items and general goods. The Brexit vote had led to large divergence in economic expectations and spending intentions between pro- and anti-Brexit voters. In the wake of the referendum, anti-Brexit voters had systematically become more pessimistic about current economic situation and general unemployment situation than pro-Brexit voters, while the disagreement was fairly small before. Anti-

[1] See the Wikipedia page "Opinion polling for the United Kingdom European Union membership referendum".

[2] According to Marr (2017) (p. 605), most British politicians, including those on the Leave side, and journalists did not expect the outcome.

Brexit voters also perceived more risks of getting into poverty and became more pessimistic about future household financial position after the vote. These movements in economic expectations reconcile with those of spending intentions. Before the Brexit vote, pro- and anti-Brexit voters differed little in assessing whether it is currently a good or bad time to buy major items and in planned general spending. However, pro-Brexit voters had shown remarkably stronger spending intentions afterwards.

We apply two forms of event study specifications to examine the changes in the belief divergence. We choose Wave 8 in the BES and Wave 2015 in the NMG as the references, both conducted before the Brexit vote. We find that relative to the references, pro-Brexit voters on average were 0.917 standard deviations more optimistic about current economic situation, 0.747 standard deviations more optimistic about general unemployment situation, 0.163 standard deviations less likely to feel getting into poverty, and 0.319 standard deviations more optimistic about their future household financial position. Similarly, they showed 0.300 standard deviations stronger spending intention on major items and 0.142 standard deviations more likely to increase general spending after the vote.[3] By examining the dynamic effects, we find that the large belief divergence was persistent during the period considered. But before the vote, there was no significant difference in the belief divergence relative to the references. Such placebo test consolidates our underlying identification assumption that without the vote, there should not be a change in the belief divergence between pro- and anti-Brexit voters.

Pro-Brexit voters tend to be inferior in socioeconomic status (Alabrese et al., 2019). Does the belief divergence arise due to distinctive compositions of voters in terms of socioeconomic status? We show that controlling for voters' socioeconomic characteristics such as educational attainment, household income, and employment status does not drive our conclusions above. Moreover, we find that revisions to economic expectations and spending intentions are mostly consistent across socioeconomic characteristics within each Brexit identity profile. By contrast, the gaps in revisions to these expectations and intentions are much larger across Brexit identities within each socioeconomic characteristic. Overall, our results suggest that Brexit identities strongly dominate in shaping economic beliefs over socioeconomic characteristics.

In the second part of the paper, we characterize the divergence in actual economic behaviors across local authority (LAU) districts. The measures of our interest on actual economic behavior are housing transaction volume per capita and licensed automobile stock per capita, both of which reflect household major economic decisions. We use Price Paid Data to access

[3]It is important to note that the stronger spending intentions by pro-Brexit voters were not because of higher expectations on the cost of living. Conversely, pro-Brexit voters had lower inflation expectations than anti-Brexit voters.

administrative records on housing transactions. From 2015 to 2019, there were 4,700,991 transaction records on transaction dates, prices, addresses, and house characteristics. We aggregate these transactions as volume in quarterly frequency for local authority districts. In addition, we access data on quarterly total per capita number of licensed private vehicles from the Department for Transport (DfT) and Driver and Vehicle Licensing Agency (DVLA). Combining these behavior data with a number of data sources for regional characteristics, we construct a LAU-quarter panel data set with the cross-section involving 313 local authority districts in England and Wales, two countries of the UK, and the time dimension from the first quarter of 2015 to the last quarter of 2019. The advantage of administrative data over survey-based measures is that they allow us to reduce "cheerleading" bias and measurement errors.

The Brexit vote shock to each local authority is measured using its share of leave voters. We jointly exploit the variation in the Brexit vote shock and that in the occurrence time of the vote, employing a difference-in-differences specification. We find that the Brexit vote had widened the gap in housing transaction volume and licensed automobile stock per capita across local authority districts. On average, a 10% difference in the share of leave voters is associated with a 5.98% increase in the gap of housing transaction volume per capita and a 0.78% increase in the gap of licensed automobile stock per capita after the Brexit vote. These conclusions are robust to controlling for gross household disposable income and a set of time trends varying with pre-vote local economic characteristics such as unemployment rates, immigration rates, and fiscal cuts.

As a further test, we examine the dynamic effects of the Brexit vote on actual economic behavior. Likewise, we estimate a LAU-level version of the two event study specifications and choose Quarter 1, 2016 as the reference. We find that the gap in housing transaction volume and licensed automobile stock per capita had nearly null difference relative to the reference before the vote, but increased distinctly in the wake of the referendum. The effects remained stable for housing transaction volume per capita, but interestingly kept increasing over time for licensed automobile stock per capita. We are vigilant about whether the year 2015 is special and extend the analysis to Quarter 1, 2014. Our results are robust to this extension.

The Brexit vote is microcosm of the recent rise in the populism and Euroscepticism around Europe. We are interested in which roots of Euroscepticism interacting with the Brexit vote engendered more powerful shocks to cause the relative movement in actual economic behavior. We identify three sets of roots: (1) short-term economic shocks, (2) industry and occupation structures that have close links to various degrees of economic distress under globalization shocks, (3) demographic compositions that reflect economic "winners" and "losers". We find

that industry and occupation structures and demographic compositions had played more important roles. The Brexit voteinduced a relatively large shock on actual economic behavior for local authority districts that had been suffering from long-term adverse globalization shocks to local manufacturing industries, low-skill occupations, and residents with lower socioeconomic status.

Do spending intentions matter for actual economic behavior? We use household views on whether it is currently a good or bad time to purchase major items to construct a local spending intention measure. We find that it has a positively linear relationship with log of housing transaction volume per capita and log of licensed automobile stock per capita, indicating that survey-based measures on economic beliefs can well predict actual economic behavior. This is consistent with Gerber and Huber (2009) who examine taxable sales and Gillitzer and Prasad (2018) who examine automobile purchases. In addition, the Brexit vote had boosted the predicted levels: given the spending intention level, mean log of housing transaction volume per capita and mean log of licensed automobile stock per capita were generally higher after the vote.

The paper proceeds as follows. Section 1.1 discusses related literature. Section 2 reports our data, measurement, and descriptive statistics. We document empirical strategies and results on the divergence in economic expectations and spending intentions in Section 3, followed by investigations into actual economic behavior in Section 4. And Section 5 concludes.

1.1 Related Literature

Our findings contribute to a strand of literature which evaluates the effects of macro shocks and individual characteristics on expectation formation. For example, Binder and Makridis (2022) find that a rise in local gas prices causes consumers to become more pessimistic about national economic conditions. The COVID-19 pandemic also triggers consumers to form higher inflation expectations and more pessimistic unemployment expectations (Binder, 2020). To the best of our knowledge, our paper is the first to study how the Brexit vote shock affected household economic beliefs. We find that the vote had led to a sharp and long-lasting belief divergence between pro- and anti-Brexit voters. Other studies focus on socioeconomic status such as own or parental income and education (e.g., Das, Kuhnen and Nagel, 2020; Kuhnen and Miu, 2017; Souleles, 2004). Our results suggest that Brexit identities dominate over socioeconomic status in shaping economic beliefs. Moreover, our findings on actual economic behavior are consistent with the research by Carroll, Fuhrer and Wilcox. (1994), Malmendier and Nagel (2016), and Gillitzer and Prasad (2018) who argue that consumer sentiment and inflation expectations

matter for household spending and exposure of liabilities.

There is a large body of research studying the economic consequences of the Brexit vote. Almost without exception, economists have shared the consensus that as a result of more new economic barriers (Sampson, 2017), leaving the EU would exert an adverse influence on the UK's economy with regard to trade (Dhingra et al., 2017; Aichele and Felbermayr, 2015; Steinberg, 2019), foreign direct investment (Bruno et al., 2016; Dhingra et al., 2016*b*), immigration (Portes and Forte, 2017; Wadsworth et al., 2016), household living standards (Dhingra et al., 2016*a*; Breinlich et al., 2017), and regional economic performance (Dhingra, Machin and Overman, 2017). Nevertheless, the patterns about how the Brexit vote contributes to micro-level household economic activities do not yet receive much attention in the existing literature. We fill this gap by analyzing the effects of the Brexit vote on housing transactions and automobile purchases.

This paper also closely relates to the growing body of political economy research pertinent to political polarization. The polarization among the American and British electorate has been pronounced recently (Boxell, Gentzkow and Shapiro, 2017; Hobolt, Leeper and Tilley, 2021). In particular, there is well documented evidence on affective polarization (Iyengar, Sood and Lelkes, 2012; Iyengar et al., 2019). Partisan members with the same partisanship increasingly share homogeneous ideology, while holding hostility towards members from the opposed political party. This line of research shows that affective polarization may lead to disagreement in factual beliefs (Druckman et al., 2021). Therefore, given that affective polarization can also emerge from Brexit identities other than partisanship (Hobolt, Leeper and Tilley, 2021), voters with different Brexit identities can also show opposite factual beliefs. Our results substantiate this argument by examining beliefs on the current economic situation and the general unemployment situation.

More broadly, our findings add to the literature on the recent rise of populism or Euroscepticism in many countries. Several papers highlight the role of the distributional consequences of globalization in explaining the vote share for populists in different countries, see Autor et al. (2020) for the US, Dippel, Gold and Heblich (2015) for Germany and Colantone and Stanig (2018) for the UK. Guiso et al. (2018) find economic insecurity is an important driver of the demand of populism in European countries. We push this vein of literature further to consider the economic consequences of populist movements and study how the roots of Euroscepticism interacting with the movement affect economic activities.

2 Data

2.1 Household Survey Data

We compare economic expectations and spending intentions between pro- and anti-Brexit voters over the period from early 2015, over one year predating the Brexit vote, until the end of 2019. The analysis primarily draws on the data from two nationally representative household surveys, the *British Election Study 2014–2019* (BES) and the *Bank of England/NMG Household Survey* (NMG). The British Election Study is the longest running social science survey in the UK. The specific BES data set we use is of high frequency, composed of 16 waves in total. It investigates British voters' political and economic attitudes around each of the general elections in the UK. We obtain variables of interest in Wave 6, 7, 8, 9, 10, 11, 14, 15, 16 of the BES. These waves were carried out in the following time periods: May 2015, April to May 2016, May to June 2016 (before the referendum), June to July 2016 (after the referendum), November to December 2016, April to May 2017, May 2018, March 2019, May to June 2019. Each wave involves approximately 30,000 respondents.

The NMG is an annual survey administered by the Bank of England, asking respondents questions about their income and spending. A nice feature of the NMG is that it also asks respondents' attitudes towards Brexit since 2016, enabling us to measure individual Brexit identity. We use the NMG waves conducted in each year from 2015 to 2019. Each wave involves around 6,000 respondents. The specific conducted timeline and sample sizes for each wave of both surveys are reported in Appendix Table B.1. In the analysis, we use repeated cross-sectional samples from the surveys and weight observations with the weights provided for sample representativeness. We document how we measure respondents' Brexit identities, economic expectations, and spending intentions in what follows. For detailed survey questions, response options, as well as sources underlying these measures, one can refer to Appendix Table B.2.

2.1.1 Brexit Identity and Demographic Compositions of Voters

We measure respondents' Brexit identities, i.e., pro- or anti-Brexit, based on their actual votes, vote intentions or attitudes towards Brexit. The BES asked respondents to express their vote intentions on Britain's membership of the EU in the waves prior to the Brexit vote (i.e., Wave 6, 7, 8), and subsequently asked actual votes in Wave 9, the wave conducted just after the vote. Since Wave 10, the BES asked for vote intentions again assuming there was another referendum on the EU membership. Utilizing these questions, we identify respondents as pro-

Brexit voters if they answered "Leave the EU" or anti-Brexit if "Remain in the EU". Using Wave 9 to compute shares of Leave voters, we plot the survey-measured vote shares against actual Leave voter shares (obtained from London Datastore) for 380 local authority districts in Appendix Figure B.1. It shows that the respondents in the BES are highly representative of Brexit voters, the correlation coefficient between the two shares, weighted by the numbers of survey respondents, reaching 0.74.

From Wave 2016 that was carried out after the Brexit vote, the NMG asked respondents for their attitudes about the UK voting to leave the EU in the referendum. We identify respondents as pro-Brexit voters if they held "somewhat positive" or "very positive" attitudes, and anti-Brexit if "somewhat negative" or "very negative". However, the respondents' attitudes are not available in the preceding-vote wave, Wave 2015. To deal with this missing value issues, because part of respondents are traced across different waves in the NMG, we successively exploit their attitudes revealed in Wave 2016, 2017, 2018, and 2019 to fill in the missing values in Wave 2015. Overall, around 39.9% of the respondents are filled via this approach.

One major concern with this approach is that respondents might alter their attitudes towards Brexit over time, especially after the Brexit vote outcome was declared as the declaration could immediately change interest rates, inflation, and other economic circumstances that might in turn change the attitudes. In Table 1, we limit respondents to those who participated in the NMG for any two particular years from 2016 to 2019, and present the percentages of respondents who expressed unchanged or changed attitudes towards Brexit. Specifically, we calculate the shares of four types of voters: (1) voters responding pro-Brexit attitudes in both years, (2) voters responding anti-Brexit attitudes in both years, (3) voters responding pro-Brexit attitudes in the former year but changing to anti-Brexit attitudes in the latter year, (4) voters responding anti-Brexit attitudes in the former year but changing to pro-Brexit attitudes in the latter year. Hence, the voters who did not change attitudes are the first two types.

The results suggest that respondents' attitudes remained relatively stable over time during the post-vote period. For instance, the respondents who held pro-Brexit (or anti-Brexit) attitudes both in 2016 and 2017 accounted for 51.7% (or 40.9%) of all the four types of voters, while the respondents who held pro-Brexit attitudes in 2016 but changed to anti-Brexit in 2017 accounted for 3.7%, the same as those who held anti-Brexit attitudes in 2016 but changed to pro-Brexit in 2017. In other words, the percentage of respondents who did not change attitudes between 2016 and 2017 is 92.6%. Although the percentage of respondents with unchanged attitudes slightly decreased over time, it still reached 83.4% between 2016 and 2019. Appendix Table B.3 provides another examination using the BES which makes it possible to compare be-

tween the waves before the vote and the waves afterwards. It suggests that the percentages of respondents with unchanged attitudes between a wave before the vote and another afterwards all exceeded 80%. Therefore, the concern associated with changing attitudes is mitigated as long as the attitudes of the traced respondents did not change remarkably over time.

We report demographic compositions of voters in the BES and NMG samples in Table 2. As shown in the table, anti-Brexit voters had higher shares of having a college degree than pro-Brexit voters (61.3% vs. 40.3% in the BES, 52.9% vs. 37.4% in the NMG). Anti-Brexit voters had higher shares in the high-income group (24.9% vs. 14.4% in the BES, 26.7% vs. 22.8% in the NMG) and lower shares in the low-income group (8.4% vs. 11.2% in the BES, 10.6% vs. 13.7% in the NMG).[4] The shares of anti-Brexit voters in the employment were also higher than those of pro-Brexit voters (58.7% vs. 46.6% in the BES, 58.9% vs. 53.3% in the NMG). Conversely, anti-Brexit voters had lower shares in the inactive group composed of students, retired and disabled people (39.1% vs. 51.4% in the BES, 38.0% vs. 44.4% in the NMG). While anti-Brexit voters had relatively high unemployment shares, the shares were closed to those of pro-Brexit voters (2.2% vs. 2.0% in the BES, 3.1% vs. 2.3% in the NMG). In Column (5), (6), (11), and (12), we test the null hypotheses that anti-Brexit and pro-Brexit voters do not have different characteristics by regressing each demographic variables on a dummy indicating if voters are pro-Brexit voters. We find that almost all null hypotheses are rejected at the 1% significance level. Taken together, these descriptive results indicate that anti-Brexit voters were superior in socioeconomic status than pro-Brexit voters. Besides, comparing Column (13) and (15) in Panel C, we find that the sample with missing attitudes filled do not significantly twist the demographic compositions of the original sample.

2.1.2 Household Economic Expectations

Our primary measures of economic expectations are voters' beliefs about the general UK economy (macro expectations) and personal economic circumstances (micro expectations). We include two variables to study voters' macro expectations. The first one (from the BES) asks a question on how the current economic situation is changing. There are five response options: "1=Getting a lot worse", "2=Getting a little worse", "3=Staying the same", "4=Getting a little better", "5=Getting a lot better". The second variable (from the NMG survey) measures beliefs on the general unemployment situation, asking how the number of unemployed people in the UK will change over the next 12 months. It also has five response options: "1=Increase

[4]The BES and NMG differ in the scales of the classification with respect to gross household income per year. In the BES, we encode "< £10,000" as "low income", "£10,000–£50,000" as "middle income", ">=£50,000" as "high income"; in the NMG, we encode "< £11,500" as "low income", "£11,500–55,000" as "middle income", ">= £55,000" as "high income".

sharply", "2=Increase slightly", "3=Remain the same", "4=Fall slightly", "5=Fall sharply". Therefore, a higher value associated with these two variables implies more positive assessments about the economy.

