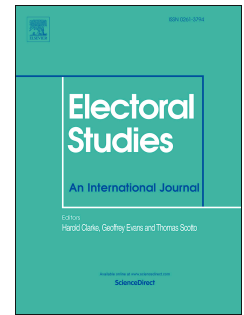


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# Leave and Remain Voters' Knowledge of the EU After the Referendum of 2016

*by*

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## Abstract

Since the UK's vote to leave the European Union, there has been considerable debate about whether voters (particularly Leave voters) were well-informed prior to making their decisions. We gave a 15-item EU knowledge quiz to a large, nationally representative sample of the British population via an online survey. Our quiz included nine 'ideologically neutral' items, as well as six items that we deemed more 'ideologically convenient' for one side or the other. Overall, there was no average difference between Leave voters and Remain voters (either before or after controlling for covariates), despite the fact that Remain voters scored slightly higher on a short test of probability reasoning. In addition, both Leave and Remain voters were more likely to answer correctly on items that were 'ideologically convenient' for them. Consistent with the previous literature, older age, male gender, higher education, and stronger political interest were all significant predictors of EU knowledge. Interestingly however, these variables only predicted knowledge on the nine 'ideologically neutral' items; their associations with knowledge on the six 'ideologically convenient' items were generally weak and non-significant.

*Key words:* EU; referendum; political knowledge; Brexit; ideological bias

## 1. Introduction

Since the UK's vote to leave the European Union, there has been considerable debate about whether voters were well informed prior to making their decisions (Brett, 2016; Suiter, 2016; Rose, 2017; Marmot, 2017). Much of this debate has centred on the claim that Leave voters were less well informed than Remain voters (e.g., Rooney, 2016; Holehouse, 2016; Fox, 2018). On the day the result was announced, Google Trends reported a +250% spike in searches for “what happens if we leave the EU”, which was cited by several pundits as evidence that many Leave voters did not understand the consequences of their decisions (Graves, 2016). In the following weeks and months, discussions about Brexit became rife with terms like ‘fake news’, ‘post-truth politics’ and ‘low information voters’. For example, in January of 2017, an article appeared in *The Independent* with the title, ‘Fake news handed Brexiteers the referendum – and now they have no idea what they're doing’ (Grice, 2017). Likewise, in a short segment for *BBC Newsnight*, the scientist and commentator Richard Dawkins described the Leave vote as “a slender majority of an ignorant and misled public” (Warren, 2017). In an op-ed for the *Huffington Post*, Baroness King argued that “many British people, possibly the majority, were unaware of the far-reaching consequences of the EU Referendum” (King, 2016). And during a parliamentary debate in December of 2017, the leader of the Green Party Caroline Lucas affirmed that “people didn't know what they were voting for” (Pinnington, 2017). Richard Dawkins, Baroness King and Caroline Lucas all supported Remain in the referendum, so the subtext of their remarks is that Leave voters were less well informed.<sup>1</sup>

The primary purpose of the present study was to compare levels of EU knowledge among Leave voters and Remain voters. In order to do this, we gave a quiz to a large, nationally representative sample of the British population via an online survey. Gauging whether Leave voters were less well informed than Remain voters is of particular interest given that the Leave side won the referendum, and one might regard an electoral outcome as less legitimate if those who voted against it were substantially more knowledgeable than those who voted for it. Indeed, this appears to be the view of figures such as Richard Dawkins, Baroness King and Caroline Lucas. As a matter of fact, several prominent scholars and pundits have defended some form of ‘epistocracy’ in recent years (Caplan, 2013; Harsanyi, 2016; Brennan, 2016; Moyo, 2018; and see Somin, 2013).<sup>2</sup> For example, Brennan (2016, Ch. 1, 6) defends ‘epistocracy’ by invoking what he calls the ‘competence principle’, namely

<sup>1</sup> Note that our study cannot help to answer the specific question of whether Britons (or Leave voters) ‘knew what they were voting for’. Answering that question would require one to have asked respondents what they expected to happen following a vote to Leave *before* the referendum took place.

