

Manuscript version: Author's Accepted Manuscript

The version presented in WRAP is the author's accepted manuscript and may differ from the published version or Version of Record.

Persistent WRAP URL:

<http://wrap.warwick.ac.uk/136412>

How to cite:

Please refer to published version for the most recent bibliographic citation information. If a published version is known of, the repository item page linked to above, will contain details on accessing it.

Copyright and reuse:

The Warwick Research Archive Portal (WRAP) makes this work by researchers of the University of Warwick available open access under the following conditions.

© 2020 Elsevier. Licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International <http://creativecommons.org/licenses/by-nc-nd/4.0/>.



Publisher's statement:

Please refer to the repository item page, publisher's statement section, for further information.

For more information, please contact the WRAP Team at: wrap@warwick.ac.uk.

1 Title: Voting patterns, revoking Article 50 and antidepressant trends in England following the
2 Brexit referendum

3 Article type: Short communication

4 Tim Liew¹

5 Robin Goodwin, PhD¹ (corresponding author)

6 Lukasz Walasek, PhD¹

7

8 ¹ Department of Psychology, University of Warwick, Gibbet Hill Road, Coventry, CV4 7AL UK.

9 Corresponding author: robin.goodwin@warwick.ac.uk

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44

Abstract

Unexpected social or economic events have been shown to negatively impact mental health and wellbeing. The result of the 2016 Brexit referendum in the UK has been associated with an increase in uncertainty and consequent anxiety. This study analyses antidepressant prescription trends in the 533 constituencies of England in the year before and three years following the referendum. We examine associations between prescription trends and constituency-level voting patterns in the referendum and later support for the March 2019 “Revoke Article 50”, signed by more than 6 million UK citizens. A mixed model analysis revealed the rate of increase in antidepressant prescription trends to be steeper in Leave constituencies and in areas that did not support the petition, after controlling for constituency education, socioeconomic status, median age, total population, and seasonal effects. Proposed interpretations are provided, along with recommendations for future research. Implications for this study include redoubling mental health care service in areas that show significantly higher mental distress following a major political event.

Keywords: antidepressants; Brexit; social change; mental health; wellbeing

45 **Voting patterns, revoking Article 50 and antidepressant trends in England following the**
46 **Brexit referendum**

47

48 **Introduction**

49 The United Kingdom voted to sever its ties with the European Union on 23rd June 2016. This
50 decision was contrary to the majority of opinion polls (EU Referendum Poll of Polls, 2016;
51 Kavetsos et al., 2018), and led to high levels of stress and apprehension, at least for some
52 (Katshu, 2019). Economic uncertainty reached record levels in the days following the
53 referendum (Wielechowski and Czech, 2016), with several reports suggesting an elevated
54 risk of recession (Dhingra et al., 2016; Financial Times, 2019; Kavetsos et al, 2018). Wider
55 fears amongst the public included concerns about employment, food and medicine
56 shortages, delays at ports, and changes in access to healthcare as a result of an impending
57 Brexit (BBC, 2019). As a result the outcome was, for many, “the very definition of... a
58 ‘stressor’” (Hughes, 2019 p. 4).

59 A substantial literature shows the negative impacts of economic stress on life
60 satisfaction and mental health (Ferrie et al., , 1995; Hughes, 2019; Llosa et al., 2018; Tonzer,
61 2017; Burgard et al., 2009). The economic stress hypothesis (Catalano and Dooley, 1983)
62 suggests that perceived economic downturns create uncertainty which in turn induces
63 poorer mental health (Ferrie et al., 1995; Burgard et al., 2009). Both interpersonal and
64 intergroup relationships can also be strained by unexpected societal changes (Goodwin,
65 2009) with several reports suggesting an increase in stigma, prejudice and discrimination as
66 a result of Brexit (Bhui, 2016). Given this, it is perhaps not surprising that a third of the UK

67 population claimed Brexit had led to a deterioration in their mental health (BACP, 2019;
68 Hughes, 2019), with four in ten adults expressing feelings of powerlessness, anger, or
69 anxiety (Million Health Foundation, 2019). Using the Kübler-Ross model of the five stages of
70 grief (Kübler-Ross, 1969), only 30% of Remain supporters surveyed in January 2020 had
71 reached the final 'acceptance' stage (Smith, 2020).

72 The current paper extends early analyses that compared antidepressant
73 prescription in the month following the Brexit vote to the prescription trend in preceding
74 years. Controlling for other drug classes, Vantoros et al (2018) reported an increase in
75 antidepressant prescription after the referendum. In a similar vein, Powdthavee used UK
76 Understanding Society Panel data collected before and immediately following the
77 referendum to show that individuals who expressed a preference to Remain reported
78 significantly heightened stress, while those who preferred to Leave claimed increased life
79 satisfaction (Powdthavee et al., 2019). Using Eurobarometer data from 2015-2017,
80 Kavetsos et al (2018) show a significant decrease in life satisfaction in the UK following the
81 referendum when compared to other EU countries, and that those with a positive attitude
82 towards the EU report lower subjective well-being post-referendum. However, this work
83 focused on the immediate aftermath of the referendum and did not allow for the complex
84 political machinations that then followed and the fluidity of the Brexit process (Hughes,
85 2019). In our paper we report the rate of change in antidepressant prescriptions in the
86 three years post-Brexit. We go beyond previous work on antidepressant use and Brexit by
87 accounting for other predictors (age, education and income) at the constituency level.
88 These factors vary substantially in their distribution across constituencies (ONS, 2018a, b)
89 and are associated with both antidepressant usage (Phillips and Nugent, 2013; Ross and

90 Mirowsky, 2006; von Soest et al., 2012) and with voting behavior in the 2016 referendum
91 (Powdthavee et al, 2019). Finally, in our modelling, we include proportions of the
92 population that signed the “Revoke Article 50” petition in March 2019. This variable allows
93 us to control for the overall constituency-level sentiment towards Brexit after years of
94 uncertainty and debate concerning the issue.