Regarding micro expectations, the first variable (from the BES) is voters' beliefs on the likelihood of being devoid of enough money to cover day to day living costs during the next 12 months, with the following five response options: "1=Very unlikely", "2=Fairly unlikely", "3=Neither likely nor unlikely", "4=Fairly likely", "5=Very likely". This measure is used to elicit voters' perceptions on the risks of getting into poverty. Therefore, a higher value implies a higher risk. Next, we study voters' beliefs about how their household financial positions will change over the next 12 months (from the NMG). The response options for this variable include: "1=Get a lot worse", "2=Get a little worse", "3=Stay the same", "4=Get a little better", "5=Get a lot better". Analogous to the macro expectation variables, this variable is in an increasing scale on sentiment. For ease of interpretation, we standardize all these four expectation variables with means equal to zero and standard deviation one.

Panel A and B of Figure 1 plot mean standardized macro and micro expectations by Brexit identities across the Brexit vote. Before the vote, anti-Brexit voters were more optimistic about current economic situation and general unemployment situation than pro-Brexit voters, though the divergence was fairly small. However, following the vote, anti-Brexit voters had become remarkably more pessimistic as opposed to pro-Brexit voters, resulting in a large and long-lasting divergence. The trends were similar when examining micro expectations. Anti-Brexit voters perceived less poverty risks than pro-Brexit voters before the vote but the pattern reversed in the wake of that. There was no significant divergence in the expectations on household financial positions between anti-Brexit and pro-Brexit voters before the vote, but anti-Brexit voters had become significantly more pessimistic in the after the vote, which was in stark contrast to pro-Brexit voters.

2.1.3 Spending Intentions

We investigate voters' spending intention with regard to major purchases and household general spending. The variable on major purchases (from the BES) asks respondents a question on whether it is currently a good or bad time to buy household major items (e.g., furniture, kitchen appliances, and televisions). It has three scales: "1=Bad", "2=Neither good nor bad", "3=Good". We use this variable as a proxy for household spending intention on major purchases, with a higher value indicating a stronger intention to buy. The second variable is on household general spending (from the NMG), asking respondents to premeditate household

general spending over the next 12 months. There are five response options: "1=Decrease a lot", "2=Decrease a little", "3=About the same", "4=Increase a little", "5=Increase a lot". Therefore, a higher value with this variable implies a stronger spending intention. Likewise, for ease of interpretation, we standardize both variables.

Panel C of Figure 1 plots mean standardized spending intentions by Brexit identities across the Brexit vote. It suggests that before the Brexit vote, the divergence in both spending intentions on major purchases and household general spending was negligible between pro-Brexit and anti-Brexit voters; however, the divergence enlarged after the vote – pro-Brexit voters had shown stronger spending intentions than their anti-Brexit counterpart.

2.2 Local Authority District Data

To study the effects of the Brexit vote on actual economic behavior, we utilize aggregate data at the local authority district (LAU) level. We assemble a number of data sources to construct a LAU-quarter panel data set. The cross-section dimension of this panel includes 313 local authority districts in England and Wales, two countries within the UK. The sample period starts from the first quarter of 2015 to the last quarter of 2019.

2.2.1 Actual Economic Behavior

The actual economic behavior of our interest includes housing transactions and automobile purchases, both of which are household major economic decisions and spending. First, we use *Price Paid Data* from HM Land Registry to access administrative records on housing transactions. This data set contains detailed information on transaction dates, prices, addresses, house characteristics of all property sales in England and Wales that are sold for value and registered since 1995. The postcode of each trading house is available. We therefore map each transaction to local authority districts with postcodes. We then aggregate these transactions as volume in quarterly frequency. There are overall 4,700,991 transaction records in the period considered (Appendix Table B.4 reports breakdowns by year and quarter). Our housing transaction measure is total per capita transactions completed for each local authority district at the end of each quarter. Population data are sourced from the UK census 2011.

Second, we use automobile data from the Department for Transport (DfT) and Driver and Vehicle Licensing Agency (DVLA). This data set documents the stock of licensed vehicles at the end of each quarter for local authority districts. The licensed vehicles can be stratified by body type (e.g., buses and coaches, cars, heavy goods vehicles etc.), fuel type (diesel, petrol, and other fuels), and keepership (company and private). Our outcome variable of interest is mea-

sured using the quarterly total per capita number of licensed private vehicles (total body types and total fuel types) at the local authority district level. To trace household actual spending behavior, the outcome variable ideally should be new purchases of automobiles, but licensed automobile stock is also a good measure as long as the seasonality patterns of vehicle scrappage are constant and we can use quarter fixed effects to capture these patterns. We measure licensed automobile stock using private vehicles only (excluding licenses to business) to be consistent with Gillitzer and Prasad (2018) who argue that private vehicle purchases map most closely to the survey of consumer sentiment.

2.2.2 Vote Shares and Control Variables

The analysis at the local authority district level requires us to construct a geographic measure of Brexit identities. We measure the Brexit identity of each local authority district using the share of Leave voters in the Brexit referendum. This vote share data set is from London Datastore, an open data-sharing portal administered by Greater London Authority. In addition to this, we use a range of local authority district level control variables as follows.

First, we obtain gross household disposable income in annual frequency from the Office for National Statistics (ONS). Second, we obtain unemployment rate 2015, EU structural funds per capita 2013, and total fiscal cuts 2010—15 from Becker, Fetzer and Novy (2017). EU structural funds are EU transfers to local areas of the member states of European Union, providing funding to implement place-based policies with a goal of reducing regional inequality. Total fiscal cuts are originally compiled by the Financial Times, capturing the financial loss per working adult in pounds sterling per year during 2010 to 2015.

Lastly, from UK Census 2011, we obtain variables on immigration rate, manufacturing employment rate, share of low-skill jobs, share without qualification, and deprivation rate. Immigration rate is measured using the number of population born in non-UK countries divided by that of total population. Manufacturing employment rate is the share of workers in the industry of manufacturing by UK Standard Industrial Classification 2007 (SIC). We map low-skill jobs with the following occupations in Standard Occupational Classification 2010 (SOC): (1) caring, leisure and other service occupations, (2) sales and customer service occupations, (3) process, plant and machine operatives, (4) elementary occupations. Share without qualification is the share of usual residents who do not receive any formal education. Deprivation rate is a measure associated with household poverty. It is the share of households that are deprived in one or more of the following dimensions: (1) Employment: where any member of a household, who is not a full-time student, is either unemployed or long-term sick; (2) Education: no person

in the household has at least Level 2 education, and no person aged 16 to 18 is a full-time student; (3) Health and disability: any person in the household has general health that is "bad" or "very bad" or has a long-term health problem; (4) Housing: the household's accommodation is either overcrowded, with an occupancy rating -1 or less, or is in a shared dwelling, or has no central heating.

2.2.3 Summary Statistics

Table 3 reports population-weighted summary statistics for the sample of 313 local authority districts. In the table, we compute cross-sectional measures for the three variables that have a time dimension. Now housing transaction volume and licensed automobile stock are the average per capita transaction volume and the average per capita number of licensed private vehicles over the quarters in the period from 2015 to 2019. Gross household disposable income is the annual average over 2015 to 2019. In Column (1) to (3), we report the mean, median, and standard deviation of the variables for all local authority districts. In Column (4) and (5), we stratify these local authority districts into Leave areas where the shares of Leave voters are over 50% and Remain for the other. Column (7) and (8) further statistically test the differences between Leave and Remain areas. The results indicate that Leave areas were more likely to have more housing transactions and licensed automobile stocks on average, and also tended to have a higher manufacturing employment share, low-skill jobs share, share without qualification, deprivation rate. However, the immigration rate and gross household disposable income level were lower in Leave areas. In addition, we do not find significant differences in the unemployment rate, EU structural fund receipts, and total fiscal cuts.

3 Divergence in Economic Expectations and Spending Intentions

We now investigate the effects of the Brexit vote on British voters' economic expectations and spending intentions. We start the analysis by examining the divergence in economic expectations and spending intentions between pro- and anti-Brexit voters. To this end, we employ two forms of event study specifications as introduced in what follows. To highlight the role for Brexit identities, we also compare revisions to economic expectations and spending intentions across the referendum for various groups of voters classified by Brexit identities and socioeconomic status.

3.1 Econometric Models

Our first event study specification is a compact one,

$$Y_{it} = ProBrexit_{it} + \sum Period_t + \sum \beta_t \times Period_t \times ProBrexit_{it} + \epsilon_{it}, \quad (1)$$

where Y_{it} denotes a particular economic expectation or spending intention variable of voter i in wave t. $ProBrexit_{it}$ is the Brexit identity which takes the value of 1 if voter i is pro-Brexit and 0 otherwise. $Period_t$ are indicator variables for a series of periods across the Brexit vote. In the BES, we group Wave 6 and 7 as the pre-vote period, Wave 9, 10, 11, 14, 15, 16 as the post-vote period. We involve these two period indicators in regressions when using the BES and drop a dummy indicating Wave 8, the wave conducted just before the vote, as the reference. In the NMG, we group Wave 2016 through to Wave 2019 as the post-vote period and involve this period dummy in regressions, dropping the dummy indicating Wave 2015 as the reference. ϵ_{it} is a disturbance term. We cluster standard errors at the local authority district by wave level in the BES, and because of different scales in the geographical unit, at the region by wave level in the NMG.[5]

Secondly, we estimate a more flexible event study model,

$$Y_{it} = ProBrexit_{it} + \sum Wave_t + \sum \rho_t \times Wave_t \times ProBrexit_{it} + \epsilon_{it}, \quad (2)$$

where Y_{it}, $ProBrexit_{it}$, and ϵ_{it} are defined as above. $Wave_t$ is a set of indicator variables for each wave. Similarly, we drop Wave 8 in the BES and Wave 2015 in the NMG as the references, and cluster standard errors at the local authority district or region by wave level.

In choosing our control variables, we control for demographics which are found to play an important role in shaping expectations, including gender, age, educational attainment, household gross income per year, and employment status (e.g., Malmendier and Nagel, 2016; Das, Kuhnen and Nagel, 2020). Additionally, one may be concerned that voters' economic expectations and spending intentions could be affected by the changes in economic fundamentals of the voters' residential areas following the Brexit vote. This concern is mitigated in our context by the fact that the UK-EU relationship remained the same without instant actual policy changes induced by the Brexit vote until the last day of 2020. Nevertheless, we also control for local authority district or region by wave fixed effects to address possible confounding factors.

The explanatory variables of our interest are the interactions between $Period_t$ (or $Wave_t$)

[5]Regions are administrative units in higher-level hierarchy than local authority districts in the UK. The NMG has a variable recording respondents' regions of residence including North / Yorks & Humberside, North West, Midlands, South East, East Anglia, South West, Wales, London, and Scotland.

and $ProBrexit_{it}$, the coefficient estimates on which capture the changes in divergence of economic expectations or spending intentions between pro- and anti-Brexit voters relative to the references. We state our hypothesis to be tested as follows: if the changes were caused by the Brexit vote, we should be able to see that the coefficient estimates on the interactions with the pre-vote periods or waves are insignificant, but significant with the post-vote periods or waves. We test this hypothesis and present the coefficient estimates in the next subsection.

3.2 Empirical Results

Figure 2, 3, and 4 present the coefficient estimates of our interest from Equation (1) and (2) graphically. We plot the estimates on the interactions between $Period_t$ and $ProBrexit_{it}$ with horizontal lines and the corresponding 95% confidence intervals with boxes. Additionally, we plot the estimates on the interactions between $Wave_t$ and $ProBrexit_{it}$ with dots and the corresponding 95% confidence intervals with vertical lines. The coefficients plotted, therefore, can be interpreted as the relative change in belief divergence between pro- and anti-Brexit voters around the Brexit vote. In the baseline models, we do not control for voters' demographics and local authority district or region by wave fixed effects. Then, we control for the fixed effects and finally, we control for both.

Macro Expectations. In Figure 2, the dependent variables are two measures on macro expectations. The results underpin that the Brexit vote had enlarged the divergence in macro expectations between pro- and anti-Brexit voters. The differences in expectation divergence relative to Wave 8 were insignificant before the Brexit vote. Yet the divergence significantly grew following the vote. As shown by the horizontal lines, pro-Brexit voters on average were 0.917 standard deviations more optimistic about the current economic situation (relative to Wave 8) and 0.747 standard deviations more optimistic about the general unemployment situation (relative to Wave 2015) than anti-Brexit voters. Furthermore, we find that the dynamic effects shown as the dots oscillate slightly around the average effects, suggesting that the enlarged expectation divergence remained stable in the post-vote period considered. Controlling for voters' demographics and the local authority district or region by wave fixed effects does not change our conclusions.

Micro Expectations. Figure 3 presents the results associated with two measures on micro expectations. Consistent with macro expectations, we find the divergence in perceived poverty risk and assessment on household financial position had grown after the Brexit vote. The divergence was also long-lasting and stable over the period considered. On average, pro-Brexit voters perceived 0.163 standard deviations higher poverty risk (relative to Wave 8) and were

0.319 standard deviations more optimistic about their household financial position over the next 12 months. Again, controlling for voters' demographics and the fixed effects does not alter our conclusions.

Spending Intentions. We now turn to analyzing spending intentions in Figure 4. Resembling the findings regarding expectations, before the vote, the belief divergence on whether it is currently a good or bad time to purchase major items between pro- and anti-Brexit voters did not significantly differ from that in the reference wave. However, the divergence immediately increased following the vote, and then fell a bit but remained at a higher level relative to the reference until the end of the period considered. On average, pro-Brexit voters had 0.300 standard deviations stronger spending intention on major items after the vote than anti-Brexit voters (relative to Wave 8). The divergence associated with household general spending also increased after the vote, on average 0.142 standard deviations higher relative to the reference. The increase in the divergence in the post-referendum period is statistically significant at the 5% level, after controlling for region-by-wave fixed effects and demographics.[6]

Additional results. In Appendix Figure B.2, we additionally examine three variables on how voters assessed (1) general economic situation (from the NMG), (2) personal risks of losing jobs (from the BES), and (3) the amount of spending on major purchases (from the NMG) over the next 12 months.[7] The first and third variables are akin to two of our primary economic expectation and spending intention variables, i.e., the variables on the optimism about current economic situation and the assessment about whether it is a good or bad time to buy household major items. But the similar variables differ in their survey provenance so that we can do cross-validation exercises. Consistent with the conclusions above, we find that the divergence between pro- and anti-Brexit voters grew significantly after the vote, as pro-Brexit voters became more optimistic about the overall economy and personal situation, and more willing to buy major items than anti-Brexit voters (relative to the references).

Changes in household spending can be because of either quantity changes or price changes. Are changes in spending intentions due to inflation expectations? We obtain two variables to study this question. The first one from the BES measures household view on how current cost of living is changing. The answers include: "1=Getting a lot lower", "2=Getting a little lower", "3=Staying the same", "4=Getting a little higher", "5=Getting a lot higher". A higher value implies more optimism about inflation. The second one from the NMG measures household expectations on how the general shop prices will change over the next 12 months. There are

[6]We note that the changes in the divergence on household general spending in the first three waves after the vote were not significantly different from zero at the 5% level; they are significantly different from zero for the fourth wave.

[7]The corresponding survey questions and response options are available in Appendix Table B.2.

eight scales for the response options: "1=Go down", "2=Not change", "3=Go up by 1% or less", "4=Go up by 1% but less than 2%", "5=Go up by 2% but less than 3%", "6=Go up by 3% but less than 4%", "7=Go up by 4% but less than 5%", "8=Go up by 5% or more". A higher value with this variable implies a larger increase in the prices. Like previous expectation variables, we standardize these two variables and use them as dependent variables in the two event study specifications. The results are presented in Figure B.3. It shows that the divergence in inflation expectations between pro- and anti-Brexit voters indeed grew remarkably. However, the changes in the divergence were in a direction opposed to that of spending intentions. In other words, pro-Brexit voters had lower inflation expectations than anti-Brexit voters relative to the references. Therefore, the divergence in spending intentions in terms of real spendings in fact was larger than nominal spendings.

Remark. Voters (in aggregate) revised significantly their economic expectations and spending intentions after the Brexit vote, probably because the vote outcome came out as a large surprise as discussed in Section 1. Moreover, we examine the likelihood that the voters believed the UK would vote to leave the EU. We obtain a variable in Wave 7 and 8 in the BES which asked respondents to express their perceived likelihood of the UK voting to leave. The scale of this variable ranges from 0 to 100. The value of "100" implies completely believing that the UK would leave. Figure B.4 depicts the distribution of the perceived likelihood by Brexit identities and waves. The distributions are broadly normal but more proportions of anti-Brexit voters on the left side and more proportions of pro-Brexit voters on the right side. The mean likelihood for anti-Brexit voters is around 40%, and 59% for pro-Brexit voters. There were very few anti-Brexit voters completely believing the UK would leave. Despite relatively high fractions of pro-Brexit voters who completely believed, the fractions were only around 6%. Therefore, the distributions indicate that a Leave vote outcome was to a large extent a surprise for most voters.

