I Z A Institute
of Labor Economics
Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 11206

Who Got the Brexit Blues? Using a Quasi-Experiment to Show the Effect of Brexit on Subjective Wellbeing in the UK

Nattavudh Powdthavee
Anke C. Plagnol
Paul Frijters
Andrew E. Clark

DECEMBER 2017

I Z A Institute
of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 11206

Who Got the Brexit Blues? Using a Quasi-Experiment to Show the Effect of Brexit on Subjective Wellbeing in the UK

Nattavudh Powdthavee
Warwick Business School and IZA

Anke C. Plagnol
City University of London

Paul Frijters
London School of Economics and IZA

Andrew E. Clark
Paris School of Economics-CNRS and IZA

DECEMBER 2017

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Who Got the Brexit Blues? Using a Quasi-Experiment to Show the Effect of Brexit on Subjective Wellbeing in the UK*

We use the 2015-2016 waves of the UK Household Longitudinal Study (Understanding Society) to look at subjective wellbeing around the time of the June 2016 EU membership Referendum in the UK (Brexit). We find that those reporting a preference for leaving the EU were 0.14 points less satisfied with life pre-referendum, with both misery (life satisfaction below 5) and job uncertainty significantly predicting the preference for a Leave vote. Post-referendum, those with leave preferences enjoyed a life satisfaction rise of 0.16 points, while there was a drop of 0.15 points for those preferring to remain. The initial positive subjective wellbeing effect of the Brexit vote was particularly pronounced for male and older respondents who reported a preference for leaving the EU. However, adaptation to the Brexit result appears to be complete three months after the EU Referendum date, both for those who preferred continued EU membership and those who did not.

JEL Classification: I14, I30, I31

Keywords: life satisfaction, Brexit, United Kingdom, democracy

Corresponding author:
Nattavudh Powdthavee
Warwick Business School
Scarman Road
Coventry, CV4 7AL
United Kingdom

E-mail: Nattavudh.powdthavee@wbs.ac.uk

* We would like to thank Nicole Martin, Jay James, and the Understanding Society team for comments and help with the UKHLS data. Understanding Society is an initiative funded by the Economic and Social Research Council and various Government Departments, with scientific leadership by the Institute for Social and Economic Research, University of Essex, and survey delivery by NatCen Social Research and Kantar Public. The research data are distributed by the UK Data Service. Support from the John Templeton Foundation and the What Works Centre for Wellbeing is gratefully acknowledged.

1. Introduction

The Referendum on EU membership held in the UK on the 23rd of June 2016 yielded an outcome that the betting markets thought had only a 20% chance of occurring: A majority of voters in a record turnout (72.2%) voted for the UK to leave the EU (The Electoral Commission, 2017). The inability of pollsters and betting markets to anticipate this outcome first raises the question of whether there are additional indicators of voter preferences, and, second, whether this unexpected shock to long-run economic and social opportunities differentially affected groups of individuals in the UK. We here analyse Understanding Society panel data (UK Household Longitudinal Study, UKHLS) to identify which individuals expressed preferences for leaving the EU, and how the resulting outcome affected different groups, particularly in terms of life satisfaction.

Life satisfaction has previously been found to be useful in predicting electoral outcomes, with Ward (2015) finding that, across 126 European elections since 1972, the self-rated wellbeing of the population before an election had twice the predictive power for the share of votes for the incumbent political parties than GDP per capita. Liberini *et al*. (2017) equally show, using data from the UK BHPS 1996-2008, that low life satisfaction reduced the probability of voting for the government of the day, even when the lower levels of life satisfaction reflected events that were unlikely to be related to politics, such as the death of a spouse. They also uncover substantial differences in the baseline life satisfaction of voters of different parties, although this difference varies from election to election. Based on around 1,500 respondents in the 2000 American National Election Study, Flavin and Keane (2012) find that those with higher life satisfaction were substantially more likely to vote and participate politically: Moving from not very satisfied to very satisfied increased the probability of voting by nearly 16%.

We extend these previous contributions by looking not just at the determinants of voting intentions for political parties, but also the attitudes towards one specific question asked in a referendum. We then follow this up by establishing the effect of the referendum outcome itself on individuals' subsequent subjective wellbeing (SWB). As such, we hope to be able to address some of the important questions regarding individual preferences for leaving the EU: Can wellbeing scores partly explain the differences in preferences for EU membership before the Referendum? What were the wellbeing differences between those preferring Remain or Leave following the Referendum result? Do the effects of Brexit on life satisfaction and mental health differ when people live in UK regions in which there are more people who share their preferences for EU membership?

We establish the wellbeing consequences of the referendum by appealing to the same research design as in Metcalfe, Powdthavee, and Dolan (2011). For the study to be thought of as a quasi-experiment, the timing of the EU Referendum has to be largely randomly assigned in terms of the UKHLS interviews. Although the date of the EU Referendum was fixed, the dates on which individuals were interviewed before or after the Referendum in 2016 should be random. This enables us to specify a difference-in-difference (DD) model in order to see whether there is a shift in the average SWB across different groups of people from before to after the referendum date of June 23rd, 2016.

In the UKHLS sample, we show that misery (a life satisfaction score of below 5) and job uncertainty are both statistically significantly associated with preferences for exiting the EU. We further find that those who prefer to leave the EU were, on average, 0.14 points less satisfied with life **prior** to the referendum. However, post-referendum their life satisfaction increased, on average, by 0.16 points, while that of Remainers fell by 0.15 points. In other words, the immediate effect of the referendum result was to invert the life satisfaction ranking of Leavers and Remainers[1]. For both

[1] In the following, we occasionally denote those with a preference for exiting or staying in the EU as Leavers and Remainers respectively. We do not know whether respondents voted in the Referendum and, if so, what their actual

groups, adaptation to the Brexit result does however appear to be largely complete three months after the EU Referendum.