95 Overall antidepressant prescriptions have steadily increased across time (Mars, et
96 al., 2017; Ilyas and Moncrieff, 2012). We suggest two hypotheses. First, as Leavers showed
97 improved life satisfaction following the referendum we expect Leave-voting constituencies
98 to show a smaller increase in prescription trends across time, compared to those with a
99 higher proportion of Remainers (Powdthavee et al., 2019). Second, as an indicator of
100 ongoing dissatisfaction with Brexit, voting to revoke Brexit in the March 2019 petition will
101 be associated with a steeper increase in prescription trends, across time. We compare
102 these trends following Brexit against a control group which we believe would not be
103 affected by this political change - the weight loss drug, Orlistat

104

105 Materials and Methods

106 Data.

107 Support for Brexit. EU 2016 Referendum votes were counted at local authority level,
108 with constituency estimates provided by Hanretty (2017). Constituencies with an estimate
109 of 50% or more Leave votes were labelled as “Leave”, those with under 50% as “Remain”
110 (Vote variable). As an indicator of continued support for the EU data from the 2019 “Revoke
111 Article 50 and remain in the EU” petition data, divided by parliamentary constituency, was

112 downloaded from the UK Parliament website (UK Parliament, 2019). This was signed by 6.1
113 million UK citizens at the time of site closure on 31st March 2019. Signatures were further
114 divided by the population in each constituency, providing a proportion of signatures for
115 analysis (Signatures variable).

116 Antidepressant Prescription. NHS digital provided monthly prescribing data of all
117 medicines, dressing and appliances by all registered practices in England (NHS Digital,
118 2019), as well as the full address of those practices. Data excludes private prescriptions
119 and prescriptions written in Wales, Scotland, or Northern Ireland. Antidepressant
120 medication was identified using the British National Formulary classificatory code (BNF
121 section code: 403), which includes major classes of antidepressants (e.g. selective
122 serotonin re-uptake inhibitors, monoamine-oxidase inhibitors, and tricyclic
123 antidepressants) (DataLab, 2019).

124 We analysed antidepressant prescription data from June 2015 to August 2019. MapIt UK
125 was used to map postcodes of individual practices to their respective parliamentary
126 constituency (mySociety, 2019), producing total prescriptions of antidepressants for each
127 of the 533 constituencies in England. These totals (in absolute terms) were used as the
128 dependent variable in our analyses. In additional analyses, we also used total numbers of
129 prescriptions of the weight-loss drug “Orlistat” obtained from the same dataset.

130 Covariates. We use constituency-based population and median age in 2017 (ONS,
131 2018b), education level (attainment 8) scores in 2018 (Department of Education, 2019),
132 and median annual earnings data in 2018 (ONS, 2018a). To allow for seasonal variations in
133 depressive symptoms we controlled for winter effects by including yearly dummies for

134 relevant months (December, January, and February). All data used was anonymized and
135 from secondary sources therefore further ethical approval was not deemed necessary.

136

137 Methods

138 Mixed models were employed to capture both intra-individual and inter-individual
139 changes across time (Singer and Willett, 2009) and to allow for the random effects
140 parameters that capture dependencies amongst data points (Singmann and Kellen, in
141 press). Random effects parameters were assumed to be normally distributed, providing
142 hierarchical shrinkages (with extreme data points adjusted towards the mean) and to avoid
143 overfitting (Singmann and Kellen, in press). All data were processed and analysed using R
144 (R Core Team, 2018).

145 In all models, our dependent variable was the (average) monthly and constituency-
146 level anti-depressant prescriptions. Model building was conducted in four main steps (Singer
147 and Willett, 2009): 1) an unconditional means model (grand mean of antidepressant
148 prescription aggregated across constituencies and time-points), 2) an unconditional growth
149 model (which includes fixed effect of time), and 3) a conditional growth model (including
150 fixed effect of time, Vote, Signatures, and two way interactions of time with Vote and
151 Signatures), and 4) a conditional growth model with covariates (including fixed effect of time,
152 Vote, Signatures, two way interactions of time with Vote and Signatures, covariates for
153 median annual earnings, median age, total population, education level, and dummy variable
154 for season (winter months)). Deviance statistics compared likelihood statistics for the two

155 models were examined to determine goodness-of-fit. We provide a more formal summary
156 of our models in the Supplementary materials.

157

158 Model Implementation

159 Each covariate was z-transformed and centered around means to facilitate interpretation.

160 All mixed models were fitted using the afex package in R (Singmann et al., 2019). Models

161 were fitted using full maximum likelihood estimation to allow for comparisons using

162 deviance statistics. *P*-values were calculated using the Satterthwaite approximation

163 method (Luke, 2017).