3.3 Brexit Identity vs. Socioeconomic Status

To place the importance of the Brexit identity in shaping voters' economic expectations and spending intentions across the vote, we turn to compare belief revisions for voters with the same socioeconomic status across Brexit identities. To this end, we first stratify voters into a variety of groups by their Brexit identities and socioeconomic status (i.e., educational attainment, household gross income per year, and employment status). And then we compute belief revisions for each group by estimating the following equation:

$$Y_{it} = \eta \times PostVote_{it} + \epsilon_{it}, \tag{3}$$

where Y_{it} denotes a particular economic expectation or spending intention variable for voter i in wave t. $PostVote_{it}$ is a dummy which is equal to one when voters were interviewed in the post-vote period. ϵ_{it} is a disturbance term. We also control for local authority district or region fixed effects and demographics (excluding the one by which the voters are stratified), and cluster standard errors at the local authority district or region by wave level.[8]

Figure 5, 6, and 7 plot the coefficient estimates of η (with 95% confidence intervals), i.e., belief revisions by various groups of voters. On left panels, four groups of voters are identified: anti-Brexit voters with (or without) a college degree and pro-Brexit voters with (or without) a college degree. On middle panels, six groups of voters are identified, individuals who are anti- or pro-Brexit voters and have low, or medium, or high income. On right panels, six groups of voters are identified, individuals who are anti- or pro-Brexit voters and inactive on labor markets (e.g., the retired, students), or employed, or unemployed.

The results suggest that belief revisions are mostly consistent across socioeconomic status for given Brexit identity (anti- or pro-Brexit).[9] But the gaps in belief revisions are much larger across Brexit identities within each socioeconomic status. For example, in Panel A of Figure 5, the absolute gap in revisions to optimism about current economic situation between anti-Brexit voters with a college degree and without a college is 0.132 standard deviations; the corresponding number is 0.062 standard deviations for pro-Brexit voters. However, the absolute gap between anti- and pro-Brexit voters, both with a college degree, increases to 0.925 standard deviations, and 0.856 standard deviations for both without a college degree. The results imply that the Brexit identity played a more important role in accounting for the gap between belief revisions by pro- and anti-Brexit voters than socioeconomic status. This conclusion broadly holds when examining other variables of economic expectations and spending intentions and stratifying voters by household gross income per year and employment status (see also Appendix Figure B.5 for results using several additional variables of expectations and spending intentions).

[8] We do not control for local authority district or region by wave fixed effect because this approach will lead to collinearity issues.

[9] Interestingly, for each Brexit identity (pro- or anti-Brexit), the decline in optimism for voters with higher socioeconomic status (education or income) on average is larger than that for voters with lower socioeconomic status.

4 Did the Brexit Vote Affect Actual Economic Behavior?

The previous section shows that the Brexit vote led to large the divergence in spending intention between pro- and anti-Brexit voters. But this divergence may be caused by the same logic as "partisan cheerleading" – respondents feel elation (or frustration) when their supporting party wins (or loses) the elections but do not assess the macro and personal economic situations seriously in surveys (Mian, Sufi and Khoshkhou, 2021). In this section, we turn to study if the vote affected actual economic behavior using the LAU-quarter panel data set described in Section 2.2. We exploit variations at the local authority district level using administrative data to reduce "partisan cheerleading" bias and measurement errors in survey measures of outcomes. Two proxies of our interest to trace actual economic behavior are quarterly housing transaction volume and licensed automobile stock because they reflect two major household economic decisions.

4.1 Average Effects

We begin the analysis with a difference-in-differences specification to estimate the average effects of the Brexit vote on housing transaction volume and licensed automobile stock,

$$Ln(S_{at}) = \delta_t + \gamma_a + \beta \times PostVote_t \times LeaveVoteShare_a + \epsilon_{at}, \tag{4}$$

where S_{at} denotes housing transaction volume per capita or licensed automobile stock per capita for local authority district a in quarter t. $PostVote_t$ is a time dummy indicating the post-vote period, after Quarter 1, 2016. The Brexit vote took place in Quarter 2, 2016 and we choose Quarter 1, 2016 as the cut-off point because our outcome variables are measured as total numbers at the end of each quarter. $LeaveVoteShare_a$ is the treatment variable, measuring the share of leave voters in the referendum. We control for a set of year-quarter fixed effects, δ_t, to capture all variations in outcomes that are varying in time but common across local authority districts such as seasonality. We also control for a set of local authority district fixed effects, γ_a, to capture all variations in outcomes that are varying in local authority districts but common across time such as geographical locations. ϵ_{at} is a disturbance term. Standard errors are clustered at the local authority district level. The regression is weighted by local population size. β is the coefficient of interest, capturing the average effects of the Brexit vote on actual economic behavior.

Column (1) – (6) of Table 4 report the coefficient estimates from Equation (4). Panel A and B use log of housing transaction volume per capita and log of licensed automobile stock per

capita as the dependent variables, respectively. Column (1) presents the baseline results. We find that the Brexit vote had widened the gap in housing transaction volume per capita and licensed automobile stock per capita across local authority districts. The divergence in economic expectations and spending intentions is not merely "cheerleading". On average, a 10% difference in the share of Leave voters is associated with a 5.98% increase in the gap of housing transaction volume per capita and a 0.78% increase in the gap of licensed automobile stock per capita after the Brexit vote. In Column (2), we examine if the vote changed actual economic behavior via affecting household disposable income. We do this by controlling for annual local average gross disposable household income. However, the results suggest that income does not remarkably mediate our average effects. This is consistent with the finding that the divergence in the share of households expecting income to increase over the next twelve months did not significantly change after the vote (see Appendix Figure B.6).

While there were no real changes in the relationship between the UK and the EU over the period from 2015 to 2019, the shocks induced by the vote could still change household actual economic behavior via a range of mechanisms such as unemployment rates and immigration rates that have impact on household income. On the other hand, even without the Brexit vote, these locality-specific variables are time-varying. Because our baseline specification can not capture locality-specific time-varying factors, this issue can add confounding effects. How to disentangle the confounding effects from the mediation effects? We examine this issue by controlling for time trends varying with pre-vote local economic characteristics, on the assumption that in the absence of the Brexit vote, these characteristics have constant growth rates.

Column (3), (4), (5), and (6) report the results, successively controlling for a time trend variable interacting with Unemployment Rate 2015, Immigration Rate 2011, log of EU Structural Funds per capita 2013, and log of Total Fiscal Cuts 2010—15. Both for Panel A and B, further controlling for time trends that vary with pre-vote local unemployment rates, immigration rates, and fiscal cuts does not change the coefficient estimates of β that much. The only one that has a relatively large role to play is EU structural funds. Now, the coefficient estimate of β in Panel A reduces to 0.316, around half of the baseline, but still significant at the 1% level. And it reduces to 0.027 in Panel B, around one third of the baseline, and is significant at the 5% level, compared to 1% originally. In fact, these reductions make sense because Brexit means the EU Structural Funds would stop provide funding to the UK, and therefore, like the share of Leave voters, EU Structural Funds per capita 2013 is also a good proxy to capture the Brexit vote shocks. Consequently, a time trend interacting with log of EU Structural Funds per capita 2013 can capture a lot of the effects caused by the Brexit vote.

4.2 Dynamic Effects

We subsequently examine the dynamic effects by estimating a LAU-level version of Equation (1) and (2) from Subsection 3.1 above. Specifically, the econometric specifications are as follows,

$$\begin{aligned} Ln(S_{at}) = \delta_t + \gamma_a + \beta_1 \times PreVote_t \times LeaveVoteShare_a + \\ \beta_2 \times PostVote_t \times LeaveVoteShare_a + \epsilon_{at}, \end{aligned} \tag{5}$$

$$Ln(S_{at}) = \delta_t + \gamma_a + \sum_{t \neq 2016q1} \eta_t \times Quarter_t \times LeaveVoteShare_a + \epsilon_{at}, \tag{6}$$

where S_{at}, δ_t, γ_a, $LeaveVoteShare_a$, and ϵ_{at} are defined as above. $PreVote_t$ is a dummy indicating the period from Quarter 1, 2015 to Quarter 4, 2015. $PostVote_t$ is another dummy indicating the period from Quarter 2, 2016 to Quarter 4, 2019. $Quarter_t$ is a set of quarter indicators. For both specifications, the reference time is Quarter 1, 2016, the preceding quarter of the Brexit vote. We cluster standard errors at the local authority district level and weight the regressions with local population size. The coefficients of interest are β_1, β_2, and η_t which capture the changes in spatial divergence of housing transactions and automobile purchases relative to the reference.

The coefficient estimates of interest are plotted in Figure 8. The estimates of β_1 are indicated as the horizontal lines on the left, and β_2 on the right. The estimates of η_t are indicated as dots with their 95% confidence intervals indicated by the gray dash lines. Panel A shows the results associated with housing transactions. The results suggest that the estimates of η_t are close to null before the Brexit vote, but increased distinctly in the wake of that. Additionally, the estimates of η_t in the post-vote period remained stable. After estimating Equation (5), we test if $\beta_1 = \beta_2$. The results reject the null hypothesis with a tiny p value less than 0.01. Taken together, these results are in line with our conclusion above that the Brexit vote had enlarged the spatial gap in housing transactions.

Panel B shows the results for licensed automobile stock. Now nearly all the coefficient estimates of η_t in the pre-vote quarters are insignificantly different from null. But interestingly there was a clear increasing trend of the estimates, suggesting that the effects of the Brexit vote on the spatial gap in terms of licensed automobile stock were increasing over time during the period considered. Likewise, we test if $\beta_1 = \beta_2$ and the results again significantly reject the null hypothesis. Furthermore, consistent with the findings in Section 3, Figure 8 displays that the effects of the Brexit vote on the actual economic behavior are long-lasting. In case the year 2015 may be a special year, we further collect data of housing transaction volume and licensed

automobile stock in 2014 and replicate the analysis above. As shown in Appendix Figure B.7, our results are robust to extending the analysis to Quarter 1, 2014.

4.3 Roots of Euroscepticism

As shown above, the divergence in actual economic behavior was caused by the Brexit vote shock that was heterogeneous to local authority districts. We capture the heterogeneous shock using the shares of Leave voters. In fact, the shares also broadly reflect the varying extent of the recent rise of Euroscepticism across local authority districts. Therefore, we are able to study which roots of Euroscepticism interacting with the vote engendered more powerful shocks to cause the relative movement in actual economic behavior.

Among the roots of Euroscepticism in the UK, governmental policies and globalization shocks such as trade competition and immigration are found to be the crucial ones (Fetzer, 2019; Rodrik, 2021; Colantone and Stanig, 2018). In spirit of these findings, we identify three sets of roots at the local authority district level: (1) economic shocks that vary quickly in a relatively short term; (2) industry and occupation structures that are relatively rigid in a long term and can lead to various degrees of economic distress under globalization shocks; (3) demographic compositions that capture economic "winners" and "losers". We use a range of variables to measure these roots. Specifically, economic shock variables include unemployment rate 2015, immigration rate 2011, EU structural funds 2013, total fiscal cuts 2010—15. Industry and occupation structure variables include manufacturing employment shares and shares of low-skill jobs. Demographic composition variables include gross household disposable income, shares of residents without qualification, and deprivation rates.

Our empirical strategy is a two-step procedure, exploiting the variation in the share of leave voters uncorrelated with the factors identified as roots of Euroscepticism. Specifically, we first regress separately the share of leave voters on the three sets of factors as classified above and store the residuals, ξ_a. The regression results are reported in Appendix Table B.5. Economic shock variables absorb 51.7% of the variation in the share of leave voters, industry and occupation structure variables absorb 54.3%, and demographic composition variables absorb 69.5%. We also include the full set of variables in Column (4). Overall, all the variables together absorb 78.6% of the variations in the share of leave voters. We then replicate the specification (4) replacing $LeaveVoteShare_a$ with ξ_a:

$$Ln(S_{at}) = \delta_t + \gamma_a + \beta \times PostVote_t \times \xi_a + \epsilon_{at}. \tag{7}$$

Since ξ_a is a generated variable, we estimate standard errors using 1,000 bootstrap replica-

tions. Now that the variation in the share of Leave voters induced by the factors considered has been filtered out, if the factors have powerful shocks to cause the relative movement in the actual economic behavior, we should be able to see a relatively large reduction in the coefficient estimates of β compared to the baseline estimates using the specification (4).

Regression results are reported in Column (7), (8), and (9) of Table 4. Panel A and B use log of housing transaction volume per capita and log of licensed automobile stock per capita as dependent variables, respectively. In Column (7), we include economic shock variables in the first step. Both for Panel A and B, the coefficient estimates of β remain quantitatively similar to the baseline results in Column (1). Conversely, the coefficient estimates of β drop significantly both for Panel A and B when controlling for industry and occupation structure variables and demographic composition variables, suggesting that such two sets of variables capture relatively powerful shocks induced by the Brexit vote. Therefore, we conclude that the Brexit vote caused relatively large shocks on actual economic behavior for local authority districts that had been suffering from long-term adverse impact of globalization on local manufacturing industries, low-skill occupations, and residents with lower socioeconomic status.

4.4 Spending Intentions and Actual Economic Behavior

Do spending intentions matter for actual economic behavior? As a first step towards answering this question, we correlate our measures of actual economic behavior with a LAU-level measure on spending intention. While such correlations can not be interpreted as causal mechanisms, our goal is merely to explore if the survey-based measures of spending intentions are powerful in predicting actual economic behavior in the context of the Brexit vote.

To construct the local spending intention measure, we use the variable from the BES on whether it is currently a good or bad time to purchase major items because it has a higher frequency. We calculate the mean for each local authority district in each wave. To match such measure with our LAU-quarter panel data set, we generate a variable indicating the year and quarter when each wave was conducted. For each local authority district, we then match observations that are closest on the time variable.

Before examining the correlations, we begin by replicating the specification in Equation 4 using the LAU-level measure on spending intentions as the dependent variable. Appendix Table B.6 reports the results. Likewise, Column (1) reports the baseline results merely controlling for LAU and time fixed effects. Column (2) further controls for log of annual gross household disposable income. Column (3) — (6) successively control for time trends interacting with pre-vote local unemployment rates, immigration rates, log of EU structural fund transfers, and log

of total fiscal cuts over the period from 2010 to 2015. The regressions yield a qualitatively similar profile to those from individual-level findings on spending intentions. After the Brexit vote, the divergence in the assessment on whether it is currently a good or bad time to purchase major items grew significantly between local authority districts with higher shares of leave voters and those with lower shares. Moreover, aggregating to the local authority district level from the individual level does not change the relative movement of spending intentions.

In Figure 9, we investigate the correlation between spending intention and actual economic behavior. It presents binned scatter plots of housing transaction volume per capita and licensed automobile stock per capita in log scale against our LAU-level spending intention measure. The conditional mean of log of housing transaction volume per capita and log of licensed automobile stock per capita given the spending intentions are positively linear. Using a population-weighted OLS regression with standard errors clustered at the LAU level, we estimate that one standard deviation increase in the spending intention measure is significantly associated with an 18% increase in the mean log housing transaction volume per capita, and a 45% increase in the mean log licensed automobile stock per capita. The magnitude and size of the estimates are broadly similar when we consider separately before and after the Brexit vote, as shown in Appendix Figure B.8. In addition, given the spending intention level, mean housing transaction volume per capita and mean licensed automobile stock per capita were generally higher after the vote.

4.5 Implications of Polarized Beliefs for the UK Economy

This section provides a brief and informal discussion on experts' forecasts of the economic consequences of a Brexit vote and the implications of political polarization about Brexit for the UK economy. Contrast to the large disagreement among households, economic experts had a nearly unanimous view that Brexit would have negative short- and long-term economic consequences.[10] For instance, on June 7, 2016 (shortly before the referendum), the Centre for Macroeconomics (CFM) survey asked a panel of economists about the consequences of a Brexit vote on the British economy, financial sector and asset prices. Nobody thought that the overall consequences of a leave outcome would be beneficial for the UK economy. Private and public economic institutions shared a similar view, such as investment banks, the Bank of England and the IMF.[11]

In the few years after the EU referendum, there had been little discernible impact on macroe-

[10] The literature has documented large disagreement about a wide range of economic and policy issues between ordinary households and economic experts, such as Sapienza and Zingales (2013).

[11] Appendix A provides a detailed discussion on economic experts' views.

conomic variables beyond a fall in the value of the pound. And the economics profession has been criticized for being overly gloomy in its predictions (e.g., Johnson and Mitchell, 2017). The pessimistic view of experts is based on one or several of the following economic channels when the short-term effects of the Brexit vote on the UK economy are analyzed. First, a less open UK economy as a consequence of Brexit would reduce foreign direct investment, productivity and household incomes in the long term. Anticipating this, households would immediately cut spending and businesses cut jobs.[12] Second, spending decisions would be put off by uncertainty about the UK's relation to the EU. Third, the above two effects would lead to rising financial market volatility, falling asset prices, and increasing borrowing rates for households and businesses. The worsening financial conditions amplify the first two effects. All three channels operate via shifting expectations by households and businesses and exert a negative influence on the UK economy.

Complementing the above three channels, our empirical findings highlight households' heterogeneous expectations as an overlooked economic channel for analyzing the economic consequences of the Brexit vote. Broadly speaking, we find that the Brexit vote has led to more pessimistic beliefs about the macroeconomy and personal financial situation and weaker spending intentions for anti-Brexit voters comparing with the pre-vote period (consistent with the above three channels); the opposite for pro-Brexit voters. Moreover, spending intentions are closely associated with actual spending (see Figure 9 and B.8 before and after the vote) and the Brexit vote has led to divergence in actual economic behavior like house and automobile purchases across local authority districts (see Figure 8).