The remainder of the paper is organised as follows. Section 2 provides some background to the Brexit vote. Section 3 then describes the data and analytical method, while the results appear in Section 4. Last, Section 5 concludes.

2. Background

There is a dearth of literature on political participation, in the form of elections and referenda, and subjective wellbeing. Participation in referenda in Switzerland has been found to be positively associated with SWB (Frey and Stutzer, 2000), suggesting that individuals' sense of political autonomy and the process utility of expressing preferences may be good for their wellbeing, or alternatively that individuals tend to vote for policies that are wellbeing-enhancing.

However, referenda are relatively rare in the UK and the 2016 Referendum was only the second time that voters had been asked about EU membership, after a large majority of 67.2% of voters elected to remain in the European Community in 1975 (Saunders, 2016). Since that time, attitudes towards EU membership have been fairly volatile in the UK (Clarke, Goodwin and Whiteley, 2017), culminating in the electorate's decision on June 23rd 2016 to leave the EU. This decision was however taken by a considerably smaller majority than that in the 1975 Referendum, with 51.9% voting Leave vs. 48.1% voting Remain. Researchers are still debating the reasons for the Leave votes, with some blaming the austerity policies that followed the 2008 financial crisis (Dorling, 2016), a cultural backlash to progressive value changes (Inglehart and Norris, 2016), missing information from the government about the economic

vote was.

consequences of Brexit (Welfens, 2016), or socio-economic background and identity politics (NatCen Social Research, 2016). It has also been argued that referenda provide an opportunity between regular elections for the electorate to express dissatisfaction with the incumbent government (Ryan, 2016), so that they become a protest vote (Kostadinova, 2017).

Overall, it appears that demographic background is a better predictor of Brexit voting decisions than are economic variables (Matti and Zhou, 2016). Post-referendum analyses have suggested that those who were more likely to vote Leave were, on average, older, more likely to live in social housing, have no formal education and have lower incomes, and were less likely to belong to a minority (NatCen Social Research, 2016; O'Reilly *et al*., 2016). In our work here, we will add to this debate by investigating whether pre-referendum subjective wellbeing significantly predicts preferences over the EU. It is possible that protest voting at the Referendum be reflected in lower subjective wellbeing scores prior to the Referendum date.

The main focus of our study is on the wellbeing consequences of the Brexit Referendum outcome. To this end, we ask whether the Referendum itself affected post-referendum subjective wellbeing, and to what extent these wellbeing effects differ between those with preferences for Leave vs. Remain, and whether the wellbeing effect was moderated by the local percentage of those who voted in a way reflecting the individual's own preferences. This last moderating effect is along the lines of the social-norm effects of others' unemployment on the wellbeing of the unemployed in Clark (2003) and Powdthavee (2007).

Despite economists' predictions of the dire short- and long-term economic consequences of a winning Leave vote (e.g., Dhingra *et al*., 2016), aside from the sharp fall in the pound, the predicted immediate economic recession has so far failed to appear (Johnson and Mitchell, 2017). Thus, any short-term impact of Brexit on SWB cannot be ascribed to sharp changes in economic circumstances. Regardless of macroeconomic conditions, individuals report higher levels of happiness when their preferred political party is in power (Di Tella and MacCulloch,

2005). Do those with a preference for Leave, who were the 'winners' of the Brexit Referendum, similarly experience increased SWB after the Referendum? We will explore this question below.

3. Methods

3.1. Data and variables

We use data from Waves 7 and 8 of the UK Household Longitudinal Study (UKHLS; also known as Understanding Society). The data are early-release data which were made available to us by the survey institute following an application for early access (ISER, 2017). The Wave 8 sample contains only observations that were collected in 2016, and thus constitutes about 50% of the full Wave 8 dataset that will be released to researchers in the autumn of 2018 (the full dataset will also contain the 2017 data). We only include respondents in our final sample who completed the survey in both Waves 7 and 8 and answered the question about EU membership preference, resulting in a balanced two-wave panel with 18,682 observations in each wave. However, not all respondents reported their life satisfaction and there are also some missing observations for self-rated health and household income. As we are comparing the same individuals across waves, and so do not use the full sample, we do not employ sampling weights. Some of our socio-demographic variables were only asked of respondents when they first joined the panel and are therefore derived from Waves 1-6 of the UKHLS.

We employ two dependent variables to assess pre- and post-referendum wellbeing in the UK. The first is self-reported life satisfaction on a scale ranging from 1-7, where 7 denotes the highest level of life satisfaction. The second wellbeing measure, the GHQ-12 (General Health Questionnaire; Goldberg 1978), is based on twelve items capturing the respondent's mental health over the last few weeks. The Caseness measure of the GHQ-12 scale ranges from 0-12

(as calculated by the survey institute, which followed the GHQ-scoring method). This counts the number of the 12 questions to which the individual supplied a response indicating poorer mental health: 12 thus denotes the lowest level of mental wellbeing.