<sup>2</sup> ‘Epistocracy’ encompasses a variety of different proposals, including restricted suffrage, weighted voting, and enfranchisement lotteries (see Brennan, 2016, Ch. 1).

that “political decisions are presumed to be unjust if they are made incompetently or in bad faith, or by a generally incompetent decision-making body”. Although our study did not seek to determine whether voters overall were sufficiently well informed to satisfy Brennan’s (2016) ‘competence principle’, it did seek to determine whether there was a significant *disparity* in knowledge between Leave and Remain voters, something which—if present—could also be considered grounds for questioning the legitimacy of the referendum result.

Two widely discussed reasons why Leave voters might have been less well informed are: first, that many people gleaned information primarily from social media ‘echo chambers’ in which ‘fake news’ was allowed to run wild without refutation; and second, that the Leave campaign disseminated misleading or downright false information, thereby inveigling voters into believing things that were not true (Brett, 2016; DiFranzo & Gloria-Garcia, 2017; Marmot, 2017). One of the most controversial claims made in the lead up to the referendum was the Leave campaign’s slogan, ‘We send the EU £350 million a week; let’s fund our NHS instead’, which was eventually repudiated by the Chair of the UK Statistics Authority (Norgrove, 2017). Another contentious claim made by the Leave campaign was that Turkey was set to join the EU, something most observers at the time considered to be highly unlikely (Ker-Lindsay, 2017). Of course, the Remain campaign did not go uncriticised either: one statement that provoked rather intense criticism was then-Chancellor George Osborne’s warning that the country would face an ‘emergency budget’ (*i.e.*, a combination of tax hikes and spending cuts) in the event of a vote to leave (Mason et al., 2016).

Interestingly, the UK appears to have the lowest average knowledge of the EU out of all 28 member states. Hix (2015) analysed data from the spring 2015 wave of the *Eurobarometer*, in which EU citizens were asked three simple questions about the EU, and found that Britons scored the lowest on average across the three questions. When he disaggregated Britons’ scores by their image of the EU, he found only a small difference between those who had a “very positive image of the EU” and those who had a “very negative image of the EU”. This finding suggests that Leave voters and Remain voters might be similarly ill-informed about the EU, contrary to the widespread presumption that Leave voters were less well informed (Rooney, 2016; Holehouse, 2016; Fox, 2018). On the other hand, Gabel and Hix (2005) observed that political knowledge was positively associated with support for joining the single currency (but see Tillman, 2012). Moreover, the *Online Privacy Foundation* (2017) surveyed 11,205 British people online, and found that Leave voters scored lower than Remain voters on both numeracy and logical reasoning. To the extent that cognitive ability is a powerful predictor of general knowledge (Furnham et al., 2008), this finding supports the conventional wisdom that Remain voters were better informed.

In addition to comparing levels of EU knowledge among Leave voters and Remain voters, we tested for evidence of ideological bias in respondents' answers. One possible source of ideological bias is so-called motivated reasoning, where someone chooses to believe whatever happens to be more psychologically comforting for him, given his ideological priors (Kahan, 2013). Motivated reasoning can involve interpreting evidence inconsistently, positing implausible alternative theories, or simply denying objective facts. Another potential source of ideological bias in respondents' answers is 'motivated information seeking', where someone preferentially consumes sources of information that flatter her ideological priors (Sunstein, 2009; Iyengar & Hahn, 2009; Flaxman et al., 2016). For example, a Remain supporter might choose to get most of her news from *the Guardian* or the *Financial Times*, while a Leave supporter might choose to get most of his news from the *Daily Mail* or the *Daily Express*. Early evidence indicated that conservatives are more prone to ideological bias than liberals (Jost et al., 2003; Jost and Amodio, 2012), yet more recent evidence suggests that the two sorts of partisans are in fact equally susceptible (Frimer et al., 2017; Washburn & Skitka, 2017; Ditto et al., 2017). As explained further in the methods section, we went about testing for evidence of ideological bias by including several items that we deemed more 'ideologically convenient' for Leave voters, as well as several items that we deemed more 'ideologically convenient' for Remain voters. The remaining items in our knowledge quiz were 'ideologically neutral'. Note that this distinction between 'ideologically neutral' items and 'ideologically convenient' items is roughly equivalent to Barabas et al.'s (2014) distinction between facts relating to "the institutions and people/players of government", and those relating to "public policy concerns".