This channel, especially the optimism displayed by pro-Brexit voters, exerts a positive influence on the macroeconomy, as opposing to the three negative channels above. This channel, along with stimulative macroeconomic policies and strong external demand, may help to explain the relatively resilient UK economy in the aftermath of the referendum. To emphasize, the three economic channels may mainly apply to the anti-Brexit voters and to a less extent the pro-Brexit voters. For future work, It would be desirable to monitor and study further the dynamic evolution of the heterogeneous expectations of households with different Brexit identities which may be a crucial ingredient for understanding the effects of the Brexit vote on household economic behavior and the UK economy.

[12]Related to this channel, Kuang and Mitra (2016) develops a learning model which suggests an important role for shifting long-run growth expectations in business cycle fluctuations.

5 Conclusion

The surprising Brexit vote was a watershed moment in European politics. While the UK-EU relation remained the same in the aftermath of the vote and till the end of the Brexit transition period (31 December 2020), the impacts of the vote are far-reaching and have been unfolding. The paper sheds some light on the political polarization in economic beliefs and behavior as a consequence of the Brexit vote.

Using two nationally representative household surveys and administrative data, we find a strong political polarization in economic expectations and behavior in the wake of the once-in-a-lifetime EU referendum. After the referendum, pro-Brexit voters had systematically become more optimistic about the general economy and personal economic situation, and more likely to spend on major items and general goods. The vote thus had remarkably enlarged the divergence in economic expectations and spending intentions between pro- and anti-Brexit voters. While pro-Brexit voters tend to be inferior in socioeconomic status, the divergence did not emerge from the distinctive compositions. Our results suggest that Brexit identities strongly dominate in shaping economic expectations and spending intentions over socioeconomic characteristics.

We utilize administrative data of housing transactions and licensed automobile stocks at the local authority level to analyze the effects of the Brexit vote on economic behavior. The Brexit vote shock had widened the gap in housing transaction volume per capita and licensed automobile stock per capita across local authority districts with varying levels of support for leaving the EU. This shock was particularly pronounced for local authority districts that had been suffering from long-term economic distress under globalization. We also examine the associations between spending intentions and economic behavior, and find that the survey-based measure of spending intentions is positively correlated with housing transaction and licensed automobile stock per capita both before and after the vote. However, these associations should not be interpreted as conclusive evidence due to limitations in both the methodology and the regional aggregate measures used. A promising avenue for further research would be to link individual spending intentions to actual economic spending, using data from personal credit card consumption.

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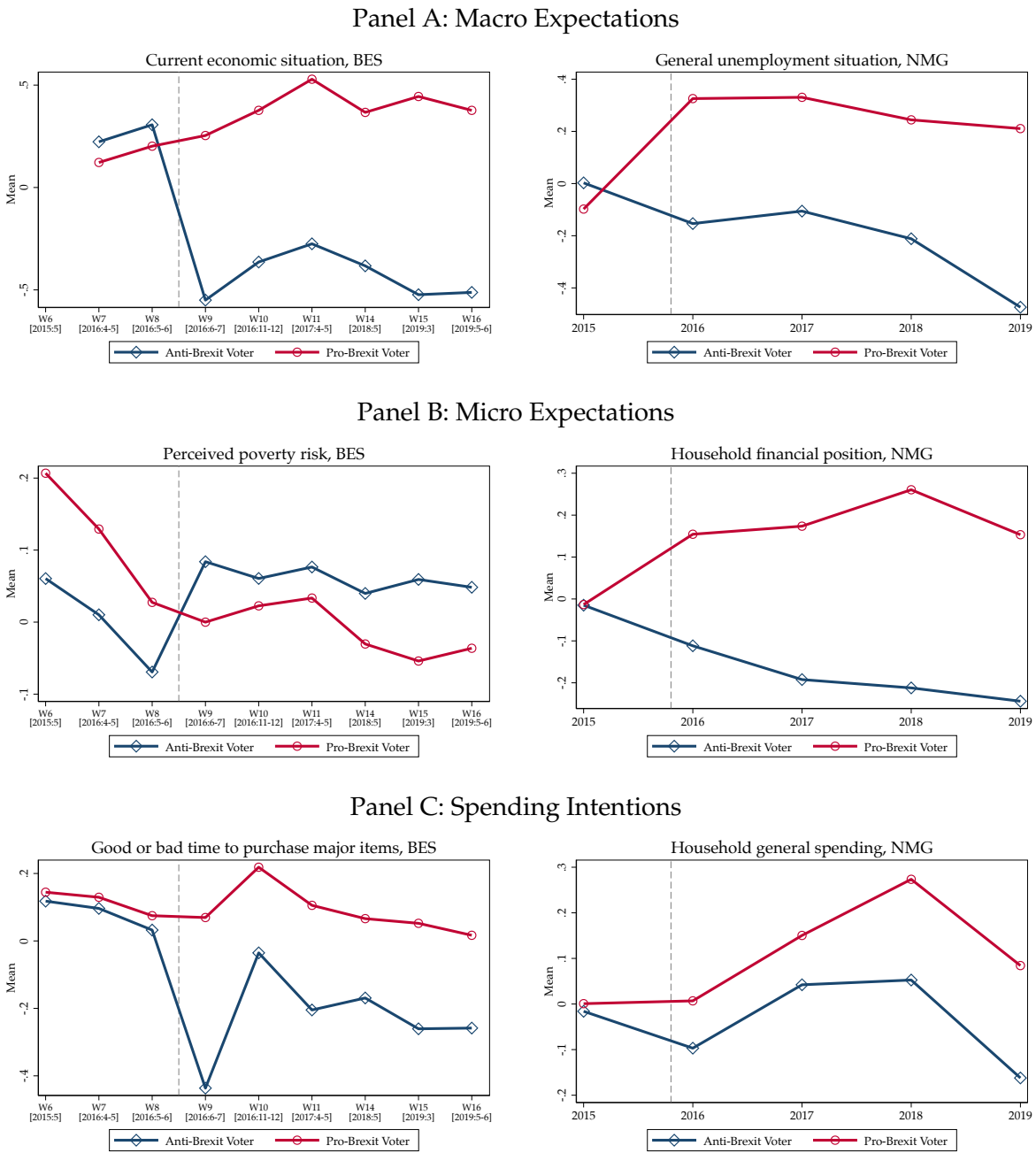
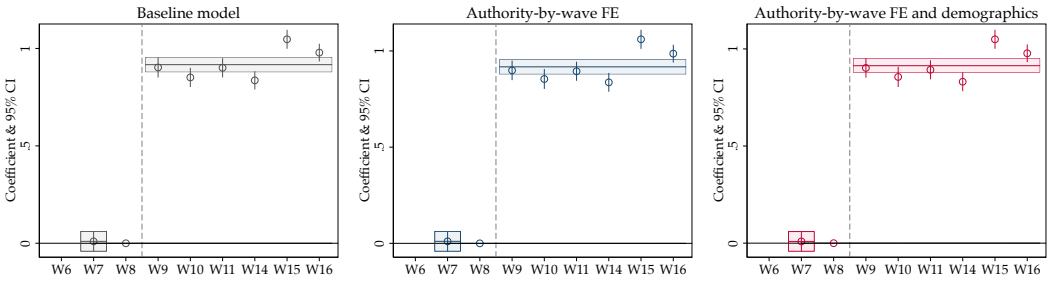


FIGURE 1: Economic Expectations and Spending Intentions across the Brexit Vote

Notes: This figure presents the mean standardized economic expectations and spending intentions by Brexit identities across the Brexit vote. Gray dash lines mark the vote date. Panel A shows macro expectations: beliefs about the current economic situation and the general unemployment situation; a higher value implies more optimism about the macro economy over the next 12 months. Panel B shows micro expectations: the perceived risk of getting into poverty and beliefs about household financial position; a higher value implies a higher perceived risk or more optimism about the household financial position over the next 12 months. Panel C shows spending intentions: judgement on whether it is currently a good or bad time to buy major items (e.g., furniture, kitchen appliances, and televisions) and intentions on household general spending; a higher value implies a stronger intention to buy major household items or to increase household general spending over the next 12 months.

Panel A: Current Economic Situation, BES



Panel B: General Unemployment Situation, NMG

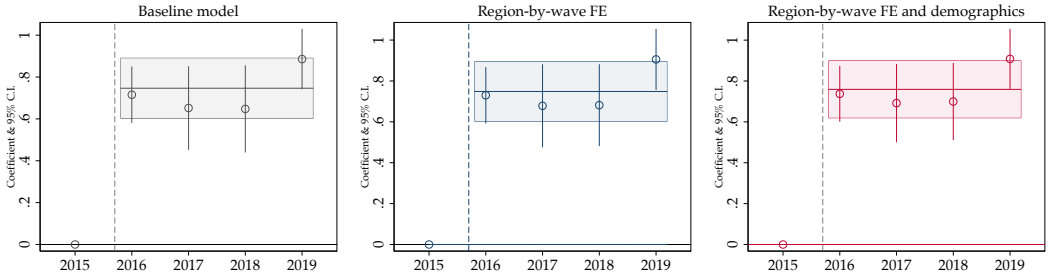


FIGURE 2: Divergence in Macro Economic Expectations across the Brexit Vote

Notes: This figure presents the divergence between pro-Brexit and anti-Brexit voters in macro expectations. Panel A presents voters' expectations on whether the economy is getting better, worse, or staying about the same. Panel B presents voters' expectations on how the general unemployment situation will change over the next 12 months. A higher value with these two expectation variables implies more optimism about the economy. To construct the plots, we first estimate the flowing specifications with Wave 8 (in the BES) and Wave 2015 (in the NMG) as the reference:

$$Y_{it} = ProBrexit_{it} + \sum Period_t + \sum \beta_t \times Period_t \times ProBrexit_{it} + \epsilon_{it},$$

$$Y_{it} = ProBrexit_{it} + \sum Wave_t + \sum \rho_t \times Wave_t \times ProBrexit_{it} + \epsilon_{it}.$$

The coefficient estimates of β_t are plotted as horizontal lines, and their 95% confidence intervals are indicated as boxes. The coefficient estimates of ρ_t are plotted as dots with their 95% confidence intervals indicated with vertical lines. The coefficients plotted can be interpreted as the relative change in belief divergence between pro-Brexit and anti-Brexit voters around the Brexit vote. In baseline models, we do not control for voters' demographics and authority/region by wave fixed effects. Then we successively include them.

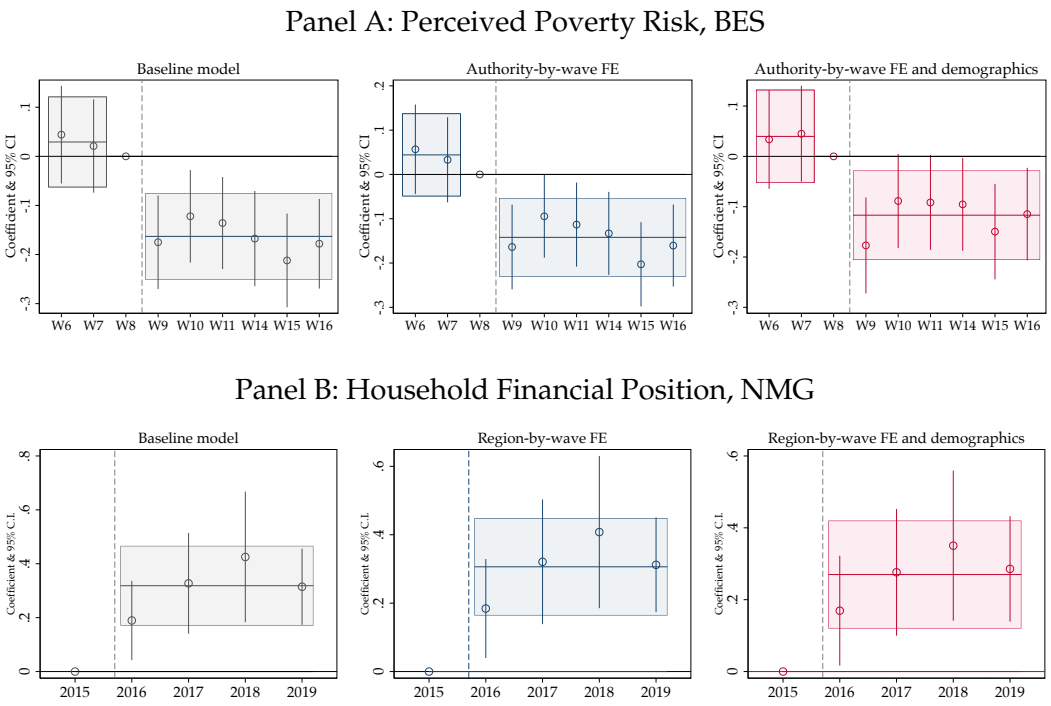


FIGURE 3: Divergence in Micro Economic Expectations across the Brexit Vote

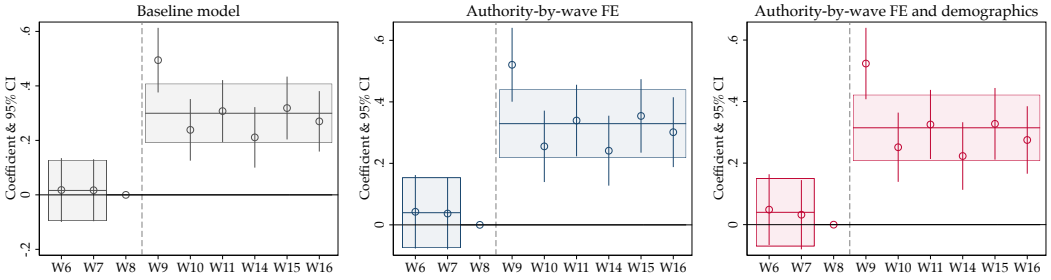
Notes: This figure presents the divergence between pro-Brexit and anti-Brexit voters in micro expectations. Panel A presents voters' perceived risk of getting into poverty, i.e., lacking in enough money to cover day to day living costs. A higher value with this variable implies a higher risk. Panel B presents voters' expectations on how the household financial position will change over the next 12 months. A higher value with this variable implies getting better. To construct the plots, we first estimate the flowing specifications with Wave 8 (in the BES) and Wave 2015 (in the NMG) as the reference:

$$Y_{it} = ProBrexit_{it} + \sum Period_t + \sum \beta_t \times Period_t \times ProBrexit_{it} + \epsilon_{it},$$

$$Y_{it} = ProBrexit_{it} + \sum Wave_t + \sum \rho_t \times Wave_t \times ProBrexit_{it} + \epsilon_{it}.$$

The coefficient estimates of β_t are plotted as horizontal lines, and their 95% confidence intervals are indicated as boxes. The coefficient estimates of ρ_t are plotted as dots with their 95% confidence intervals indicated with vertical lines. The coefficients plotted can be interpreted as the relative change in belief divergence between pro-Brexit and anti-Brexit voters around the Brexit vote. In baseline models, we do not control for voters' demographics and authority/region by wave fixed effects. Then we successively include them.

Panel A: Good or Bad Time to Purchase Major Items, BES



Panel B: Household General Spending, NMG

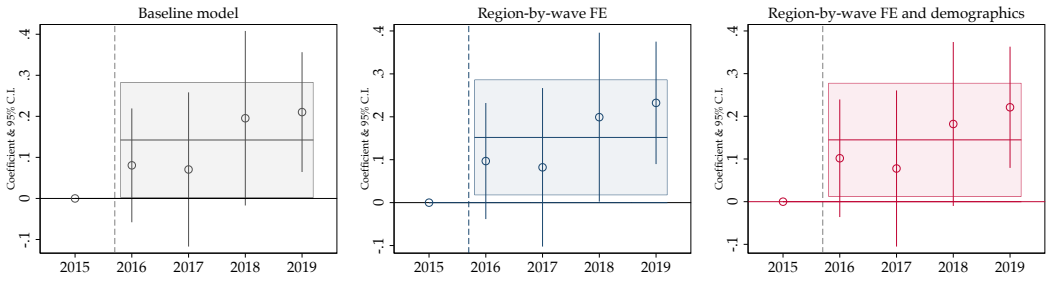


FIGURE 4: Divergence in Spending Intentions across the Brexit Vote

Notes: This figure presents the divergence between pro-Brexit and anti-Brexit voters in spending intentions. Panel A presents voters' judgement on whether it is currently a good or bad time to purchase major items (e.g., furniture, kitchen appliances, and televisions). Panel B presents voters' intentions on household general spending over the next 12 months. A higher value with these two variables implies a stronger intention to buy major household items or to increase household general spending. To construct the plots, we first estimate the flowing specifications with Wave 8 (in the BES) and Wave 2015 (in the NMG) as the reference:

$$Y_{it} = ProBrexit_{it} + \sum Period_t + \sum \beta_t \times Period_t \times ProBrexit_{it} + \epsilon_{it},$$

$$Y_{it} = ProBrexit_{it} + \sum Wave_t + \sum \rho_t \times Wave_t \times ProBrexit_{it} + \epsilon_{it}.$$

The coefficient estimates of β_t are plotted as horizontal lines, and their 95% confidence intervals are indicated as boxes. The coefficient estimates of ρ_t are plotted as dots with their 95% confidence intervals indicated with vertical lines. The coefficients plotted can be interpreted as the relative change in belief divergence between pro-Brexit and anti-Brexit voters around the Brexit vote. In baseline models, we do not control for voters' demographics and authority/region by wave fixed effects. Then we successively include them.