Respondents were only asked about their preferences over EU membership in Wave 8 of the UKHLS, for which we have the responses collected between January and December 2016. More specifically, they were asked: "*Should the United Kingdom remain a member of the European Union or leave the European Union?*" It should be pointed out that the responses to this question do not indicate whether the respondent intended to vote in the EU referendum or, for surveys collected after 23 June 2016, whether they did actually vote in the referendum, and, if so, whether their stated preference matched their actual vote. In our final Wave 8 sample, 51.9% of respondents expressed a preference for remaining in the EU, while 39.4% favoured Leave, 4.3% selected 'Don't know' and 4.4% refused to answer the question. Although the UKHLS constitutes a representative sample of the UK population, these percentages do not match the actual referendum outcome of 51.9% Leave vs. 48.1% Remain. It is possible that some UKHLS respondents did not vote in the actual referendum, or changed their minds between the date of the survey and the day of the referendum. Unfortunately, we do not have information on whether respondents actually voted. However, it has been reported that voter turnout was higher in areas with greater support for the Leave campaign (Goodwin and Heath, 2016).

Our analysis further includes socio-demographic control variables, which have previously been shown to be associated with SWB, including gender, age, marital status, employment status, level of education, number of children and income (see Layard, Clark and Senik, 2012). To best pick up respondents' socio-economic standing, our measure of income is respondent average log monthly income over UKHLS Waves 1-6 (if available). The descriptive statistics for all measures are reported in Table 1A in the appendix. The regional dummy variables are

local authority districts (LADs). We matched the LADs in the dataset to the referendum results for each LAD published by the Electoral Commission (The Electoral Commission, 2017).[2] We use this information to construct a dummy variable indicating whether respondents live in an LAD in which the majority of voters at the time of the referendum shared the preference for continued EU membership that the individual expressed in their UKHLS interview.

3.2. Econometric method

Our main equation to examine the effect of the June 2016 referendum is a simple DD specification, focusing on the SWB of individual *i* at time t (SWB_{it}):

$$SWB_{it} = \alpha + \beta_1 PostEURef_i + \beta_2 Ref\ year_t + \beta_3 [PostEURef_i \times Ref\ year_t] + x_{it}\gamma + \varepsilon_{it}, \quad (1)$$

where $PostEURef_i$ is a dummy variable for the individual being interviewed post-EU Referendum in Wave 8 of the UKHLS (i.e., from June 23rd, 2016 onwards); $Ref\ year$ is a dummy for having been interviewed in Wave 8, i.e. 2016, the year of the EU referendum; x_{it} includes a number of control variables; and ε_{it} denotes time-varying random shocks. The parameter β_1 thus captures the baseline difference in SWB between people who were interviewed in Wave 8 before and after the EU Referendum which took place on June 23th, 2016; and the parameter β_2 captures the wave effect (the average wellbeing difference between 2016 and 2015).

Our main assumptions are that the outcome of Brexit was unknown, as well as largely unanticipated, prior to the referendum date, and that in the absence of the EU Referendum

[2] The referendum results for Northern Ireland were only published for Northern Ireland overall and not reported separately by LAD.

SWB_{it} would have changed identically in the pre- and post-EU Referendum groups between Waves 7 and 8 (simply because the interview dates are randomised across individuals in each survey year). The parameter β_3 will then represent the average treatment effect (ATE) of Brexit on the subjective wellbeing of those interviewed in Wave 8 from June 23rd, 2016 onward. More formally, in the absence of treatment, β_3 would be statistically insignificantly different from zero: in other words, in the absent of a Brexit effect, pre- and post-EU Referendum SWB should be the same in Wave 8 of the UKHLS as it was in any other wave (Meyer, 1995). In this case, an unbiased estimator of β_3 can be obtained by DD as:

$$\hat{\beta}_3 = \Delta\overline{SWB}^{PostEURef}_{2016-2015} - \Delta\overline{SWB}^{PreEURef}_{2016-2015}$$
$$= \overline{SWB}^{PostEURef}_{2016} - \overline{SWB}^{PostEURef}_{2015} - (\overline{SWB}^{PreEURef}_{2016} - \overline{SWB}^{PreEURef}_{2015}). \quad (2)$$

We also attempt to dissect the ATE of Brexit by the preferences that the individual expressed regarding EU membership (*Remain, Leave Refusal, Don't Know, Missing*) that we capture in a vector Z_i'. This is carried out by estimating the following difference-in-difference-in-difference (DDD) model.

$$SWB_{it} = \alpha + \beta_1 PostEURef_i + \beta_2 Ref\ year_t + \beta_3[PostEURef_i \times Ref\ year_t]$$
$$\beta_4' Z_i' + \beta_5' [PostEURef_i \times Z_i'] + \beta_6' [Ref\ year_t \times Z_i'] +$$
$$\beta_7' [PostEURef_i \times Ref\ year_t \times Z_i'] + x_{it}\gamma + \varepsilon_{it}, \quad (3)$$

where β_4' represents the baseline effect of individual EU preferences; β_5' is the baseline differences in SWB by EU preferences for people interviewed post-EU Referendum in 2016; β_6' captures the effects of being interviewed in the referendum year by EU preferences; and β_7' shows the ATE of Brexit on SWB by EU preferences for people who were interviewed from

June 23rd, 2016 onward.

We vary the outcome variable in different specifications, and we also perform separate analyses for different sub-groups. Note also that robust standard errors, clustered at the individual level, are reported in all tables.

4. Analyses

We start with the question: Who preferred Brexit? To answer this question, we first estimate in Table 1 a logit regression equation with the dependent variable taking the value of 1 if the individual expressed a preference for Brexit (i.e., Leave the EU) and 0 otherwise. We restrict our sample to individuals who answered this EU preference question in Wave 8 before the Referendum date (i.e., in the year 2016, before 23rd June). While we control for many of the personal characteristics measured in Wave 8, our main independent variable of interest is a dummy variable indicating whether life-satisfaction reported in the previous wave (i.e., Wave 7, or in 2015) was in a particular band (0-4 *versus* 5-7).