164

165

166 **Results**

167 Preliminary Analyses.

168 372 constituencies were coded as voting Leave in the referendum, 161 as Remain.

169 Constituencies who voted leave were less likely to sign the Revoke Article 50 petition

170 (Supplementary Figure 1). Residual plots suggested residuals were normally distributed and

171 assumptions of linearity and homoskedasticity were satisfied.

172

173 Model Building

174 Table 1 and Supplementary Table 1 present the statistical output for fixed and random
175 effects, respectively. Models 1 to 4 represented the unconditional means model, the
176 unconditional growth model, the conditional growth model with predictors only, and
177 the conditional growth model with predictors and covariates, respectively. An
178 intraclass correlation coefficient (ICC) dividing between-constituency variance by
179 between + within-constituency variance (Singer and Willett, 2009) suggested
180 substantial inter-constituency variation, supporting the appropriateness of a mixed
181 model (ICC = 0.94)

182

183

Insert Table 1 about here

184

185 In order to address the proposed hypotheses, referendum vote and proportion of
186 signatures signed were included into the first conditional growth model (model 3). The
187 addition of predictors significantly improved the model fit (model 2 vs. model 3; $\chi^2 = 91.10$,
188 $p < .001$). Interactions between time and referendum vote, between time and petition
189 signatures, suggested rate of change in antidepressant prescriptions across time is
190 moderated by the vote and petition signatures. Deviance statistics indicated the addition
191 of covariates significantly improved the model fit, (model 3 vs. model 4; $\chi^2 = 566.44$, p
192 $< .001$). Those in areas with less education, and lower salaries, were more likely to be
193 given anti-depressants. Bi-serial correlations (Supplementary Table 3) show that those
194 constituencies which voted Remain reported less prescription use, had significantly greater

195 earnings, were in more populated areas and had a younger and more educated
196 population. They were also more likely to sign the 2019 petition.

197 We examined the relationship between time and antidepressant prescriptions at
198 three different values of petition signatures (1 SD above the mean, at the mean itself,
199 and 1 SD below the mean) (Supplementary Table 2: Aiken and West, 1991). The linear,
200 positive relationship between time and antidepressant prescriptions became increasingly
201 steep with decreasing petition signature proportions. We repeated this at both levels of
202 referendum vote: Leave and Remain. This showed the slope of the relationship between
203 time and antidepressant prescriptions was steeper for Leavers compared to Remainers
204 (Figure 1; see also Supplementary Table 2).

205

206 Insert Figure 1 about here

207

208 As a robustness check, we also conducted our analysis using total constituency-level
209 prescriptions of the Orlistat – a NHS approved weight-loss drug. Our prediction was that
210 there should be no differences in the overall prescription numbers and the rate of
211 change between constituencies that voted Leave and Remain. Figure 2 shows that while
212 prescriptions dropped over time, there were no systematic differences between Leave
213 and Remain regions.

214 Insert Figure 2 about here

215

216 Regression results with Orlistat prescriptions as a dependent variable confirm this,
217 showing no significant interaction between a) time and referendum vote, and b) time
218 and petition signatures (rightmost column of Table 1; see Table S3 in the Supplement for
219 the summary of the random effects).

220 As a further robustness check, we re-ran model 4 with antidepressant prescriptions
221 after excluding constituencies that were most evenly split in terms of the vote to Leave
222 and Remain (50% +/- 1%). With the remaining 25500 observations, we still found a
223 significant interaction between the vote (Leave and Remain) and prescriptions of anti-
224 depressants ($b = 3.527$, $t = 2.093$, $p = .037$), in a model using all controls.

225

226

Discussion

227 The present study examined change in antidepressant prescriptions across time among
228 English parliamentary constituencies following the 2016 EU membership referendum.

229 The rate of antidepressant prescription increased during the three years following the
230 referendum, with constituencies that voted to Leave, and those that did not sign the
231 2019 Revoke Brexit petition, exhibiting the greatest increase in antidepressant
232 prescription. These findings persisted even controlling for education, socioeconomic
233 status, total population, median age, and seasonal effects.

234 The results of the present study are contrary to past research suggesting greater
235 distress amongst Remain voters in the months immediately following the 2016
236 referendum (Kavetsos et al, 2018; Powdthavee et al., 2019). Our results also indicated
237 that rate of change in antidepressant was less steep amongst constituencies who signed
238 the 2019 petition. One possible explanation for these results is that Leavers, despite

239 attaining their desired result in the EU referendum, may have suffered from frustration
240 about the management of Brexit (e.g., in Parliament’s inability to agree on a deal and
241 uncertainty about the actual Brexit date). Kavetsos et al. (2018) note that while those
242 most negative towards the EU initially reported increased subjective well-being (in the
243 autumn of 2016), there is a significant reduction in subjective well-being by spring 2017.
244 An increasing proportion of British people expressed “Brexit regret”, believing that the
245 vote to leave the EU was an erroneous one (Business Insider, 2019). Further, some Leave
246 voters may have experienced discomfort as a result of the interpersonal polarization that
247 followed the decision (Kavetsos et al, 2018), and negative caricatures of their behaviour
248 in the press (Hughes, 2019) - even if they did not regret their original vote.