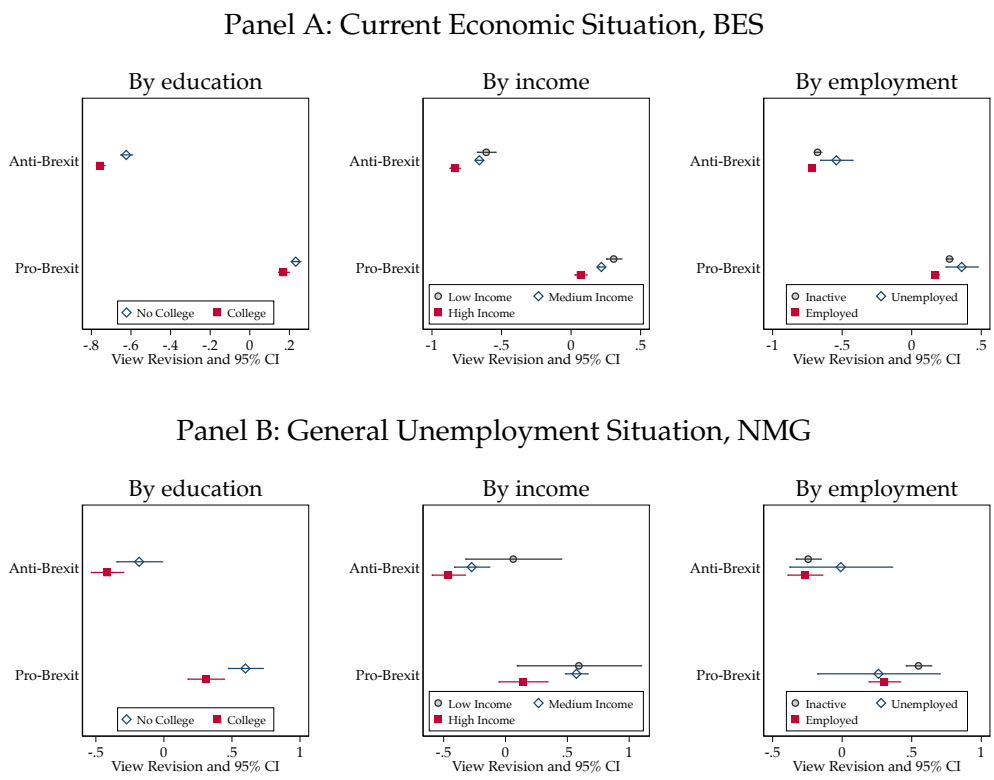


FIGURE 5: Macro Expectations: Brexit Identity vs. Socioeconomic Status

Notes: This figure presents view revisions for voters in macro expectations. To construct this figure, we first stratify voters into various groups based on their Brexit identities and socioeconomic status (i.e., educational attainment, household gross income per year, and employment status). In left panels, 4 groups of voters are identified: (1) anti-Brexit voters without a college degree, (2) anti-Brexit voters with a college degree, (3) pro-Brexit voters without a college degree, (4) pro-Brexit voters with a college degree. In middle panels, 6 groups of voters are identified: (1) anti-Brexit voters in low-income households, (2) anti-Brexit voters in medium-income households, (3) anti-Brexit voters in high-income households, (4) pro-Brexit voters in low-income households, (5) pro-Brexit voters in medium-income households, (6) pro-Brexit voters in high-income households. For the definitions of the income ranges, see the notes in Appendix Table 2. In right panels, 6 groups of voters are identified: (1) anti-Brexit voters inactive in labor markets (e.g., the retired, students), (2) anti-Brexit voters who are unemployed, (3) anti-Brexit voters who are employed, (4) inactive pro-Brexit voters, (5) unemployed pro-Brexit voters, (6) employed pro-Brexit voters. Next, for each group, we estimate the following specification: $Y_{it} = \eta \times PostVote_{it} + \epsilon_{it}$, and plot the coefficient estimates of η with their 95% confidence intervals.

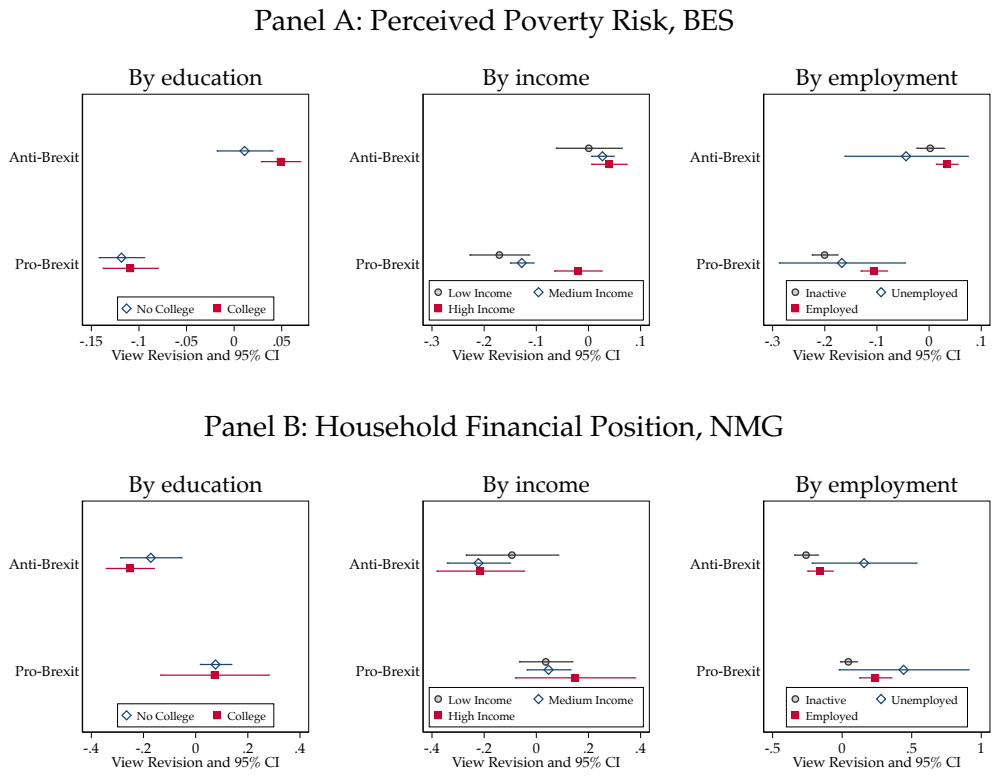


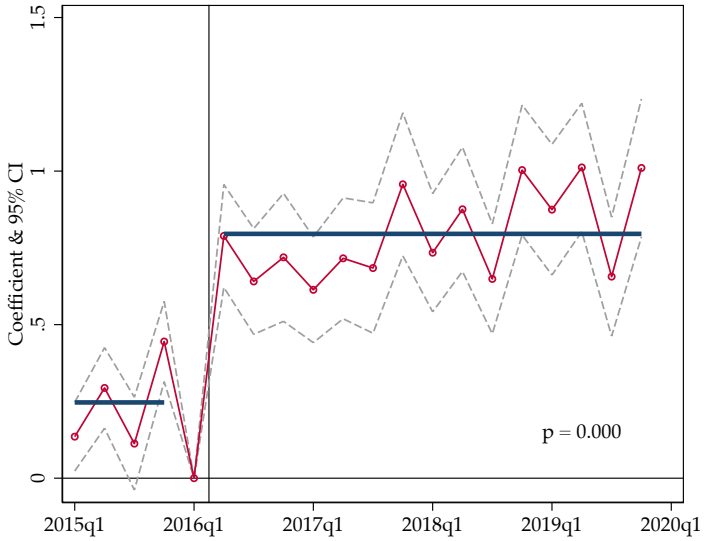
FIGURE 6: Micro Expectations: Brexit Identity vs. Socioeconomic Status

Notes: This figure presents view revisions for voters in micro expectations. To construct this figure, we first stratify voters into various groups based on their Brexit identities and socioeconomic status (i.e., educational attainment, household gross income per year, and employment status). In left panels, four groups of voters are identified: (1) anti-Brexit voters without a college degree, (2) anti-Brexit voters with a college degree, (3) pro-Brexit voters without a college degree, (4) pro-Brexit voters with a college degree. In middle panels, six groups of voters are identified: (1) anti-Brexit voters in low-income households, (2) anti-Brexit voters in medium-income households, (3) anti-Brexit voters in high-income households, (4) pro-Brexit voters in low-income households, (5) pro-Brexit voters in medium-income households, (6) pro-Brexit voters in high-income households. For the definitions of the income ranges, see the notes in Appendix Table 2. In right panels, six groups of voters are identified: (1) anti-Brexit voters inactive in labor markets (e.g., the retired, students), (2) anti-Brexit voters who are unemployed, (3) anti-Brexit voters who are employed, (4) inactive pro-Brexit voters, (5) unemployed pro-Brexit voters, (6) employed pro-Brexit voters. Next, for each group, we estimate the following specification: $Y_{it} = \eta \times PostVote_{it} + \epsilon_{it}$, and plot the coefficient estimates of η with their 95% confidence intervals.

FIGURE 7: Spending Intentions: Brexit Identity vs. Socioeconomic Status

Notes: This figure presents view revisions for voters in spending intentions. To construct this figure, we first stratify voters into various groups based on their Brexit identities and socioeconomic status (i.e., educational attainment, household gross income per year, and employment status). In left panels, four groups of voters are identified: (1) anti-Brexit voters without a college degree, (2) anti-Brexit voters with a college degree, (3) pro-Brexit voters without a college degree, (4) pro-Brexit voters with a college degree. In middle panels, six groups of voters are identified: (1) anti-Brexit voters in low-income households, (2) anti-Brexit voters in medium-income households, (3) anti-Brexit voters in high-income households, (4) pro-Brexit voters in low-income households, (5) pro-Brexit voters in medium-income households, (6) pro-Brexit voters in high-income households. For the definitions of the income ranges, see the notes in Appendix Table 2. In right panels, six groups of voters are identified: (1) anti-Brexit voters inactive in labor markets (e.g., the retired, students), (2) anti-Brexit voters who are unemployed, (3) anti-Brexit voters who are employed, (4) inactive pro-Brexit voters, (5) unemployed pro-Brexit voters, (6) employed pro-Brexit voters. Next, for each group, we estimate the following specification: $Y_{it} = \eta \times PostVote_{it} + \epsilon_{it}$, and plot the coefficient estimates of η with their 95% confidence intervals.

Panel A: Housing Transaction Volume



Panel B: Licensed Automobile Stock

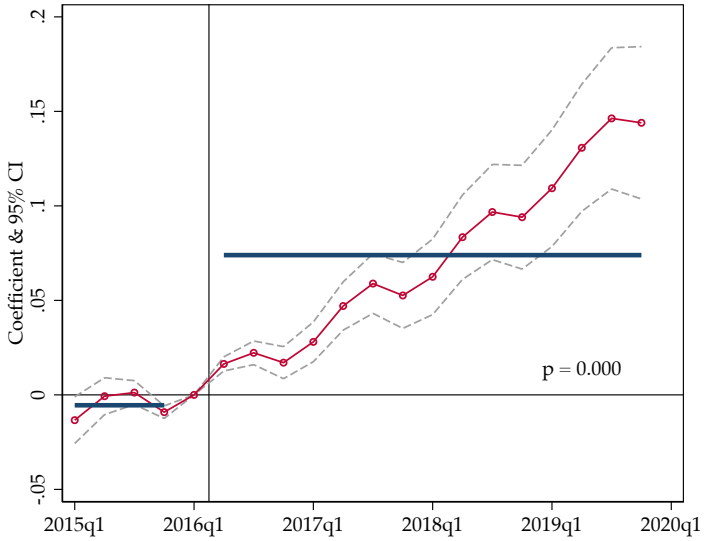


FIGURE 8: Housing Transaction Volume and Licensed Automobile Stock, 2015 – 2019

Notes: This figure presents the effects of the Brexit vote on housing transaction volume per capita (Panel A) and licensed automobile stock per capita (Panel B). The effects are estimated at the local authority district level, for 313 local authority districts in England and Wales. We plot the coefficient estimates of η_t as dots with their 95% confidence intervals indicated by the dash lines from the following specification:

$$Ln(S_{at}) = \delta_t + \gamma_a + \sum_{t \neq 2016q1} \eta_t \times Quarter_t \times LeaveVoteShare_a + \epsilon_{at}.$$

To compare the average pre-vote "effects" to post-vote effects, we run the following specification and test the null hypothesis that $\beta_1 = \beta_2$. Coefficient estimates of β_1 and β_2 are plotted as the blue horizontal lines. We report the p values underlying the tests.

$$Ln(S_{at}) = \delta_t + \gamma_a + \beta_1 \times PreVote_t \times LeaveVoteShare_a + \beta_2 \times PostVote_t \times LeaveVoteShare_a + \epsilon_{at}.$$

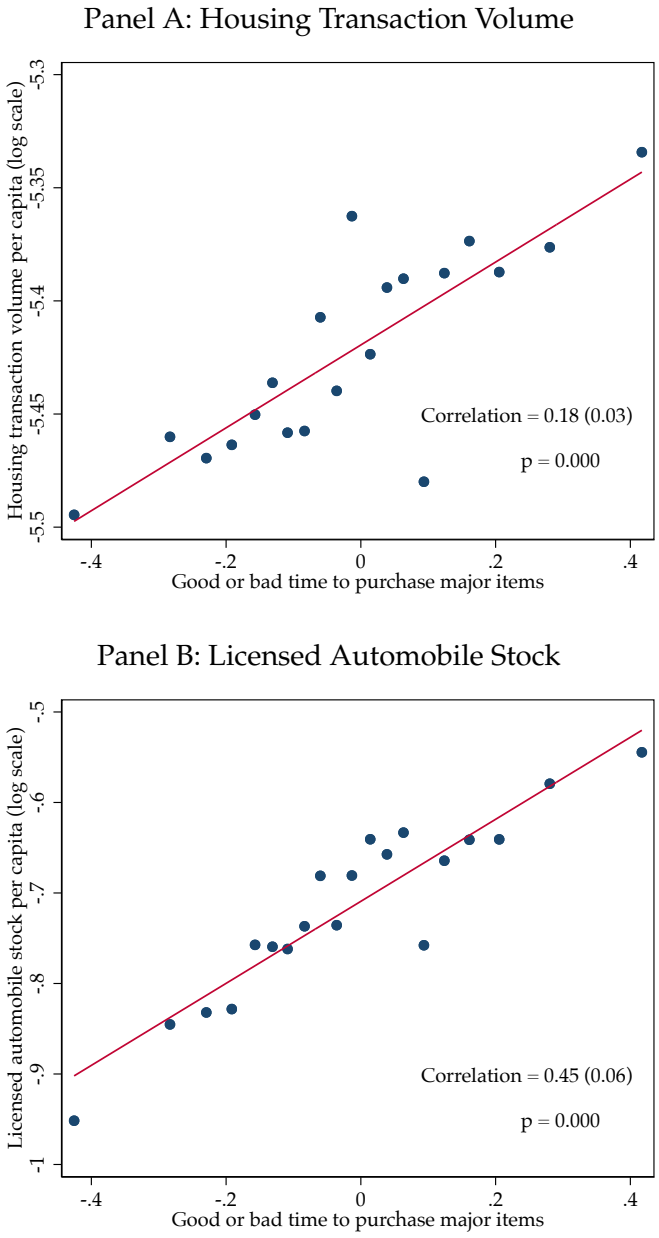


FIGURE 9: Correlation between Spending Intentions and Actual Economic Behavior

Notes: This figure presents binned scatter plots of housing transaction volume per capita and licensed automobile stock per capita (both in log scale) vs. households' judgement on whether it is currently a good or bad time to purchase major items. To construct this figure, we group LAU-quarter observations into twenty equally sized bins based on the spending intention measure. We then plot the mean log of housing transaction volume per capita (or mean log of licensed automobile stock per capita) vs. the mean spending intention within each bin. The correlation coefficients between the variables are estimated using the LAU-quarter data, with standard errors (in the parentheses) clustered at the LAU level. The corresponding p values are also reported.

TABLE 1: (Un)Changed Brexit Identities, NMG

		2016		2017		2018	
		Pro-Brexit	Anti-Brexit	Pro-Brexit	Anti-Brexit	Pro-Brexit	Anti-Brexit
2017	Pro-Brexit	51.7%	3.7%				
	Anti-Brexit	3.7%	40.9%				
2018	Pro-Brexit	42.6%	4.4%	42.6%	2.8%		
	Anti-Brexit	9.4%	43.5%	7.5%	47.1%		
2019	Pro-Brexit	39.5%	3.3%	37.2%	2.3%	36.7%	5.1%
	Anti-Brexit	13.3%	43.9%	12.7%	47.8%	7.7%	50.5%

Notes: This table reports the percentages of voters who expressed unchanged/changed attitudes towards Brexit between any two particular years from 2016 to 2019. Percentages of voters who did not change attitudes between two particular years are shaded as color gray. To calculate these percentages, we first limit respondents to those who were traced in two particular waves of the NMG. We then calculate the shares of four types of voters: (1) voters responding pro-Brexit attitudes in both years, (2) voters responding anti-Brexit attitudes in both years, (3) voters responding pro-Brexit attitudes in the former year but changing to anti-Brexit attitudes in the latter year, (4) voters responding anti-Brexit attitudes in the former year but changing to pro-Brexit attitudes in the latter year. Hence, the voters who did not change attitudes are the first two types.