This simple logit analysis is of course not causal. However, it does suggest that particularly low life satisfaction in year *t*-1 is strongly predictive of preferences for Brexit in year *t*, even when controlling for income, job, other socio-economic characteristics, and regional fixed effects. This is consistent with a recent study by Liberini et al. (2016) who also find evidence that unhappy feelings significantly contributed to Brexit in the UKHLS.

On average, men are more likely than women to prefer leaving the EU. There is also a hump-shape in age in preferences for Brexit. People who are married, cohabiting, separated, divorced, and widowed are significantly more pro-Brexit than the never married. The same applies for retirees and people with lower education. There is also evidence that those with higher long-term income, measured by their average log monthly household income in the first

six waves of the UKHLS, are significantly less likely to want to leave the EU.

Did the result of the EU Referendum raise or lower average life satisfaction in the UK in 2016? Column 1 of Table 2 takes a first look at this question by estimating Eq. (1) via OLS. Here, we can see that the estimated coefficient on the interaction between "Interviewed Post-EU Referendum" and "Referendum year" is positive, but very small and not statistically significantly different from zero: the interaction coefficient is 0.002 with a robust standard error of 0.024. The Brexit result then seems to have had almost no average effect on life satisfaction in the UK between June 23rd and December 31st, 2016.

Of course, the lack of an average effect does not mean that no-one was affected. It is easy to imagine that the effect of Brexit varies by the respondent's own preference for EU membership. Figure 1 shows that the mean life satisfaction of Remainers and Leavers may have differed around the Referendum date. To test this formally, we introduce an interaction by EU-membership preference in the life satisfaction equation, as in Eq. (2). The resulting estimates appear in Column 2 of Table 2.

In this DDD setting, the interaction term between "Interviewed Post-EU Referendum" and "Referendum year" is now negative but continues to be statistically insignificant. The positive effect of Brexit on the life satisfaction of individuals who expressed a preference for "Leave" is only marginal and statistically insignificantly different from zero.

However, the estimated coefficient on the interaction term between "Interviewed Post-EU Referendum" and "Preference for leaving the EU" is negative, sizeable, and statistically significant at the 5% level: pre-EU Referendum, the life satisfaction of those expressing a preference for Brexit was, on average, approximately 0.14 points lower compared to Remainers. On the other hand, the baseline effect of "Interviewed Post-EU Referendum" is positive but statistically insignificantly different from zero, thus implying that there was no notable movement in the pre-EU Referendum life satisfaction for those who preferred continued EU

membership.

We now shift our attention to the estimated effect of Brexit on the post-EU Referendum life satisfaction among those who preferred Leave. Here, we can see from the 3-way interaction term between "Interviewed Post-EU Referendum", "Referendum year", and "Leave the EU" that the effect is positive and statistically well-determined, with an estimated coefficient of 0.16 and a robust standard error of 0.073. This result implies that although those with a preference for Leave who were interviewed after the referendum date experienced lower SWB in the 2015 wave (which is reflected in the 2-way interaction term), they reported significantly higher SWB after the referendum date compared to Remainers (i.e. in their interview during the referendum year, which is reflected in the three-way interaction term). We do not find any significant effects for those who did not reveal their preferences for EU membership (refusals, missing and don't know answers).

For robustness checks, we first split the sample in Table 3 into those who preferred to remain in the EU and those who preferred to leave the EU. We also introduce another moderating variable: a dummy variable that denotes whether the respondent lives in an area where the majority of Referendum voters shared their own EU preference (i.e. they "won"). Looking across columns, we can still see that the Brexit effect continues to be positive though only marginally significant for people who preferred leaving the EU, whilst the opposite is true for those who preferred to remain. However, we do not find strong evidence from the 3-way interaction terms that the Brexit effect on life satisfaction is significantly moderated by living in an area where own EU preference won.

One question of interest is whether people's mental health is affected in the same way as life satisfaction by the Brexit result. To answer this question, we replace the dependent variable by respondent's mental stress scores (as captured by the General Health Questionnaire-12); the estimated results appear in Table 2A in the Appendix. While we uncover some evidence that

people who expressed a preference for Leave tend to report lower mental stress scores than those who preferred Remain, our findings do not suggest that the Brexit effect has a significant impact on either group of individuals.

Did the Brexit effect last over a long period of time? To answer this, we look at the effect 0-3 and 4-6 months after the Referendum. We also allow for an anticipation effect, measured 0-3 months before the Referendum. These new estimates appear in Table 4. Looking across columns, we find a quite sharp, statistically significant drop in SWB of -0.15 measured 0-3 months after the EU Referendum (Table 4, Column 2). In contrast, the smaller declines in SWB 0-3 months before the Referendum and starting from 4 months after 23rd June are not statistically significant (Table 4, Column 2).

Finally, we conduct a sub-sample analysis by gender and age groups, as shown in Table 5. It is men who preferred to leave the EU who derive the most benefit from Brexit; the interaction coefficient between "Interviewed Post-EU Referendum", "Referendum year", and "Leave the EU" in the male sub-sample regression is 0.245, with a robust standard error of 0.109. This is a sizeable effect. In addition, we find marginally significant evidence that the Brexit effect on the life satisfaction of people who preferred Leave is more positive and statistically more robust for the old than for the young.

5. Conclusions

We have here analysed the SWB determinants of preferences for Brexit in the UK in 2016, as well as the effects of the outcome of the Referendum on EU membership held in June of that year. We found that those who reported preferences for Leave were slightly less satisfied with life, in that they were 2% more likely to be in misery (defined as a life satisfaction score of below 5).