249 We recognize a number of limitations to our work. Our data did not permit us to
250 form causal conclusions about the impact of Brexit on mental health. While a good
251 proxy, antidepressant prescriptions may not fully represent mental distress in the
252 population (Kavetsos et al, 2018) and is inevitably tied to local prescription practices.
253 Future research could complement antidepressant prescriptions with other measures of
254 psychological wellbeing, including self-reports of mental health. Subsequent studies
255 could also measure attitudes to an event such as Brexit at multiple time points to
256 ascertain temporal fluctuations in dissatisfaction, and might tie those fluctuations to
257 significant events (e.g., the appointment of a new government or prime ministers). This
258 may help clarify the relationship between public sentiment and antidepressant
259 prescriptions. Although disruption to the availability of prescription drugs is unlikely
260 until after the Brexit transition period (i.e. until 2021) it is also possible that there was
261 greater anxiety about this in Leave areas, a factor that could also not be explored

262 directly within our data. Our data was constrained to general practices in England, and
263 did not take into account private practices, specialists, or general practices in other parts
264 of the UK, limiting the generalisability of the results. Further work can extend this
265 research by combining multiple datasets. EU nationals in the UK face major
266 uncertainties and anxieties with regards to their rights and status post-Brexit (Hughes,
267 2019), including the availability of health care (Yong, 2019), and their health needs to
268 be incorporated within similar future investigations. Finally, as data from another major
269 societal change (German unification) has shown, any large political decision may have
270 quite different salience for different individuals (Silbereisen and Wiesner, 2002).
271 Further work could profitably seek to combine analyses of constituency-level sentiment
272 with considerations of the individual meanings of such changes.

273 Despite the above, our study has important potential implications in terms of
274 policy and interventions. Our results are consistent with notions that Brexit is
275 associated with a considerable stress-load (Hughes, 2019). Policy makers should
276 endeavour to identify the specific factors behind the greater increase of antidepressant
277 prescriptions amongst Leaver voters and address the particular concerns of this group.
278 Faced with Brexit-engendered uncertainty, communities in Leave areas may suffer
279 disproportionately from economic disadvantages with a consequent impact on their
280 wellbeing (Cheung and Lucas, 2015; Jofre- Bonet et al., 2018). Although of course not
281 directly comparable, disaster research has pointed to the additional burden placed by
282 those whose livelihoods are particularly uncertain, with the psychological burden often
283 exceeding that of those who directly suffered material losses (e.g. survivors of the
284 Fukushima nuclear incident, Goodwin et al, 2019). Mental health practitioners should

285 be aware that the uncertainty associated with major event might inflict stressors upon

286 different members of the population over time.

287 References

- 288 Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting*
289 *interactions*. Newbury Park, London: Sage.
- 290 BACP. (2019, April 11). *One third of adults say Brexit has affected their mental health,*
291 *BACP research finds*. Retrieved from British Association for Counselling and
292 Psychotherapy: [https://www.bacp.co.uk/news/news-from-bacp/2019/11-april-](https://www.bacp.co.uk/news/news-from-bacp/2019/11-april-one-third-of-adults-say-brexit-has-affected-their-mental-health-bacp-research-finds/)
293 [one-third-of-adults-say-brexit-has-affected-their-mental-health-bacp-research-](https://www.bacp.co.uk/news/news-from-bacp/2019/11-april-one-third-of-adults-say-brexit-has-affected-their-mental-health-bacp-research-finds/)
294 [finds/](https://www.bacp.co.uk/news/news-from-bacp/2019/11-april-one-third-of-adults-say-brexit-has-affected-their-mental-health-bacp-research-finds/)
- 295 BBC. (2019, August 1). *No-deal Brexit: 10 ways it could affect you*. Retrieved from
296 <https://www.bbc.com/news/uk-politics-47470864>
- 297 Bhui, K. (2016). Brexit, social division and discrimination: impacts on mortality and mental
298 illness. *The British Journal of Psychiatry*, 209, 181–182. doi: 10.1192/bjp.209.2.181
- 299 Burgard, S. A., Brand, J. E., & House, J. S. (2009). Perceived job insecurity and worker health
300 in the United States. *Social Science & Medicine*, 69, 777–785.
301 doi:10.1016/j.socscimed.2009.06.029
- 302 Business Insider. (2019, February 24). *Polls show Brexit regret is so strong that*
303 *'Remain' would win a second referendum by 9 points*. Retrieved from
304 [https://www.businessinsider.my/yougov-poll-brexit-regret-remain-second-](https://www.businessinsider.my/yougov-poll-brexit-regret-remain-second-referendum-2019-2/?r=US&IR=Thttps://www.businessinsider.my/yougov-poll-brexit-regret-remain-second-referendum-2019-2/?r=US&IR=T)
305 [referendum-2019-2/?r=US&IR=Thttps://www.businessinsider.my/yougov-poll-](https://www.businessinsider.my/yougov-poll-brexit-regret-remain-second-referendum-2019-2/?r=US&IR=Thttps://www.businessinsider.my/yougov-poll-brexit-regret-remain-second-referendum-2019-2/?r=US&IR=T)
306 [brexit-regret-remain-second-referendum-2019-2/?r=US&IR=T](https://www.businessinsider.my/yougov-poll-brexit-regret-remain-second-referendum-2019-2/?r=US&IR=T)
- 307 Catalano, R., & Dooley, D. (1983). Health effects of economic instability: a test of the
308 economic stress hypothesis. *Journal of Health and Social Behavior*, 24, 46–60
- 309 Cheung, F., & Lucas, R. E. (2015). When Does Money Matter Most? Examining the
310 Association between Income and Life Satisfaction over the Life Course. *Psychology and*
311 *Aging*, 30, 120-135. doi:10.1037/a0038682
- 312 DataLab, E. (2019). *4.3: Antidepressant Drugs*. Retrieved from
313 OpenPrescribing: <https://openprescribing.net/bnf/0403/>
- 314 Department of Education. (2019). Key stage 4 and multi-academy trust performance 2018
315 (revised). UK. Retrieved from [https://www.gov.uk/government/statistics/key-stage-](https://www.gov.uk/government/statistics/key-stage-4-and-multi-academy-trust-performance-2018-revised)
316 [4-and-multi-academy-trust-performance-2018-revised](https://www.gov.uk/government/statistics/key-stage-4-and-multi-academy-trust-performance-2018-revised)
- 317 Dhingra, S., Ottaviano, G., Sampson, T. and Van Reenen, J. (2016). The
318 Consequences of Brexit for UK Trade and Living Standards. London: Centre
319 for Economic Performance; available online at
320 <http://cep.lse.ac.uk/pubs/download/brexit02.pdf> (accessed 6 January
321 2019).