TABLE 2: Demographic Compositions of Voters, BES and NMG

	Panel A: British Election Study Survey						Panel B: Filled and Pooled NMG Household Survey					
	All		Anti-Brexit	Pro-Brexit	Anti-Brexit vs. Pro-Brexit		All		Anti-Brexit	Pro-Brexit	Anti-Brexit vs. Pro-Brexit	
	Mean	Std.Dev.	Mean	Mean	Diff.	p-value	Mean	Std.Dev.	Mean	Mean	Diff.	p-value
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Male	0.498	0.500	0.485	0.511	0.025	0.000	0.516	0.500	0.468	0.568	0.099	0.000
Age	48.6	16.9	44.2	53.3	9.1	0.000	49.1	17.2	46.7	51.8	5.0	0.000
College	0.483	0.500	0.570	0.387	-0.183	0.000	0.454	0.498	0.530	0.373	-0.156	0.000
Low income	0.108	0.310	0.096	0.121	0.024	0.000	0.123	0.328	0.108	0.139	0.032	0.000
Middle income	0.698	0.459	0.661	0.739	0.077	0.000	0.629	0.483	0.626	0.633	0.007	0.298
High income	0.194	0.395	0.242	0.141	-0.102	0.000	0.248	0.432	0.266	0.227	-0.039	0.000
Employed	0.561	0.496	0.610	0.509	-0.101	0.000	0.588	0.492	0.616	0.558	-0.058	0.000
Unemployed	0.027	0.161	0.029	0.025	-0.004	0.000	0.026	0.159	0.030	0.022	-0.008	0.000
Inactive	0.412	0.492	0.362	0.467	0.105	0.000	0.386	0.487	0.354	0.421	0.066	0.000
Pro-Brexit	0.479	0.500	0	1	–	–	0.482	0.500	0	1	–	–

	Panel C: 2015 NMG Household Survey							
	All		Filled Sample					
			All Filled		Anti-Brexit	Pro-Brexit	Anti-Brexit vs. Pro-Brexit	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Mean	Diff.	p-value
Variables	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Male	0.488	0.500	0.605	0.489	0.558	0.648	0.091	0.000
Age	47.4	17.1	52.0	16.4	49.0	54.8	5.8	0.000
College	0.425	0.494	0.421	0.494	0.529	0.321	-0.209	0.000
Low income	0.118	0.322	0.119	0.324	0.108	0.130	0.022	0.291
Middle income	0.671	0.470	0.678	0.468	0.632	0.721	0.089	0.003
High income	0.212	0.408	0.203	0.402	0.260	0.149	-0.111	0.000
Employed	0.594	0.491	0.506	0.500	0.564	0.453	-0.112	0.000
Unemployed	0.022	0.146	0.021	0.144	0.027	0.016	-0.011	0.058
Inactive	0.384	0.486	0.473	0.499	0.409	0.532	0.123	0.000
Pro-Brexit	–	–	0.522	0.500	0	1	–	–

Notes: This table provides an overview of demographic compositions of voters in British Election Study (BES) and NMG Household Survey datasets (NMG). In the BES, we encode "< £10,000" as "low income", "£10,000–£50,000" as "middle income", ">=£50,000" as "high income"; in the NMG, we encode "< £11,500" as "low income", "£11,500–55,000" as "middle income", ">= £55,000" as "high income". Column (6), (12), and (20) present p-values of testing the null hypotheses that anti-Brexit and pro-Brexit voters have no different compositions regarding the particular demographics.

TABLE 3: Summary Statistics: Local Authority District Level

	All			Remain	Leave	Remain vs. Leave		
	Mean	Median	Std.Dev.	Mean	Mean	Diff.	p-value	Source
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Housing transaction volume per capita 2015–19	0.005	0.005	0.001	0.004	0.005	0.001	0.000	Price Paid Data
Licensed automobile stock per capita 2015–19	0.507	0.513	0.128	0.428	0.544	0.116	0.000	DfT and DVLA
Share of Leave voters 2016	0.529	0.540	0.106	0.408	0.585	0.177	0.000	London Datastore
Unemployment rate 2015	0.057	0.054	0.022	0.055	0.057	0.002	0.527	Becker, Fetzer and Novy (2017)
Immigration rate 2011	0.136	0.092	0.120	0.235	0.090	-0.145	0.000	UK Census 2011
EU structural funds per capita 2013	45.1	16.0	80.4	35.9	49.4	13.4	0.262	Becker, Fetzer and Novy (2017)
Total fiscal cuts 2010–15	476.3	472.0	119.1	461.3	483.2	22.0	0.211	Becker, Fetzer and Novy (2017)
Manufacturing employment share 2011	0.090	0.091	0.040	0.055	0.106	0.052	0.000	UK Census 2011
Share of low-skill jobs 2011	0.367	0.368	0.066	0.320	0.389	0.069	0.000	UK Census 2011
Gross household disposable income 2015–19	20386	18978	6127	24359	18557	-5803	0.000	ONS
Share without qualification 2011	0.228	0.229	0.051	0.186	0.247	0.061	0.000	UK Census 2011
Deprivation rate 2011	0.579	0.585	0.064	0.570	0.583	0.014	0.188	UK Census 2011
Number of LAUs		313		79	234	–	–	–

Notes: This table reports summary statistics for the sample of 313 local authority districts (LAUs) in England and Wales. Housing transaction volume per capita 2015–19 is the average per capita transaction volume completed each quarter over the period from 2015 to 2019. Licensed automobile stock per capita 2015–19 is the average per capita number of licensed private vehicles over the quarters in the period from 2015 to 2019. "DfT and DVLA" is abbreviation for Department for Transport and Driver and Vehicle Licensing Agency. Immigration rate is measured using the number of population born in non-UK countries divided by that of total population. Total fiscal cuts are originally compiled by Financial Times, capturing the financial loss per working adult in pounds sterling per year during 2010 to 2015. Low-skill jobs include (1) caring, leisure and other service occupations, (2) sales and customer service occupations, (3) process, plant and machine operatives, (4) elementary occupations. Gross household disposable income 2015–19 is annually average gross household disposable income over 2015 to 2019. Deprivation rate is measured by the share of households that meet one or more of the following conditions: (1) Employment: where any member of a household, who is not a full-time student, is either unemployed or long-term sick; (2) Education: no person in the household has at least Level 2 education, and no person aged 16 to 18 is a full-time student; (3) Health and disability: any person in the household has general health that is "bad" or "very bad" or has a long-term health problem; (4) Housing: the household's accommodation is either overcrowded, with an occupancy rating -1 or less, or is in a shared dwelling, or has no central heating. Column (6) presents differences in the regional characteristics between Leave and Remain LAUs, measured by regressing the characteristics on a Leave dummy indicating LAUs' shares of Leave voters are over 50%. Column (7) presents p-values for testing the null hypotheses of no differences between Leave and Remain LAUs.

TABLE 4: The Effects of the Brexit Vote on Housing Transaction Volume and Licensed Automobile Stock

	Baseline	Income	Time Trend				Two-Step Procedure		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Dependent variable: log of housing transaction volume per capita									
$PostVote_t \times LeaveVoteShare_a$	0.598***	0.592***	0.590***	0.316***	0.525***	0.577***			
	(0.064)	(0.064)	(0.065)	(0.070)	(0.061)	(0.069)			
$ln(income)_{at}$		-0.641***							
		(0.210)							
$PostVote_t \times \xi_a$							0.591***	0.139*	0.282***
							(0.069)	(0.078)	(0.083)
Mean of DV	-5.42	-5.42	-5.42	-5.42	-5.43	-5.42	-5.42	-5.42	-5.42
Number of clusters	313	313	313	313	306	313	–	–	–
Observations	6260	6260	6260	6260	6120	6260	6260	6260	6260
Panel B: Dependent variable: log of licensed automobile stock per capita									
$PostVote_t \times LeaveVoteShare_a$	0.078***	0.078***	0.076***	0.027**	0.071***	0.075***			
	(0.013)	(0.013)	(0.013)	(0.012)	(0.014)	(0.013)			
$ln(income)_{at}$		-0.077							
		(0.049)							
$PostVote_t \times \xi_a$							0.076***	0.039***	0.021*
							(0.013)	(0.015)	(0.012)
Mean of DV	-.717	-.717	-.717	-.717	-.72	-.717	-.717	-.717	-.717
Number of clusters	313	313	313	313	306	313	–	–	–
Observations	6260	6260	6260	6260	6120	6260	6260	6260	6260
Control									
LAU FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Time trend × Unemployment rate 2015			✓						
Time trend × Immigration rate 2011				✓					
Time trend × ln(EU structural funds per capita 2013)					✓				
Time trend × ln(Total fiscal cuts 2010–15)						✓			
Root of Euroscepticism									
Economic shocks							✓		
Industry and occupation structures								✓	
Demographic compositions									✓

Notes: Column (1) – (6) report coefficient estimates from an OLS regression with controlling for local authority district (LAU) fixed effects and time fixed effects. Column (2) further controls for annual gross household disposable income (log). Column (3) – (6) successively control for time trends interacting with pre-vote local unemployment rates, immigration rates, EU structural fund transfers (log), and total fiscal cuts over the period from 2010 to 2015 (log). In Column (7) – (9), we apply a two-step procedure. We first regress the share of Leave voters on a set of variables measuring economic shocks, industry and occupation structures, and demographic compositions. Economic shock variables include unemployment rate 2015, immigration rate 2011, EU structural funds 2013 (log), total fiscal cuts 2010–15 (log). Industry and occupation structure variables include manufacturing employment shares, shares of low-skill jobs. Demographic composition variables include gross household disposable income (log), shares of residents without qualification, deprivation rates. See the notes in Table 3 for detailed explanations of the variables. We then store the residuals and regress the outcome variables of interest on the residuals interacting with a dummy indicating post-Brexit period. We report standard errors clustered at the LAU level in Column (1) – (6). Since the two-step procedure hings on generated variables, we report bootstrap standard errors in Column (7) – (9). *: Significant at 10%; **: 5%; ***: 1%.

Supplementary Appendix

A Experts' Views on Economic Consequences of the Brexit Vote

On June 7, 2016, the Centre for Macroeconomics (CFM) survey asked a panel of economists about the consequences of Brexit on the British economy, financial sector and asset prices. For example, in the question, "what do you think will be the overall economic consequences of Brexit for the UK?", 48% of the participants answered "significantly negative", 44% "mildly negative" and 9% "neutral". Nobody thought that the overall consequences of a Leave outcome would be beneficial for the UK economy. Another question asks "what is the probability that the UK experiences such a significant disruption to financial markets and asset prices following a vote for Brexit on 23 June?". The panel members were extremely worried about the consequences of a Brexit vote for financial markets. 26% thought that the chance was higher than 70%, 29% thought this probability was between 31% and 70%, 24% thought it was between 11% and 30%, and 18% thought that it was less than 10%.

TABLE A.1: UK Quarter-on-Quarter GDP Growth (%): Forecast

	16 Q3	16 Q4	17 Q1	17 Q2	17 Q3	17 Q4	18 Q1	18 Q2
Treasury (scenario 1)	-0.1	-0.1	-0.1	-0.1	0.2	0.2	0.2	0.2
Treasury (scenario 2)	-1.0	-0.4	-0.4	-0.4	0.0	0.0	0.1	0.1

Notes: This table reports forecasts of real GDP growth rate for the UK made by HM Treasury conditional on the assumption of a vote to leave the EU published in a government study (HM Treasury, 2016*a*). Two scenarios are analyzed: a "shock scenario" (scenario 1) and a more pessimistic "severe shock scenario" (scenario 2). The exact explanations of the two scenarios can be seen from HM Treasury (2016*a*).

Public and private economic institutions shared a similar pessimistic view. Table A.1 displays forecasts of real GDP growth rate for the UK made by HM Treasury conditional on the assumption of a vote to leave the EU published in a government study (HM Treasury, 2016*a*). Two scenarios are analyzed: a "shock scenario" (scenario 1) and a more pessimistic "severe shock scenario" (scenario 2).[13] Under both scenarios, HM Treasury predicted that a vote to leave would immediately push the UK economy into recession with four quarters of negative growth. In May 2016, Mark Carney, the then-governor of Bank of England, described the Brexit vote as "the most immediate and significant risk" for the UK's economic outlook and warned that a Leave vote "could possibly include a technical recession" (Guardian, 2017). The published minutes of the Monetary Policy Committee meeting in May 2016 warned a leave

[13]The exact explanations of the two scenarios can be seen from HM Treasury (2016*a*).

vote could increase unemployment and prompt households and businesses to delay spending (MPC, 2016). Christine Lagarde, the managing director of the IMF noted that she shares the Bank of England's view that a leave vote "could lead to a recession" (IMF, 2016). Table A.2 reports the forecasts of the immediate effect on the level of GDP conditional on the assumption of a Brexit vote made by a number of financial institutions shortly before the Brexit referendum. The forecasts are reproduced from Box 3.D of HM Treasury (2016*b*) and the sources of the forecasts are provided there.

TABLE A.2: Forecasts of the Immediate Effect of a Brexit Vote on Level of GDP (%) (Relative to Remaining in the EU)

PwC/CBI	-3.1 to -5.5 (over 5 years)
Citi	-4.0 (over 3 years)
Credit Suisse	-1.0 to -2.0 (over 2 years)
Deutsche Bank	-3.0 (over 3 years)
HSBC	-1.0 to -1.5 (over 1 year)
JP Morgan	-1.0 (over 1 year)
Morgan Stanley	-1.5 to -2.5 (over 2 years)
Normura	-4.0 (over 1 year)
Societe Generale	-4.0 to -8.0 (over 5 years)

B Additional Figures and Tables

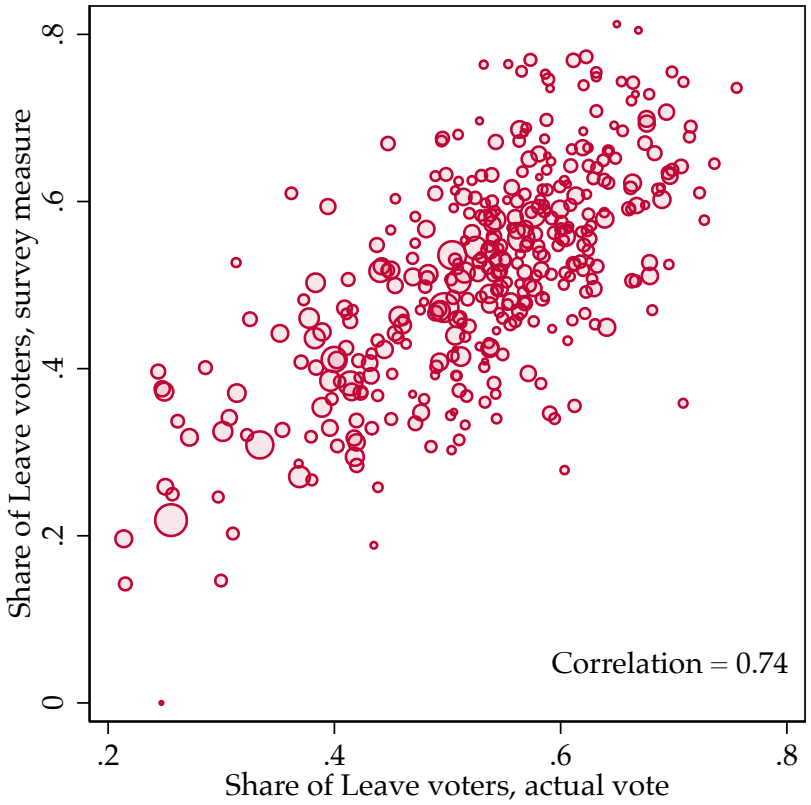


FIGURE B.1: Leave Voter Shares: Survey Measure vs. Actual Vote

Notes: This figure compares survey-based Leave voter shares to the actual ones for 380 local authority districts. Each bubble denotes a local authority district. The actual Leave voter shares are obtained from London Datastore, an open data-sharing portal administered by Greater London Authority. To measure the survey-based shares, we use Wave 9 of the BES that asked respondents' actual vote choices to calculate the shares of whom voted Leave in the EU referendum. Bubble sizes are proportional to numbers of survey respondents in the corresponding local authority districts. The correlation coefficient between survey-based and actual shares is weighted by the numbers of survey respondents.