At the individual level, the referendum outcome produced a windfall satisfaction gain amongst Leavers compared to Remainers of around 0.16 life-satisfaction points that lasted for three months, a wellbeing effect of the same size as around 20% of annual incomes (some 5,000 pounds per person). At the level of the UK as a whole though, the effects were statistically not significant and close to zero as the losses amongst the Remainers roughly offset the gains amongst the Leavers.

In conclusion, SWB does have some predictive content for the Brexit referendum. Equally, the life satisfaction impact of the outcome is significantly different according to the individual's stated EU membership preference, with fairly large effect sizes. The effects do seem to be relatively short-lived, however. We have also repeated our analysis with the preliminary sampling weights supplied by the survey institute and, subsequently, not all of our significant coefficients remained so. It is possible that despite huge disappointment on the side of Remainers and elation on the side of Leavers, Brexit did not in the end permanently affect SWB as life satisfaction captures individuals' evaluations of many different domains of their life (e.g. health, family, finances, etc.), many of which have not (yet) been affected by the Referendum result.

References

Clark, A.E. (2003). 'Unemployment as a Social Norm: Psychological Evidence from Panel Data'. *Journal of Labor Economics,* 21, pp. 323-351.

Clarke, H. D., Goodwin, M. and Whiteley, P. (2017) *Brexit: Why Britain voted to leave the European Union*. Cambridge: Cambridge University Press. doi: 10.1017/9781316584408.

Dhingra, S. *et al*. (2016) *The consequences of Brexit for UK trade and living standards*. London. Available at: http://cep.lse.ac.uk/pubs/download/brexit02.pdf.

Dorling, D. (2016) 'Brexit: the decision of a divided country', *BMJ*, 354, p. i3697. doi: 10.1136/bmj.i3697.

Flavin, P. and Keane, M. J. (2012) 'Life satisfaction and political participation: Evidence from the United States', *Journal of Happiness Studies*, 13(1), pp. 63–78. doi: 10.1007/s10902-011-9250-1.

Frey, B. S. and Stutzer, A. (2000) 'Happiness, economy and institutions', *Economic Journal*, 110(466), pp. 918–938. doi: 10.1111/1468-0297.00570.

Goldberg, D. (1978) *The Manual of the General Health Questionnaire*. Windsor: NFER.

Goodwin, M. and Heath, O. (2016) 'The 2016 Referendum, Brexit and the left behind: An aggregate-level analysis of the result', *The Political Quarterly*, 87(3), pp. 323–332. doi: 10.1111/1467-923X.12285.

Inglehart, R. and Norris, P. (2016) *Trump, Brexit, and the rise of populism: Economic have-nots and cultural backlash*. Available at: https://research.hks.harvard.edu/publications/getFile.aspx?Id=1401.

ISER (2017) 'University of Essex. Institute for Social and Economic Research, NatCen Social Research and Kantar Public, [producers]: Understanding Society: Early-access release waves 1-8, 2009-2016 [computer file]'. Colchester, Essex: UK Data Service [distributor].

Johnson, P. and Mitchell, I. (2017) 'The Brexit vote, economics, and economic policy', *Oxford Review of Economic Policy*, 33(S1), pp. S12–S21. doi: 10.1093/oxrep/grx017.

Kostadinova, V. (2017) 'Brexit is unlikely to provide answers to governance problems under globalisation', *Economic Affairs*, 37(1), pp. 135–140. doi: 10.1111/ecaf.12219.

Layard, R., Clark, A. E. and Senik, C. (2012) 'The causes of happiness and misery', in Helliwell, J., Layard, R., and Sachs, J. (eds) *World Happiness Report 2012*. New York: Columbia Earth Institute.

Liberini, F., Redoano, M. and Proto, E. (2017) 'Happy voters', *Journal of Public Economics*, 146, pp. 41–57. doi: 10.1016/j.jpubeco.2016.11.013.

Liberini, F., Oswald, A.J., Proto, E. and Redoano, M. (2017). 'Was Brexit Caused by the Unhappy and the Old?'. IZA Discussion Paper No. 11059. University of Bonn.

Matti, J. and Zhou, Y. (2016) 'The political economy of Brexit: Explaining the vote', *Applied Economics Letters*, pp. 1–4. doi: 10.1080/13504851.2016.1259738.

Metcalfe, R., Powdthavee, N. and Dolan, P. (2011) 'Destruction and distress: Using a quasi-experiment to show the effects of the September 11 attacks on mental well-being in the United Kingdom', *Economic Journal*, 121(550), pp. F81–F103. doi: 10.1111/j.1468-0297.2010.02416.x.

Meyer, B. D. (1995) 'Natural and quasi-experiments in economics', *Journal of Business & Economic Statistics*, 13(2), p. 151. doi: 10.2307/1392369.

NatCen Social Research (2016) *Understanding the Leave vote*. Available at: http://natcen.ac.uk/our-research/research/understanding-the-leave-vote/.

O'Reilly, J. *et al*. (2016) 'Brexit: Understanding the socio-economic origins and consequences', *Socio-Economic Review*, 14(4), pp. 807–854. doi: 10.1093/ser/mww043.Powdthavee, N. (2007). 'Are There Geographical Variations in the Psychological Cost of Unemployment in South Africa? '. *Social Indicators Research,* 80, pp.

629-652.

Ryan, C. (2016) 'Where does one start to make sense of Brexit?', *International Economics and Economic Policy*, 13(4), pp. 531–537. doi: 10.1007/s10368-016-0363-1.

Saunders, R. (2016) 'A tale of two referendums: 1975 and 2016', *Political Quarterly*, 87(3), pp. 318–322. doi: 10.1111/1467-923X.12286.