- 322 Ferrie, J., Shipley, M. J., Marmot, M. G., Stansfeld, S. A., & Smith, G. D. (1995). Health
323 Effects of Anticipation of Job Change and Non-employment: Longitudinal Data From
324 the Whitehall II Study. *BMJ Clinical Research*, 311(7015), 1264-9.
325 doi:10.1136/bmj.311.7015.1264
- 326 EU Referendum Poll of Polls. (n.d.). Retrieved from [https://whatukthinks.org/eu/opinion-](https://whatukthinks.org/eu/opinion-polls/poll-of-polls/)
327 [polls/poll-of-polls/](https://whatukthinks.org/eu/opinion-polls/poll-of-polls/)
- 328 Financial Times. (2019, August 11). Shrinking UK economy is a Brexit warning.
329 Retrieved from Financial Times: [https://www.ft.com/content/c3496774-ba8f-](https://www.ft.com/content/c3496774-ba8f-11e9-96bd-8e884d3ea203)
330 [11e9-96bd-8e884d3ea203](https://www.ft.com/content/c3496774-ba8f-11e9-96bd-8e884d3ea203)
- 331 Goodwin, R., Sugiyama, K., Sun, S., Aida, J., Ben-Ezra, M. (2019). Distress six years after
332 the Great Earthquake: Two, Multi-Level Prospective Analyses. *British Journal of*
333 *Psychiatry*. <https://doi.org/10.1192/bjp.2019.251>.
- 334 Goodwin, R. (2009). *Changing Relations: Achieving Intimacy in a Time of Transition*.
335 Cambridge: Cambridge University Press.
- 336 Hanretty, C. (2017). Areal interpolation and the UK's referendum on EU
337 membership. *Journal of Elections, Public Opinion and Parties*, 27(4), 466-483.
338 doi:10.1080/17457289.2017.1287081
- 339 Hughes, B.M., 2019. *The Psychology of Brexit*. Springer International Publishing.
- 340 Ilyas, S., & Moncrieff, J. (2012). Trends in prescriptions and costs of drugs for
341 mental disorders in England, 1998-2010. *British Journal of Psychiatry*, 200(5),
342 393-8. doi:10.1192/bjp.bp.111.104257.
- 343 Independent, T. (2019, March 23). *Revoke Article 50 petition calling for Brexit to be*
344 *cancelled becomes most popular in Parliament website's history*. Retrieved from
345 [https://www.independent.co.uk/news/uk/politics/brexit-petition-article-50-](https://www.independent.co.uk/news/uk/politics/brexit-petition-article-50-revoke-record-website-deal-theresa-may-latest-a8836536.html)
346 [revoke-record-website-deal-theresa-may-latest-a8836536.html](https://www.independent.co.uk/news/uk/politics/brexit-petition-article-50-revoke-record-website-deal-theresa-may-latest-a8836536.html)
- 347 Jofre-Bonet, M., Serra-Sastrea, V., & Vondoros, S. (2018). The impact of the Great
348 Recession on health-related risk factors, behaviour. *Social Science & Medicine*, 197,
349 213-225.
- 350 Katshu, M.Z.U.H. (2019). Acute transient psychotic disorder precipitated by Brexit vote.
351 *BMJ Case Reports CP*, 12(10), p.e232363.
- 352 Kavetsos, G., Kawachi, I., Kyriopoulos, I. and Vondoros, S., 2018. The effect of the Brexit
353 referendum result on subjective well-being. CEP Discussion Paper 1586
- 354 Kübler-Ross, E. (1969). *On Death and Dying*. Routledge.