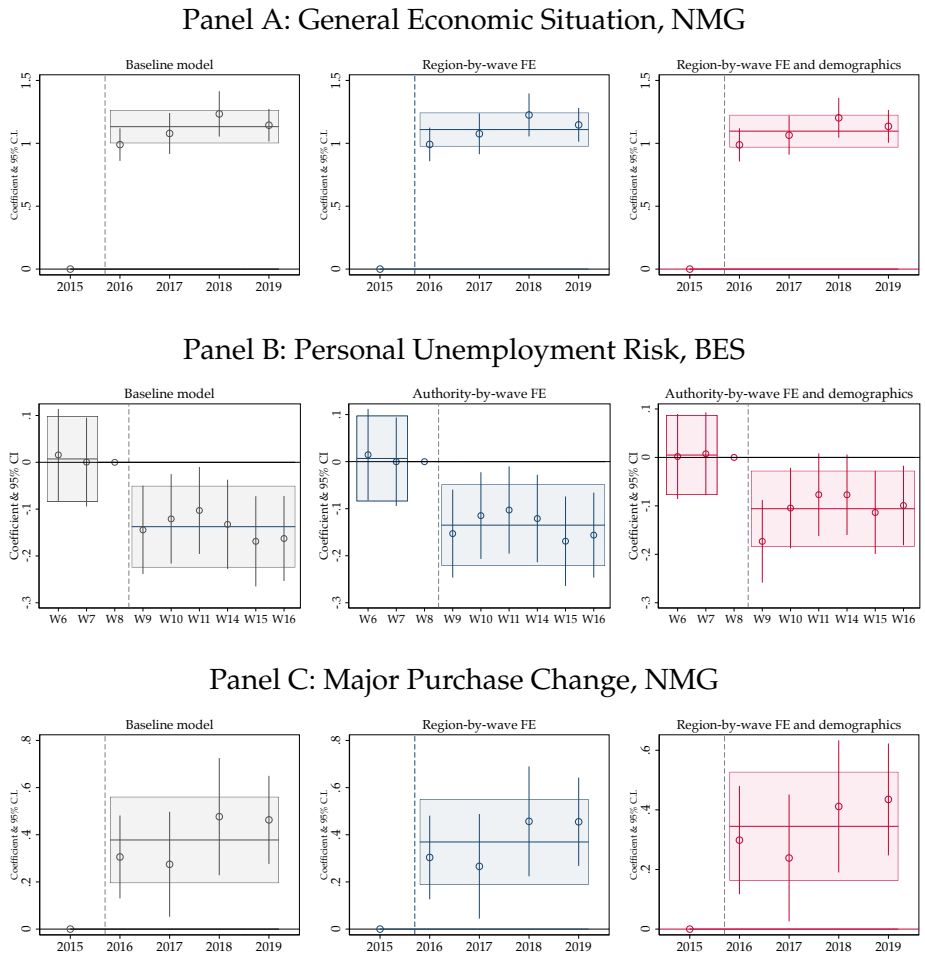


FIGURE B.2: Additional Examinations on Economic Expectations and Spending Intentions

Notes: This figure presents the divergence between pro-Brexit and anti-Brexit voters in additional variables on macro (Panel A) and micro (Panel B) expectations and spending intentions (Panel C). To construct the plots, we first estimate the flowing specifications:

$$Y_{it} = ProBrexit_{it} + \sum Period_t + \sum \beta_t \times Period_t \times ProBrexit_{it} + \epsilon_{it},$$

$$Y_{it} = ProBrexit_{it} + \sum Wave_t + \sum \rho_t \times Wave_t \times ProBrexit_{it} + \epsilon_{it}.$$

The coefficient estimates of β_t are plotted as horizontal lines, and their 95% confidence intervals are indicated as boxes. The coefficient estimates of ρ_t are plotted as dots with their 95% confidence intervals indicated with vertical lines. The coefficients plotted can be interpreted as the relative change in belief divergence between pro-Brexit and anti-Brexit voters around the Brexit vote. In baseline models, we do not control for voters' demographics and authority/region by wave fixed effects. Then we successively include them.

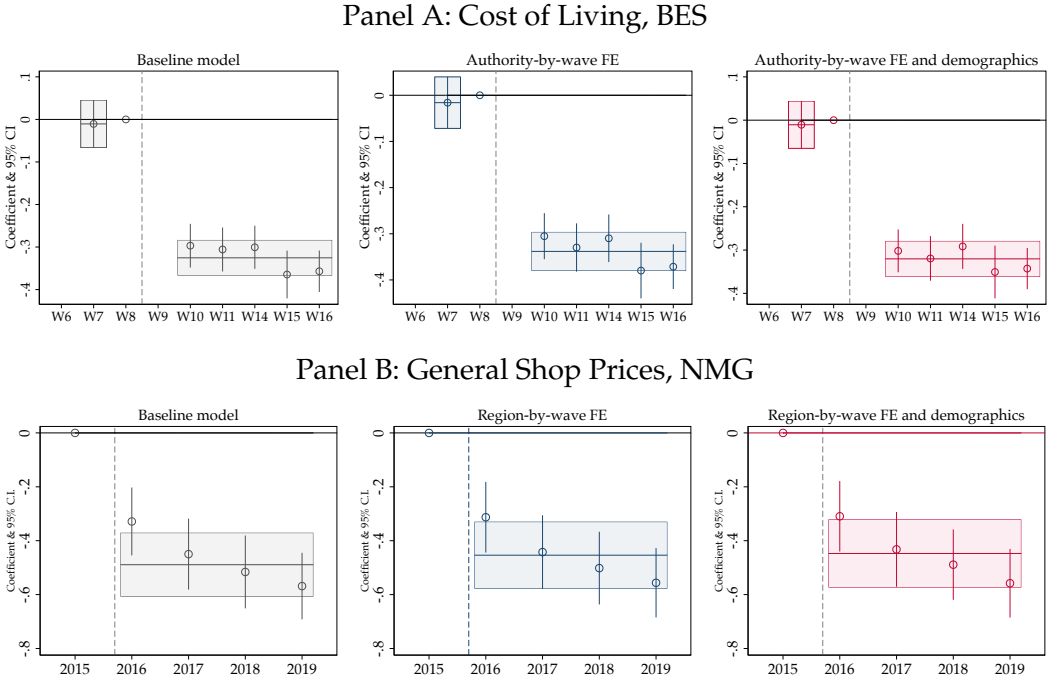


FIGURE B.3: Beliefs on the Cost of Living and General Shop Prices

Notes: This figure presents the belief divergence between pro-Brexit and anti-Brexit voters on the cost of living (Panel A) and general shop prices (Panel B). To construct the plots, we first estimate the flowing specifications:

$$Y_{it} = ProBrexit_{it} + \sum Period_t + \sum \beta_t \times Period_t \times ProBrexit_{it} + \epsilon_{it},$$

$$Y_{it} = ProBrexit_{it} + \sum Wave_t + \sum \rho_t \times Wave_t \times ProBrexit_{it} + \epsilon_{it}.$$

The coefficient estimates of β_t are plotted as horizontal lines, and their 95% confidence intervals are indicated as boxes. The coefficient estimates of ρ_t are plotted as dots with their 95% confidence intervals indicated with vertical lines. The coefficients plotted can be interpreted as the relative change in belief divergence between pro-Brexit and anti-Brexit voters around the Brexit vote. In baseline models, we do not control for voters' demographics and authority/region by wave fixed effects. Then we successively include them.

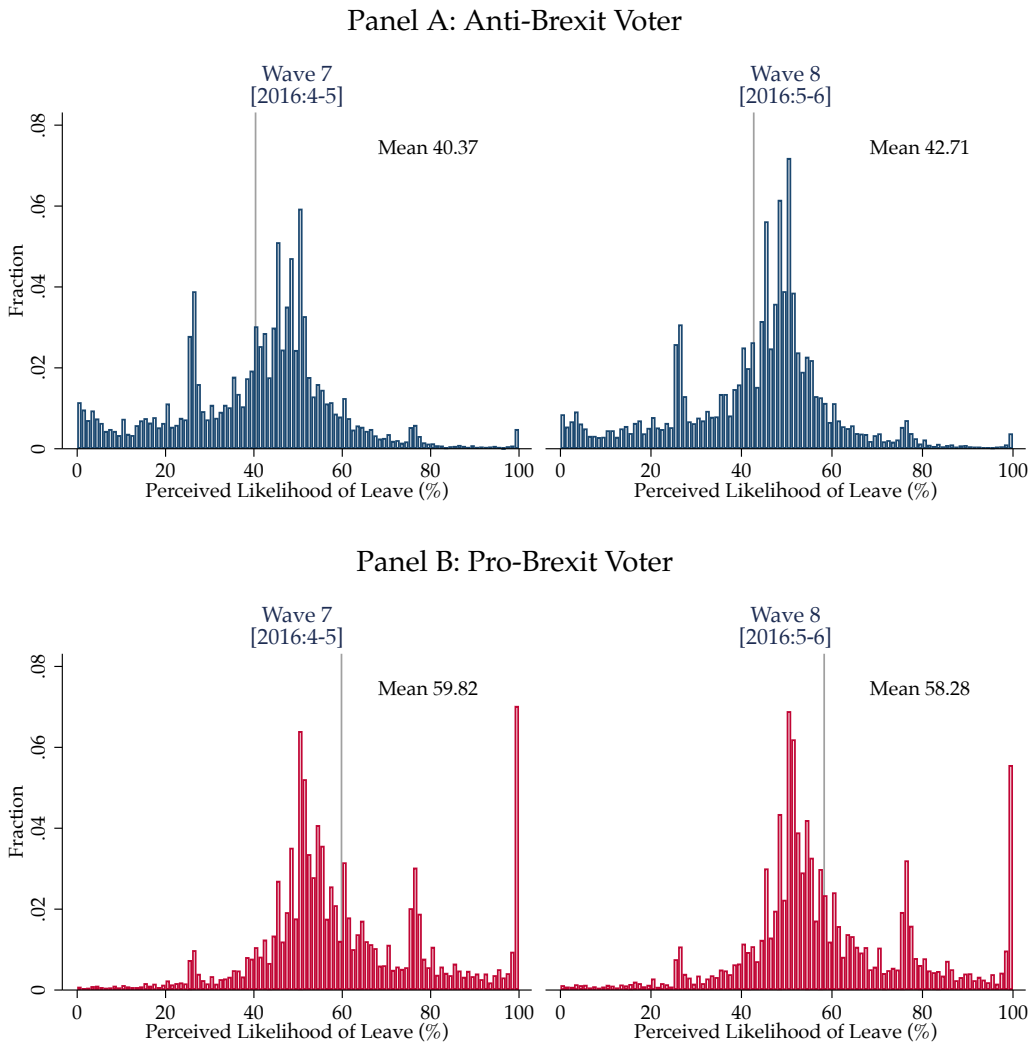


FIGURE B.4: Perceived Likelihood of A "Leave" Outcome

Notes: This figure presents the distributions of perceived likelihood of a "Leave" outcome in the EU referendum for anti-Brexit (Panel A) and pro-Brexit voters (Panel B). To construct this figure, we employ a variable available in Wave 7 and 8 of the BES that asked respondents' perceived likelihood that the UK would finally vote to leave the EU in the referendum. This variable measures the perceived likelihood with a scale ranging from 0 to 100. The value of "100" implies completely believing that the UK would leave.

FIGURE B.5: Additional Examinations: Brexit Identity vs. Socioeconomic Status

Notes: This figure presents view revisions for voters, examining additional variables on economic expectations and spending intentions. Panel A presents the results with expectations on the general economic situation as the dependent variable. Panel B presents the results with the perceived risk of losing jobs as the dependent variable. Panel C presents the results with spending intentions on major purchases as the dependent variable. To construct this figure, we first stratify voters into various groups based on their Brexit identities and socioeconomic status (i.e., educational attainment, household gross income per year, and employment status). In left panels, four groups of voters are identified: (1) anti-Brexit voters without a college degree, (2) anti-Brexit voters with a college degree, (3) pro-Brexit voters without a college degree, (4) pro-Brexit voters with a college degree. In middle panels, six groups of voters are identified: (1) anti-Brexit voters in low-income households, (2) anti-Brexit voters in medium-income households, (3) anti-Brexit voters in high-income households, (4) pro-Brexit voters in low-income households, (5) pro-Brexit voters in medium-income households, (6) pro-Brexit voters in high-income households. For the definitions of the income ranges, see the notes in Table 2. In right panels, six groups of voters are identified: (1) anti-Brexit voters inactive in labor markets (e.g., the retired, students), (2) anti-Brexit voters who are unemployed, (3) anti-Brexit voters who are employed, (4) inactive pro-Brexit voters, (5) unemployed pro-Brexit voters, (6) employed pro-Brexit voters. Next, for each group, we estimate the following specification: $Y_{it} = \eta \times PostVote_{it} + \epsilon_{it}$, and plot the coefficient estimates of η with their 95% confidence intervals.

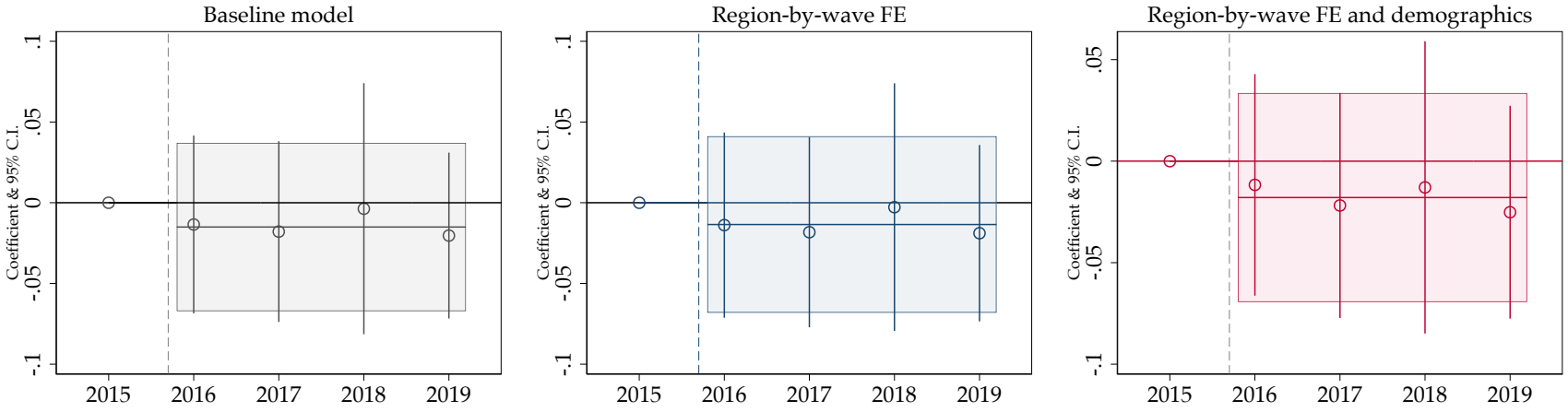


FIGURE B.6: Divergence in the Share of Households Expecting Income to Increase

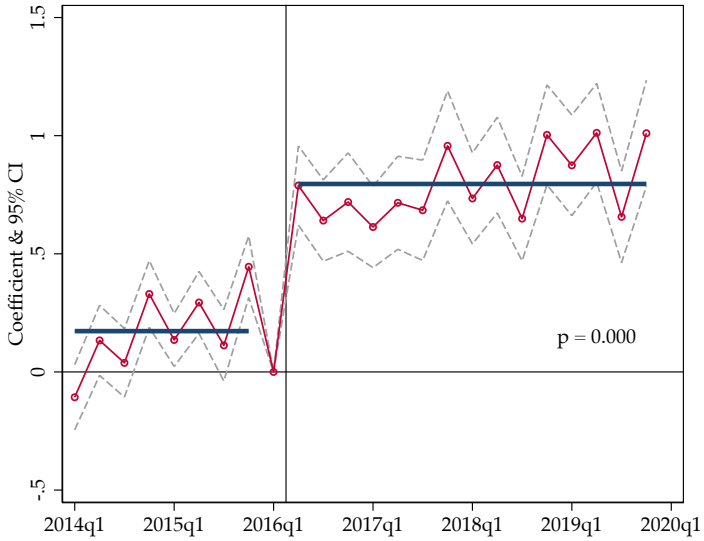
Notes: This figure presents the divergence between pro-Brexit and anti-Brexit voters in the share of households expecting income to increase over the next 12 months. To construct the plots, we first estimate the flowing specifications:

$$Y_{it} = ProBrexit_{it} + \sum Period_t + \sum \beta_t \times Period_t \times ProBrexit_{it} + \epsilon_{it},$$

$$Y_{it} = ProBrexit_{it} + \sum Wave_t + \sum \rho_t \times Wave_t \times ProBrexit_{it} + \epsilon_{it}.$$

The coefficient estimates of β_t are plotted as horizontal lines, and their 95% confidence intervals are indicated as boxes. The coefficient estimates of ρ_t are plotted as dots with their 95% confidence intervals indicated with vertical lines. The coefficients plotted can be interpreted as the relative change in the divergence between pro-Brexit and anti-Brexit voters around the Brexit vote. In baseline models, we do not control for voters' demographics and authority/region by wave fixed effects. Then we successively include them.