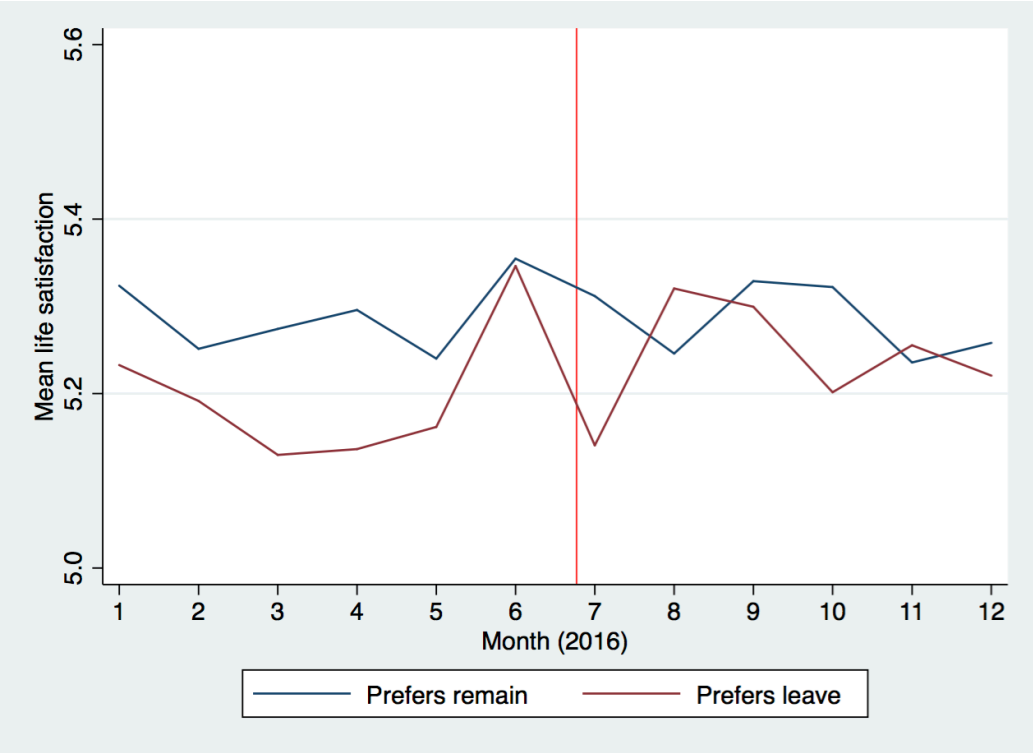
Di Tella, R. and MacCulloch, R. (2005) 'Partisan social happiness', *Review of Economic Studies*, 72(2), pp. 367–393.

The Electoral Commission (2017) *EU referendum results*. Available at: https://www.electoralcommission.org.uk/find-information-by-subject/elections-and-referendums/past-elections-and-referendums/eu-referendum/electorate-and-count-information (Accessed: 7 June 2017).

Ward, G. (2015) *Is happiness a predictor of election results?* CEP Discussion Paper No 1343.

Welfens, P. J. J. (2016) 'Cameron's information disaster in the referendum of 2016: An exit from Brexit?', *International Economics and Economic Policy*, 13(4), pp. 539–548. doi: 10.1007/s10368-016-0361-3.

Figure 1: Mean life satisfaction of Remainers and Leavers by interview date before and after the EU Referendum



Note: mean life satisfaction is computed per month

Table 1: Predicting preference for leaving the EU before the Referendum in 2016 (W8 before referendum date): Logit regression

VARIABLES	Preference for Leave (=1)
Life satisfaction (5-7) in 2015 (W7)	-0.204***
	(0.053)
Male	0.317***
	(0.030)
Age	0.091***
	(0.033)
Age-squared	-0.002**
	(0.001)
Age-cubed	0.000*
	(0.000)
Married	0.352***
	(0.107)
Same-sex civil partnership	0.335
	(0.474)
Separated	-0.145
	(0.231)
Divorced	0.318***
	(0.112)
Widowed	0.252***
	(0.097)
Separated from civil partner	0.246**
	(0.100)
Cohabiting	0.592***
	(0.102)
Self-employed	0.195
	(0.128)
Unemployed	0.041
	(0.200)
Retired	0.259**
	(0.107)
On maternity leave	-1.344**
	(0.651)
Looking after home	0.100
	(0.146)
Full-time student	-0.269
	(0.190)
Long-term sick or disabled	0.050
	(0.137)
Apprenticeship	0.090
	(0.731)
Self-rated health	-0.061**
	(0.027)
Highest education: A-level	-0.391***
	(0.088)

Highest education: Higher degree	-0.817***
	(0.133)
Average log monthly household income (W1-6)	-0.348***
	(0.069)
Number of children	-0.037
	(0.045)
Constant	0.481
	(0.792)
Regional dummies (14)	Yes
Pseudo R-squared	0.0582
Observations	7,473

Note: Sample taken from W8 and before the EU Referendum date (23 June 2016).