- 355 Llosa, J. A., Espina, S. M., Suárez, J. R., & Tomás, E. A. (2018). Job insecurity and mental
356 health: A meta-analytical review of the consequences of precarious work in clinical
357 disorders. *Anales de Psicología*, 34(2), 211-223. doi:10.6018/analesps.34.2.281651
- 358 Luke, S. (2017). Evaluating significance in linear mixed-effects models in R. *Behavior*
359 *Research Methods*, 49(4), 1494–1502. Doi
- 360 Mars, B., Heron, J., Kessler, D., Davies, N. M., Martin, R. M., Thomas, K. H., & Gunnell, D.
361 (2017). Influences on antidepressant prescribing trends in the UK: 1995–2011. *Social*
362 *Psychiatry and Psychiatric Epidemiology*, 52, 193–200.
- 363 Million Health Foundation. (2019, March 21). *Millions have felt 'powerless', 'angry'*
364 *or 'worried' because of Brexit – results of our new poll*. Retrieved from Million
365 Health Foundation: [https://www.mentalhealth.org.uk/news/millions-have-felt-](https://www.mentalhealth.org.uk/news/millions-have-felt-powerless-angry-or-worried-because-brexit-results-our-new-poll)
366 [powerless-angry-or-worried-because-brexit-results-our-new-poll](https://www.mentalhealth.org.uk/news/millions-have-felt-powerless-angry-or-worried-because-brexit-results-our-new-poll)
- 367 mySociety. (2019). *The easy way to match points to boundaries*. Retrieved from MapIt UK:
368 <https://mapit.mysociety.org/>
- 369 NHS Digital. (2019). *Practice Level Prescribing in England: a summary*. Retrieved from
370 [https://digital.nhs.uk/data-and-information/areas-of-interest/prescribing/practice-](https://digital.nhs.uk/data-and-information/areas-of-interest/prescribing/practice-level-prescribing-in-england-a-summary)
371 [level-prescribing-in-england-a-summary](https://digital.nhs.uk/data-and-information/areas-of-interest/prescribing/practice-level-prescribing-in-england-a-summary)
- 372 ONS. (2018a). Annual Survey of Hours and Earnings. UK. Retrieved from
373 [https://www.ons.gov.uk/releases/analysesbasedonannualsurveyofhoursandearningsprovisi](https://www.ons.gov.uk/releases/analysesbasedonannualsurveyofhoursandearningsprovisional2018andrevised2017)
374 [onal2018andrevised2017](https://www.ons.gov.uk/releases/analysesbasedonannualsurveyofhoursandearningsprovisional2018andrevised2017)
- 375 ONS. (2018b). Parliamentary constituency population estimates (Experimental Statistics).
376 UK. Retrieved from
377 [https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/p](https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/parliamentaryconstituencymidyearpopulationestimates)
378 [opulationestimates/datasets/parliamentaryconstituencymidyearpopulationestimates](https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/parliamentaryconstituencymidyearpopulationestimates)
- 379 Phillips, J., & Nugent, C. (2013). Antidepressant Use and Method of Suicide in the United States:
380 Variation by Age and Sex, 1998–2007. *Archives of Suicide Research*, 17(4), 360–372.
381 <https://doi.org/10.1080/13811118.2013.785373>
- 382 Powdthavee, N., Plagnol, A. C., Frijters, P., & Clark, A. E. (2019). Who Got the Brexit
383 Blues? The effect of Brexit on subjective wellbeing in the UK. *Economica*, 86(343),
384 471-494.
- 385 R Core Team. (2018). *R: A language and environment for statistical computing*. Vienna,
386 Austria: R Foundation for Statistical Computing. Retrieved from
387 <https://www.R-project.org/>

- 388 Ross, C. E., & Mirowsky, J. (2006). Sex differences in the effect of education on depression:
389 Resource multiplication or resource substitution? *Social Science & Medicine*, 63(5),
390 1400–1413. <https://doi.org/10.1016/j.socscimed.2006.03.013>
- 391 Silbereisen, R.K., & Wiesner, M. (2002). Lessons from research on the consequences of German
392 unification. *Applied Psychology: An International Review*, 51, 291-317.
- 393 Singer, J. D., & Willett, J. B. (2009). *Applied Longitudinal Data Analysis: Modeling Change*
394 *and Event Occurrence*. Oxford Scholarship Online.
395 [https://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780195152968.001.0001/a](https://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780195152968.001.0001/acprof-9780195152968)
396 [cprof-9780195152968](https://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780195152968.001.0001/acprof-9780195152968)
- 397 Singmann, H., & Kellen, D. (2019). An Introduction to Mixed Models for Experimental
398 Psychology. In D. H. Spieler, & E. Schumacher, *New Methods in Neuroscience and*
399 *Cognitive Psychology*. Psychology Press.
- 400 Singmann, H., Bolker, B., Westfall, J., Aust, F., & Ben-Shachar, M. S. (2019). afex: Analysis
401 of Factorial Experiments R package version 0.24-1. Retrieved from [https://CRAN.R-](https://CRAN.R-project.org/package=afex)
402 [project.org/package=afex](https://CRAN.R-project.org/package=afex)
- 403 Smith, M. (2020, January 29). Only 30% of Remain voters have reached acceptance on the
404 five stages of Brexit grief. Retrieved from
405 [https://yougov.co.uk/topics/politics/articles-reports/2020/01/29/only-three-ten-](https://yougov.co.uk/topics/politics/articles-reports/2020/01/29/only-three-ten-remain-voters-have-reached-acceptan)
406 [remain-voters-have-reached-acceptan](https://yougov.co.uk/topics/politics/articles-reports/2020/01/29/only-three-ten-remain-voters-have-reached-acceptan)
- 407 UK Parliament. (2019). *Petition: Revoke Article 50 and remain in the EU*. Retrieved August
408 18, 2019, from <https://petition.parliament.uk/petitions/241584>
- 409 VANDOROS, S., AVENDANO, M., & KAWACHI, I. (2018, November 12). The EU referendum and
410 mental health in the short term: a natural experiment using antidepressant
411 prescriptions in England. *Journal of Epidemiology and Community Health*, 73(2),
412 168-175.
- 413 von Soest, T., Bramness, J. G., Pedersen, W., & Wichstrom, L. (2012). The relationship
414 between socio-economic status and antidepressant prescription: a longitudinal survey
415 and register study of young adults. *Epidemiology and Psychiatric Sciences*, 1, 87-95.
- 416 Wielechowski, M., & Czech, K. (2016). Brexit Related Uncertainty for United
417 Kingdom Economy. *Oeconomia*, 15(4), 171–181.
- 418 Yong, A. (2019, August 22). *Boris Johnson's dramatic immigration u-turn leaves*
419 *2.5m uncertain of their future*. Retrieved from The Conversation:
420 [https://theconversation.com/boris-johnsons-dramatic-immigration-u-turn-](https://theconversation.com/boris-johnsons-dramatic-immigration-u-turn-leaves-2-5m-uncertain-of-their-future-122166)
421 [leaves-2-5m-uncertain-of-their-future-122166](https://theconversation.com/boris-johnsons-dramatic-immigration-u-turn-leaves-2-5m-uncertain-of-their-future-122166)