Panel A: Housing Transaction Volume



Panel B: Licensed Automobile Stock

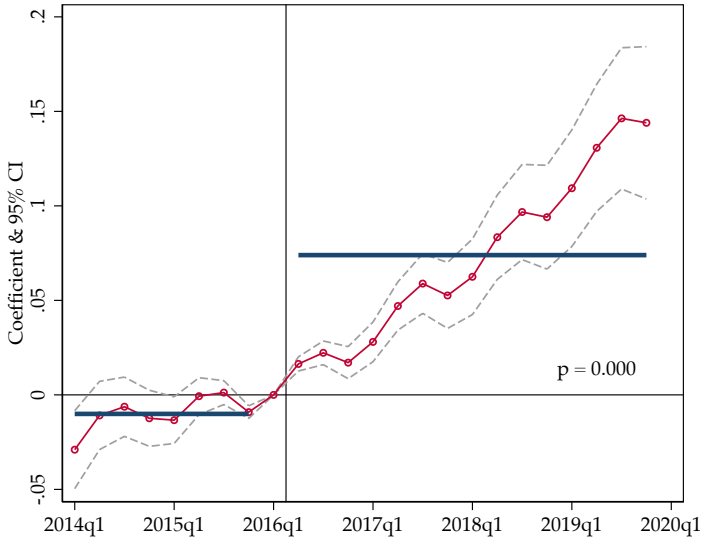


FIGURE B.7: Housing Transaction Volume and Licensed Automobile Stock, 2014 – 2019

Notes: This figure presents the effects of the Brexit vote on housing transaction volume per capita (Panel A) and licensed automobile stock per capita (Panel B). The effects are estimated at the local authority district level, for 313 local authority districts in England and Wales. We plot the coefficient estimates of η_t as dots with their 95% confidence intervals indicated by the dash lines from the following specification:

$$Ln(S_{at}) = \delta_t + \gamma_a + \sum_{t \neq 2016q1} \eta_t \times Quarter_t \times LeaveVoteShare_a + \epsilon_{at}.$$

To compare the average pre-vote "effects" to post-vote effects, we run the following specification and test the null hypothesis that $\beta_1 = \beta_2$. Coefficient estimates of β_1 and β_2 are plotted as the blue horizontal lines. We report the p values underlying the tests.

$$Ln(S_{at}) = \delta_t + \gamma_a + \beta_1 \times PreVote_t \times LeaveVoteShare_a + \beta_2 \times PostVote_t \times LeaveVoteShare_a + \epsilon_{at}.$$

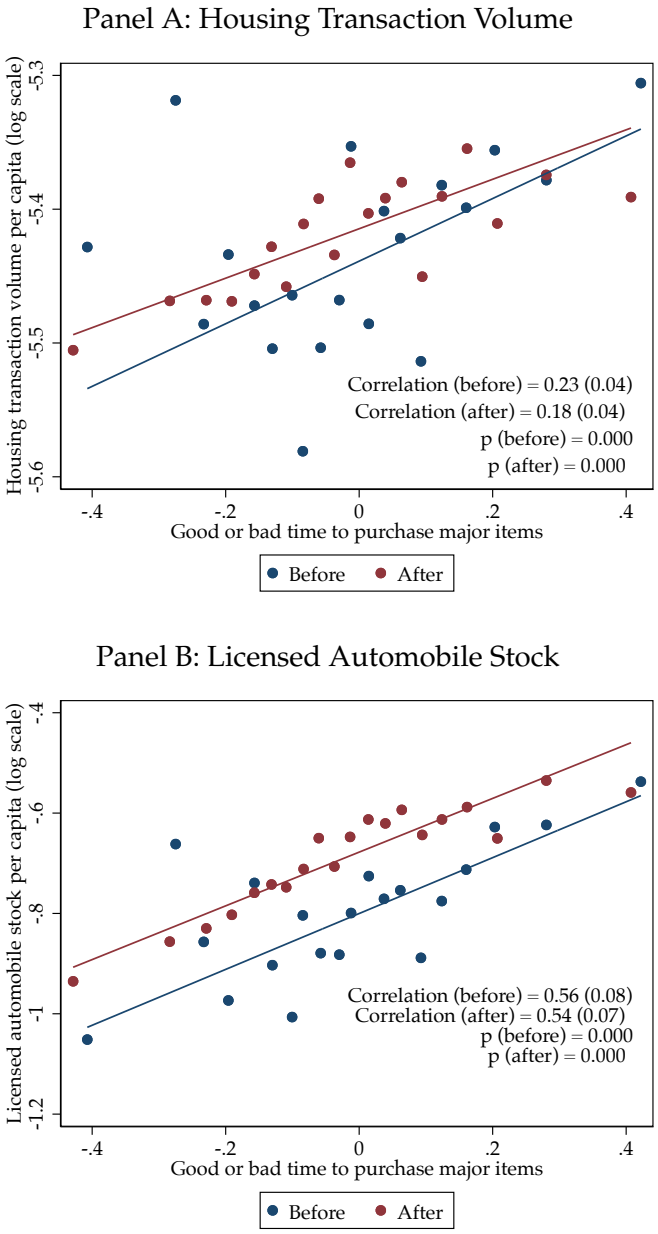


FIGURE B.8: Spending Intentions and Actual Economic Behavior across the Brexit Vote

Notes: This figure presents binned scatter plots of housing transaction volume per capita and licensed automobiles stock per capita (both in log scale) vs. households' judgement on whether it is currently a good or bad time to purchase major items, stratified by before and after the Brexit vote. To construct this figure, we first divide the observations into pre-vote and post-vote groups. In each of the two groups, we then group LAU-quarter observations into twenty equally sized bins based on the spending intention measure. We subsequently plot the mean log of housing transaction volume per capita (or mean log of licensed automobile stock per capita) vs. the mean spending intention within each bin. The correlation coefficients between the variables are estimated using the LAU-quarter data, with standard errors (in the parentheses) clustered at the LAU level. The corresponding p values are also reported.

TABLE B.1: Conducted Timeline and Sample Sizes of the BES and NMG

Wave	Survey Period	Sample Size
Panel A: The BES		
W6	8th May 2015 – 26th May 2015	30,027
W7	14th April 2016 – 4th May 2016	30,895
W8	6th May 2016 – 22nd June 2016	33,502
W9	24th June 2016 – 4th July 2016	30,036
W10	24th November 2016 – 12th December 2016	30,319
W11	24th April 2017 – 3rd May 2017	31,014
W14	4th May 2018 – 21st May 2018	31,063
W15	11th March 2019 – 29th March 2019	30,842
W16	24th May 2019 – 18th June 2019	37,959
Panel B: The NMG		
W2015	2–22 September 2015	6,007
W2016	31 August–19 September 2016	6,011
W2017	6–26 September 2017	6,018
W2018	5–26 September 2018	6,000
W2019	4-24 September 2019	6,051

Notes: This table reports the conducted timeline and sample sizes of the BES and NMG utilized in the paper. Wave 8 (W8) of the BES was conducted immediately before the Brexit vote taking place on 23rd June 2016, followed by Wave 9 (W9) just afterwards.

TABLE B.2: Variables and Survey Questions

Panel A: Brexit Identities	
[A.1] Variable: **euRefVote**	
Question 1	If there was a referendum on Britain's membership of the European Union, how do you think you would vote? (W6)
Question 2	If you do vote in the referendum on Britain's membership of the European Union, how do you think you will vote? (W7, W8)
Question 3	Which way did you vote in the EU referendum? (W9)
Question 4	If there was another referendum on EU membership, how do you think you would vote? (W10, W11, W14, W15, W16)
Answer	0=Remain in the EU, 1=Leave the EU
Wave	W6, W7, W8, W9, W10, W11, W14, W15, W16
Source	BES
[A.2] Variable: **Brexit**	
Question	Taking everything into account, how do you currently view the UK leaving the EU (European Union) – which has become known as 'Brexit'?
Answer	1=Very positive about it, 2=Somewhat positive, 3=No opinion, 4=Somewhat negative, 5=Very negative
Wave	W2016, W2017, W2018, W2019
Source	NMG
Panel B: Economic Expectations	
[B.1] Variable: **changeEconomy**	
Question	Do you think that the economy is getting better, getting worse or staying about the same?
Answer	1=Getting a lot worse, 2=Getting a little worse, 3=Staying the same, 4=Getting a little better, 5=Getting a lot better
Wave	W6, W7, W8, W9, W10, W11, W14, W15, W16
Source	BES
[B.2] Variable: **changeUnemployment**	
Question	How do you expect the number of unemployed people in this country will change over the next 12 months?
Answer	1=Increase sharply, 2=Increase slightly, 3=Remain the same, 4=Fall slightly, 5=Fall sharply
Wave	W2015, W2016, W2017, W2018, W2019
Source	NMG

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[B.3] Variable: **riskPoverty**	
Question	During the next 12 months, how likely or unlikely is it that there will be times when you do not have enough money to cover your day to day living costs?
Answer	1=Very unlikely, 2=Fairly unlikely, 3=Neither likely nor unlikely, 4=Fairly likely, 5=Very likely
Wave	W6, W7, W8, W9, W10, W11, W14, W15, W16
Source	BES
[B.4] Variable: **changeFinancialPosition**	
Question	How do you expect the financial position of your household to change over the next 12 months?
Answer	1=Get a lot worse, 2=Get a little worse, 3=Stay the same, 4=Get a little better, 5=Get a lot better
Wave	W2015, W2016, W2017, W2018, W2019
Source	NMG
Panel C: Spending Intentions	
[C.1] Variable: **goodTimePurchase**	
Question	Do you think now is a good or a bad time for people to buy major household items (furniture, kitchen appliances, televisions, and things like that)?
Answer	1=Bad, 2=Neither good nor bad, 3=Good
Wave	W6, W7, W8, W9, W10, W11, W14, W15, W16
Source	BES
[C.2] Variable: **changeSpending**	
Question	How do you expect your household to change its spending over the next 12 months? Please exclude money put into savings and repayment of bank loans.
Answer	1=Decrease a lot, 2=Decrease a little, 3=About the same, 4=Increase a little, 5=Increase a lot
Wave	W2015, W2016, W2017, W2018, W2019
Source	NMG

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Panel D: Additional Economic Expectations and Spending Intentions

[D.1] Variable: **changeEconomicSituation**

Question	How do you expect the general economic situation in this country to develop over the next 12 months?
Answer	1=Get a lot worse, 2=Get a little worse, 3=Stay the same, 4=Get a little better, 5=Get a lot better
Wave	W2015, W2016, W2017, W2018, W2019
Source	NMG

[D.2] Variable: **riskUnemployment**

Question	During the next 12 months, how likely or unlikely is it that you will be out of a job and looking for work?
Answer	1=Very unlikely, 2=Fairly unlikely, 3=Neither likely nor unlikely, 4=Fairly likely, 5=Very likely
Wave	W6, W7, W8, W9, W10, W11, W14, W15, W16
Source	BES

[D.3] Variable: **changeMajorPurchase**

Question	Compared to the last 12 months, do you expect to spend more or less money on major purchases (such as a car, furniture or electrical goods) over the next year?
Answer	1=Much less, 2=A little less, 3=About the same, 4=A little more, 5=Much more
Wave	W2015, W2016, W2017, W2018, W2019
Source	NMG

Panel E: Others

[E.1] Variable: **euRefExpectation**

Question	How likely do you think it is that the UK will vote to leave the EU?
Answer	0 – 100 (Scale)
Wave	W7, W8
Source	BES

[E.2] Variable: **changeCostLive**

Question	Do you think that the cost of living is getting higher, getting lower or staying about the same?
Answer	1=Getting a lot lower, 2=Getting a little lower, 3=Staying the same, 4=Getting a little higher, 5=Getting a lot higher
Wave	W7, W8, W10, W11, W14, W15, W16
Source	BES

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[E.3] Variable: **changePrice**	
Question	How much would you expect prices in the shops generally to change over the next twelve months?
Answer	1=Go down, 2=Not change, 3=Go up by 1% or less, 4=Go up by 1% but less than 2%, 5=Go up by 2% but less than 3%, 6=Go up by 3% but less than 4%, 7=Go up by 4% but less than 5%, 8=Go up by 5% or more
Wave	W2015, W2016, W2017, W2018, W2019
Source	NMG
[E.4] Variable: **changeHouseholdIncome**	
Question	Over the next twelve months, how do you expect your household income (before anything is deducted for tax, National Insurance, pension schemes etc.) to change?
Answer	1=Increase, 0=Decrease or stay the same
Wave	W2015, W2016, W2017, W2018, W2019
Source	NMG

Notes: This table documents survey questions, response options, and waves where the variables are available. These variables measure respondents' Brexit identities, economic expectations, spending intentions, perceptions on the likelihood of a "Leave" outcome in the Brexit vote, and expectations on changes in cost of living, household income, and shop prices. In the analysis, we subsume changeEconomy, changeUnemployment, changeEconomicSituation as macro expectations, and riskPoverty, changeFinancialPosition, riskUnemployment as micro expectations.

TABLE B.3: Unchanged Brexit Identities, BES

	W6	W7	W8	W9	W10	W11	W14	W15
W7	88.4%							
W8	87.4%	95.3%						
W9	86.7%	92.5%	94.6%					
W10	85.9%	90.8%	92.1%	95.2%				
W11	85.6%	90.6%	92.0%	94.4%	96.9%			
W14	85.1%	89.5%	90.6%	93.0%	95.9%	96.5%		
W15	83.9%	87.9%	88.8%	91.0%	93.9%	94.6%	96.1%	
W16	83.7%	88.4%	89.4%	91.1%	94.0%	94.8%	96.1%	97.5%

Notes: This table reports the percentages of voters who did not change vote intentions towards Brexit between any two particular waves in the BES. Percentages of voters who did not change vote intentions between a wave before the Brexit vote and another after the vote are shaded as color gray. To calculate these percentages, we first limit respondents to those who were traced in two particular waves of the BES. We then calculate the shares of four types of voters: (1) voters responding pro-Brexit attitudes in both years, (2) voters responding anti-Brexit attitudes in both years, (3) voters responding pro-Brexit attitudes in the former year but changing to anti-Brexit attitudes in the latter year, (4) voters responding anti-Brexit attitudes in the former year but changing to pro-Brexit attitudes in the latter year. Hence, the voters who did not change attitudes are the first two types. And the percentages presented are the total shares of the first two types of voters.

TABLE B.4: Housing Transaction Volume, Q1 of 2014 to Q4 of 2019

	2015	2016	2017	2018	2019
Q1	183346	261746	214044	207007	201942
Q2	222312	195303	238668	228620	222307
Q3	256478	247651	259913	250988	244689
Q4	259845	245399	255394	256007	249332
Total	921981	950099	968019	942622	918270

Notes: This table reports housing transaction volume in 313 local authority districts in England and Wales, by year and quarter, from Q1 of 2014 to Q4 of 2019.

TABLE B.5: Roots of Euroscepticism: Explaining Variations in Shares of Leave Voters

	Econ. Shocks	Ind. Occ. Str.	Demo. Comp.	All
	(1)	(2)	(3)	(4)
Unemployment rate 2015	0.763***			0.109
	(0.246)			0.109
Immigration rate 2011	-0.678***			-0.235***
	(0.060)			(0.079)
ln(EU structural funds per capita 2013)	-0.017***			-0.012***
	(0.005)			(0.003)
ln(Total fiscal cuts 2010—15)	0.128***			-0.099***
	(0.024)			(0.031)
Manufacturing employment share 2011		1.218***		0.019
		(0.160)		(0.146)
Share of low-skill jobs 2011		0.597***		1.128***
		(0.093)		(0.142)
ln(Gross household disposable income 2015–19)			0.018	0.199***
			(0.028)	(0.030)
Share without qualification 2011			2.343***	1.467***
			(0.182)	(0.240)
Deprivation rate 2011			-0.927***	-0.254
			(0.125)	(0.210)
Mean of DV	.528	.529	.529	.528
Adj. R Squared	.517	.543	.695	.786
Observations	306	313	313	306

Notes: This table report coefficient estimates from OLS regressions with shares of Leave voters as the dependent variable. The sample is cross-sectional, containing 313 local authority districts. In Column (1), we include a set of economic shock variables. In Column (2), we include a set of industry and occupation structure variables. In Column (3), we include a set of demographic composition variables. Column (4) includes all the variables. We report White heteroscedasticity robust standard errors in parentheses. *: Significant at 10%; **: 5%; ***: 1%.

TABLE B.6: The Effects of the Brexit Vote on Spending Intentions: Evidence from Local Authority Districts

	Baseline	Income	Time Trend			
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: Good or bad time to purchase major items						
$PostVote_t \times LeaveVoteShare_a$	0.204**	0.204**	0.186**	0.303***	0.174*	0.168*
	(0.092)	(0.092)	(0.090)	(0.096)	(0.093)	(0.090)
$ln(income)_{at}$		0.048				
		(0.257)				
Mean of DV	-.0166	-.0166	-.0166	-.0166	-.0176	-.0166
Number of clusters	313	313	313	313	306	313
Observations	6260	6260	6260	6260	6120	6260
Controls						
LAU FE	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓
Time trend × Unemployment rate 2015			✓			
Time trend × Immigration rate 2011				✓		
Time trend × ln(EU structural funds per capita 2013)					✓	
Time trend × ln(Total fiscal cuts 2010–15)						✓

Notes: This table reports coefficient estimates from an OLS regression with controlling for local authority district (LAU) fixed effects and time fixed effects. Column (2) further controls for annual gross household disposable income (log). Column (3) – (6) successively control for time trends interacting with pre-vote local unemployment rates, immigration rates, EU structural fund transfers (log), and total fiscal cuts over the period from 2010 to 2015 (log). We report standard errors clustered at the LAU level. *: Significant at 10%; **: 5%; ***: 1%.