Table 2: Life satisfaction and the Brexit effect: Linear difference-in-difference regressions (UKHLS, 2015-2016)

VARIABLES	(1)	(2)
Interviewed post-EU Ref in W8 (=1)	0.002	0.049
	(0.020)	(0.045)
Referendum year (=1)	0.003	0.029
	(0.021)	(0.035)
Interviewed post-EU Ref in W8 × Referendum year	**0.002**	**-0.063**
	(0.024)	**(0.048)**
Preference towards EU		
Leave the EU	-0.003	0.046
	(0.019)	(0.052)
Don't know	0.083*	0.130
	(0.046)	(0.097)
Refusal/missing	0.034	0.051
	(0.022)	(0.038)
2-way interaction terms		
Post-EU Ref × Leave the EU		**-0.139****
		(0.069)
Post-EU Ref × Don't know		0.038
		(0.163)
Post-EU Ref × Refusal/missing		-0.041
		(0.051)
Ref year × Leave the EU		-0.051
		(0.055)
Ref year × Don't know		-0.121
		(0.103)
Ref year × Refusal/missing		-0.132
		(0.126)
3-way interaction terms		
Post-EU Ref × Ref year × Leave the EU		**0.162****
		(0.073)
Post-EU Ref × Ref year × Don't know		0.133
		(0.176)
Post-EU Ref × Ref year × Refusal/missing		0.090
		(0.174)
Control variables		included
Observations	35,202	35,202
R-squared	0.187	0.187

Notes: *<10%; **<5%; ***<1%. Robust standard errors are in parentheses. Control variables include gender, age, age-squared, age-cubed, employment, education, marital status, average of log monthly income (W1-6), number of children, and regional fixed effects.

Table 3: Does living in an area where own EU preference won reinforce or mitigate the Brexit SWB effect?

	Prefer to Remain in the EU		Prefer to Leave the EU	
VARIABLES	(1)	(2)	(3)	(4)
Post-EU Ref in W8	0.049	0.075	-0.091*	-0.120
	(0.045)	(0.066)	(0.053)	(0.086)
Referendum year	0.023	0.047	-0.019	-0.086
	(0.036)	(0.050)	(0.043)	(0.068)
Post-EU Ref in W8 × Referendum year	**-0.073**	**-0.128***	**0.110***	**0.128**
	(0.048)	**(0.072)**	**(0.057)**	**(0.093)**
Living in an area where own EU preference won	0.018	0.041	0.089*	-0.000
	(0.038)	(0.072)	(0.050)	(0.091)
2-way interaction terms				
Post-EU Ref × In area where own EU preference won		**-0.049**		**0.047**
		(0.090)		**(0.109)**
Ref year × In area where own EU preference won		-0.050		0.105
		(0.070)		(0.087)
3-way interaction terms				
Post-EU Ref × In area where own EU preference won		**0.108**		**-0.032**
		(0.098)		**(0.118)**
Control variables	included	included	included	included
Observations	11,345	11,345	8,624	8,624
R-squared	0.169	0.170	0.202	0.202

Notes: *<10%; **<5%; ***<1%. Robust standard errors are in parentheses. Control variables include gender, age, age-squared, age-cubed, employment, education, marital status, average of log monthly income (W1-6), number of children, and regional fixed effects.

Table 4: Anticipation and adaptation to Brexit (Referendum date: 23/06/2016)

VARIABLES	(1)	(2)
Interviewed between 24/03/2016 and 23/06/2016	-0.011	0.101
	(0.030)	(0.069)
Interviewed between 24/06/2016 and 23/09/2016	-0.008	0.134*
	(0.030)	(0.069)
Interviewed after 24/09/2016	0.005	0.093
	(0.029)	(0.070)
Referendum year (=1)	-0.016	0.066
	(0.030)	(0.084)
B/w 24/03/2016 and 23/06/2016 x Ref Year	**0.034**	**-0.080**
	(0.034)	**(0.072)**
B/w 24/06/2016 and 23/09/2016 x Ref Year	**0.017**	**-0.150****
	(0.034)	**(0.073)**
After 24/09/2016 x Ref Year	**0.038**	**-0.066**
	(0.037)	**(0.075)**
Preference towards EU		
Leave the EU	-0.004	0.066
	(0.020)	(0.084)
2-way interaction terms		
B/w 24/03/2016 and 23/06/2016 × Leave the EU		**-0.044**
		(0.107)
B/w 24/06/2016 and 23/09/2016 × Leave the EU		**-0.153**
		(0.108)
After 24/09/2016 × Leave the EU		**-0.162**
		(0.106)
Ref year × Leave the EU		-0.087
		(0.087)
3-way interaction terms		
B/w 24/03/2016 and 23/06/2016 × Ref year × Leave the EU		**0.070**
		(0.113)
B/w 24/06/2016 and 23/09/2016 × Ref year × Leave the EU		**0.212***
		(0.112)
After 24/09/2016 × Ref year × Leave the EU		**0.182**
		(0.110)
Control variables	included	included
Observations	34,968	34,968
R-squared	0.188	0.188

Notes: *<10%; **<5%; ***<1%. Robust standard errors are in parentheses. Control variables include gender, age, age-squared, age-cubed, employment, education, marital status, average of log monthly income (W1-6), number of children, and regional fixed effects.

Table 5: Sub-sample analysis: Men versus Women and Young versus Old

VARIABLES	**Men**	**Women**	**Young (age<=40)**	**Old (age>40)**
Post-EU Ref in W8	0.059	0.046	0.123	0.018
	(0.069)	(0.059)	(0.077)	(0.055)
Referendum year	0.050	0.012	0.022	0.037
	(0.053)	(0.047)	(0.061)	(0.043)
Post-EU Ref in W8 × Referendum year	**-0.083**	**-0.051**	**-0.107**	**-0.049**
	(0.074)	**(0.063)**	**(0.083)**	**(0.059)**
Preference towards EU				
Leave the EU	0.090	0.006	0.018	0.049
	(0.076)	(0.071)	(0.099)	(0.061)
2-way interaction terms				
Post-EU Ref × Leave the EU	**-0.186***	**-0.103**	**-0.098**	**-0.143***
	(0.103)	**(0.094)**	**(0.129)**	**(0.082)**
Ref year × Leave the EU	-0.101	-0.005	-0.121	-0.036
	(0.081)	(0.075)	(0.106)	(0.064)
3-way interaction terms				
Post-EU Ref × Ref year × Leave the EU	**0.245****	**0.095**	**0.216**	**0.146***
	(0.109)	**(0.099)**	**(0.139)**	**(0.087)**
Control variables	included	included	included	included
Observations	15,455	19,747	10,153	25,049
R-squared	0.178	0.198	0.202	0.186

Notes: *<10%; **<5%; ***<1%. Robust standard errors are in parentheses. Control variables include gender, age, age-squared, age-cubed, employment, education, marital status, average of log monthly income (W1-6), number of children, and regional fixed effects.