Figure 1. Total constituency-level monthly prescriptions of anti-depressants in the UK over the period from June 2015 to August 2019. The vertical dashed line represents the month of the Brexit referendum (June 2016). The lines are simple slopes (along with the confidence intervals) based on the model including all covariates (model 4).

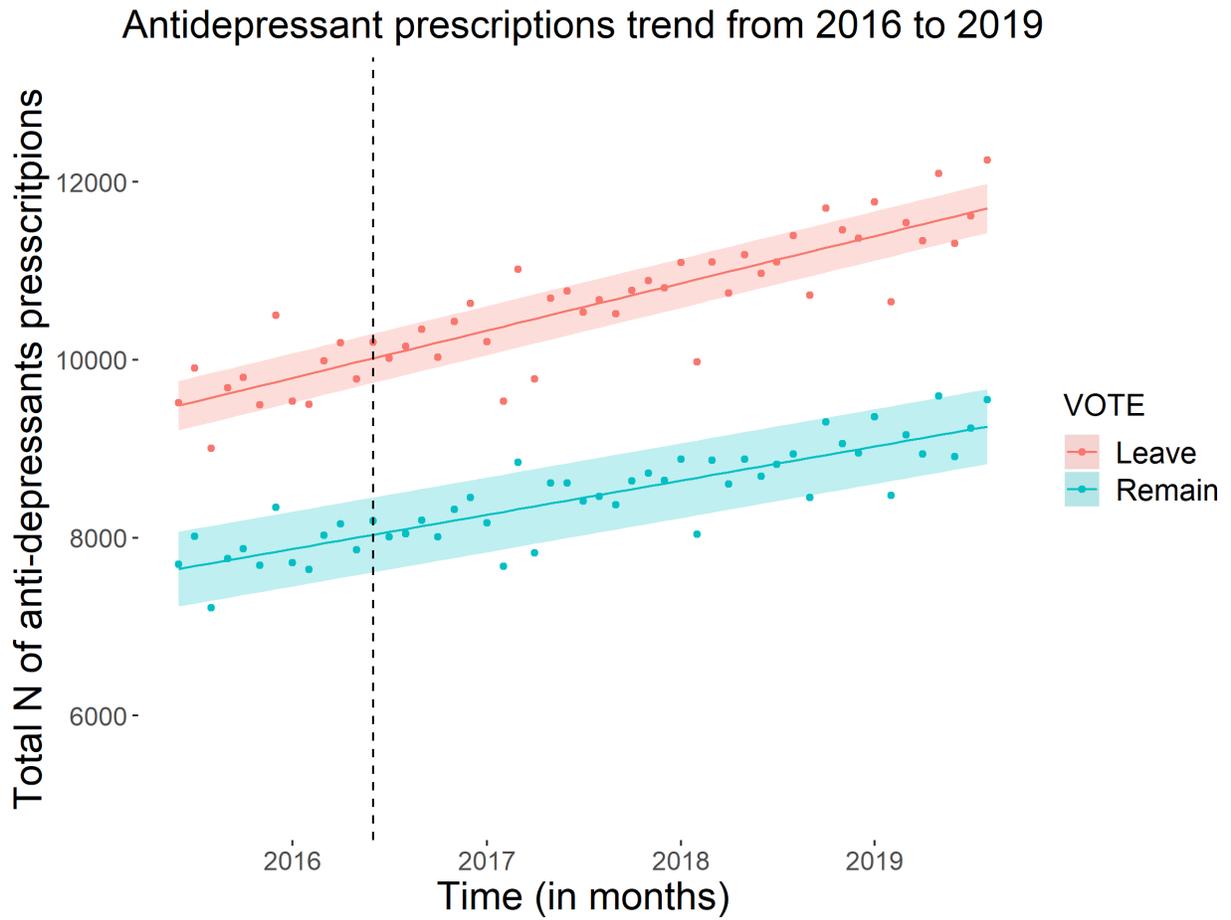
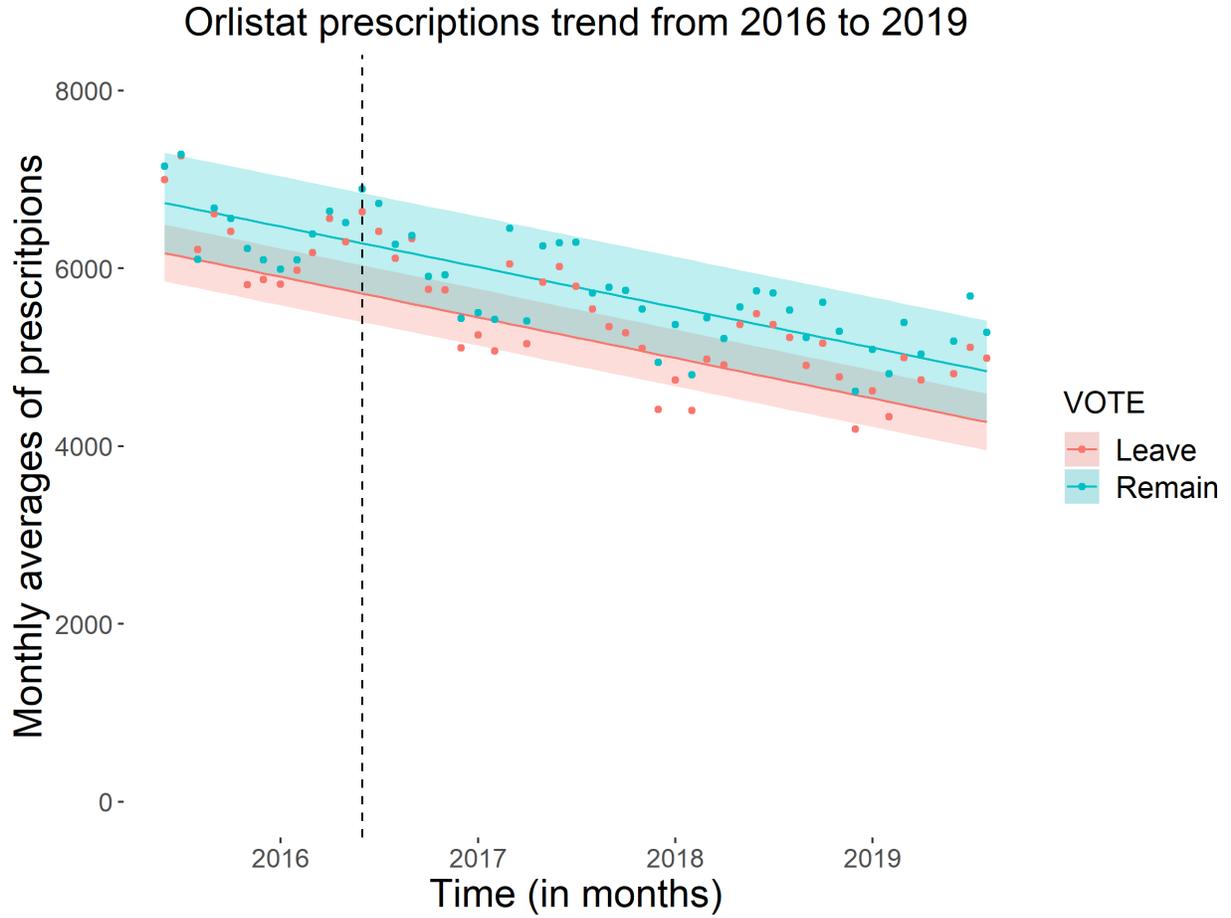


Figure 2. Total constituency-level monthly prescriptions of Orlistat in the UK over the period from June 2015 to August 2019. The vertical dashed line represents the month of the Brexit referendum (June 2016). The lines are simple slopes (along with the confidence intervals) based on the model including all covariates (model 4).



Aftermath of Brexit

Table 1: Summary of the models testing the change of anti-depressant and Orlistat prescriptions over time.

	Model 1	Model 2	Model 3	Model 4	Model 4 (Orlistat)
Parameters	Coef. (S.E.)	Coef. (S.E.)	Coef. (S.E.)	Coef. (S.E.)	Coef. (S.E.)
Intercept	9946.78*** (138.60)	8931.06*** (123.48)	8687.32*** (137.29)	6130.82*** (1044.73)	13360.71*** (1082.90)
Time		40.63*** (1.04)	39.18*** (1.17)	39.18*** (1.17)	-37.92*** (1.91)
Vote			615.71** (180.29)	442.84* (183.76)	-281.07 (190.50)
Signature			-394.04* (165.56)	15.50 (172.35)	-726.02*** (178.66)
Time * Vote			3.66* (1.54)	3.66* (1.54)	-0.10 (2.50)
Time * Signature			-3.25* (1.42)	-3.25* (1.42)	4.15 (2.30)
Earnings				-407.08** (135.57)	-234.38 (140.50)
Age				65.53* (26.84)	-175.07*** (27.82)
Population				601.13*** (142.34)	1031.22*** (147.58)
Education				-858.18*** (133.18)	-644.19*** (138.67)
Winter dummy				76.41*** (3.39)	332.55*** (7.49)

Notes: *** $p < .001$, ** $p < .01$ * $p < .05$;

Model 1-4: 27,183 observations, 533 constituencies; Model 4 (Orlistat): 26,517 observations, 533 constituencies