Appendix

Table 1A: Descriptive statistics, by wave

	Wave 7 (2015)					Wave 8 (2016)				
Variable	Obs	Mean	Std.	Min	Max	Obs	Mean	Std.	Min	Max
Life satisfaction	18,064	5.298	1.421	1	7	18,114	5.256	1.437	1	7
Sex	18,682	0.441	0.497	0	1	18,682	0.441	0.497	0	1
Age	18,682	50.685	18.260	16	101	18,682	51.679	18.266	16	102
Marital status										
Single and never married/in civil partnership	18,682	0.194	0.396	0	1	18,682	0.192	0.394	0	1
Married	18,682	0.544	0.498	0	1	18,682	0.547	0.498	0	1
In a registered same-sex civil partnership	18,682	0.004	0.061	0	1	18,682	0.004	0.062	0	1
Separated but legally married	18,682	0.015	0.121	0	1	18,682	0.014	0.116	0	1
Divorced	18,682	0.067	0.251	0	1	18,682	0.068	0.252	0	1
Widowed	18,682	0.068	0.251	0	1	18,682	0.070	0.256	0	1
Separated from civil partner	18,682	0.000	0.007	0	1	18,682	0.000	0.021	0	1
A former civil partner	18,682	0.000	0.007	0	1	18,682	0.000	0.010	0	1
A surviving civil partner	18,682	0.000	0.007	0	1	18,682	0.000	0.010	0	1
Living as couple	18,682	0.107	0.309	0	1	18,682	0.103	0.304	0	1
Not reported	18,682	0.001	0.031	0	1	18,682	0.001	0.031	0	1
Employment status										
In paid employment (full or part-time)	18,682	0.475	0.499	0	1	18,682	0.473	0.499	0	1
Self employed	18,682	0.073	0.261	0	1	18,682	0.076	0.266	0	1
Unemployed	18,682	0.035	0.184	0	1	18,682	0.033	0.178	0	1
Retired	18,682	0.280	0.449	0	1	18,682	0.293	0.455	0	1
On maternity leave	18,682	0.005	0.072	0	1	18,682	0.004	0.063	0	1
Looking after family or home	18,682	0.042	0.200	0	1	18,682	0.041	0.197	0	1
Full-time student	18,682	0.051	0.219	0	1	18,682	0.038	0.191	0	1
Long-term sick or disabled	18,682	0.033	0.178	0	1	18,682	0.035	0.185	0	1
On a government training scheme	18,682	0.001	0.024	0	1	18,682	0.000	0.013	0	1
Unpaid worker in family business	18,682	0.001	0.026	0	1	18,682	0.001	0.023	0	1
Working in an apprenticeship	18,682	0.001	0.037	0	1	18,682	0.001	0.038	0	1
Doing something else	18,682	0.004	0.065	0	1	18,682	0.004	0.066	0	1
Not reported	18,682	0.000	0.016	0	1	18,682	0.000	0.019	0	1
Self-rated health	18,081	3.392	1.060	1	5	18,141	3.318	1.067	1	5
Obtained A-levels	18,682	0.159	0.366	0	1	18,682	0.161	0.368	0	1
Obtained a first degree	18,682	0.186	0.389	0	1	18,682	0.188	0.391	0	1
log of household income	18,189	7.795	0.582	-0.517	9.903	18,189	7.795	0.582	-0.517	9.903

Number of own children in household	18,682	0.459	0.883	0	8	18,682	0.453	0.876	0	7

Table 2A: Mental stress and the Brexit effect: Linear difference-in-difference regressions (UKHLS, 2015-2016)

VARIABLES	(1)	(2)
Interviewed post-EU Ref in W8 (=1)	0.020	-0.020
	(0.040)	(0.093)
Referendum year (=1)	-0.062	-0.118
	(0.044)	(0.072)
Interviewed post-EU Ref in W8 × Referendum year	0.031	0.090
	(0.049)	(0.099)
Preference towards EU		
Leave the EU	-0.104**	-0.220**
	(0.041)	(0.108)
Don't know	-0.182*	-0.321
	(0.100)	(0.204)
Refusal/missing	-0.195***	-0.225***
	(0.047)	(0.080)
2-way interaction terms		
Post-EU Ref × Leave the EU		0.122
		(0.143)
Post-EU Ref × Don't know		0.105
		(0.386)
Post-EU Ref × Refusal/missing		0.031
		(0.105)
Ref year × Leave the EU		0.152
		(0.113)
Ref year × Don't know		0.164
		(0.206)
Ref year × Refusal/missing		0.158
		(0.257)
3-way interaction terms		
Post-EU Ref × Ref year × Leave the EU		-0.154
		(0.149)
Post-EU Ref × Ref year × Don't know		-0.053
		(0.392)
Post-EU Ref × Ref year × Refusal/missing		-0.511
		(0.351)
Control variables	included	included
Observations	35,115	35,115
R-squared	0.179	0.179

Note: *<10%; **<5%; ***<1%. Robust standard errors are in parentheses. Control variables include gender, age, age-squared, age-cubed, employment, education, marital status, average of log monthly income(W1-6), number of children, and regional fixed effects.