Furthermore, our study sought to identify the individual characteristics most strongly associated with EU knowledge. According to the previous literature, the following characteristics are among the best predictors of political knowledge in general: older age, male gender, better education, higher openness, stronger political interest, and higher cognitive ability (Galston, 2001; Furnham et al., 2008; Jerit & Barabas, 2017; Barabas et al., 2014). There is also some evidence that Liberal Democrat supporters have better political knowledge than both Labour and Conservative supporters (Andersen et al., 2002). Of the foregoing characteristics, male gender, better education and stronger political interest are also among the best predictors of EU knowledge (Clark, 2014; Rapeli, 2014). Interestingly, while US studies typically find that older people display better political knowledge than younger people (Delli Carpini & Keeter, 2014; Barabas et al., 2014), evidence concerning the relationship between age and EU knowledge is rather mixed. Age and age squared were both non-significant in Rapeli's (2014) multiple regression analysis of EU knowledge (see his Table 4). Similarly, while Clark (2014) observed a positive effect of age on EU knowledge in one dataset (see his Table 4), he observed a negative

effect of age on EU knowledge in another dataset (see his Table 3). We were particularly interested in whether the usual positive effect of age would obtain, given the widespread claim that young people—a majority of whom voted Remain—were betrayed by their parents’ and grandparents’ generations—a majority of whom voted Leave (Lennard, 2016; Low, 2017).<sup>3</sup> Finally, given evidence that the effects of certain predictors may vary across different types of political knowledge (e.g., education; see Barabas et al., 2014), we analysed the ‘ideologically neutral’ items and the ‘ideologically convenient’ items separately.

The remainder of this paper is structured as follows. Section 2 describes our data, outlines the methodology we used to assess respondents’ EU knowledge, and explains how we tested for evidence of ideological bias in respondents’ answers. Section 3 reports our main results. Finally, Section 4 summarises our findings, and discusses a number of important limitations.

## 2. Data and methodology

3,003 members of the British public were surveyed online in February and March of 2018 by the polling company Kantar. Respondents were recruited through a stratified sampling procedure so that the final sample was approximately representative of the general population with respect to region, age, gender, ethnicity and education. Post-stratification weights were applied to improve representativeness further. (Not applying weights did not materially affect any of our main results.) The data were collected as part of an ongoing panel survey of political attitudes, and the sample size was determined at the study’s outset. Support for Leave versus Remain was measured by simply asking respondents which way they voted in the referendum. 11.3% of respondents (unweighted) said that they did turn out, and were therefore assigned to the category ‘did not vote’.<sup>4</sup> Note that information on some covariates (e.g., gender, country of birth, referendum vote choice) was obtained from earlier waves of the survey.

To assess respondents’ knowledge of the EU, we gave them a 15-item quiz. Each item comprised a positive statement, followed by the question ‘True or false?’ For example, item 1 was, ‘Austria is a member state of the EU. True or false?’ (The full list of items is displayed in Table 1.) In general, there are three main question formats used in surveys of political knowledge: ‘true or false’, multiple-choice, and open-ended.<sup>5</sup> Each of these has its advantages and disadvantages (Delli Carpini & Keeter, 1993). We opted against using open-

<sup>3</sup> In the months following the referendum, a number of articles were published asking whether older people should be allowed to vote at all (e.g., Schrieberg, 2016; Chesterton, 2016).

<sup>4</sup> The percentage was 33.6% when applying sample weights.

<sup>5</sup> For a defense of semi-structured interviewing as a method for assessing political knowledge, see Killick (2017).

ended questions to obviate problems related to coding, notably the time required to code  $\sim 3,000 \times 15 = 45,000$  responses, as well as the issue of deciding whether a given response really constitutes a correct answer (*i.e.*, borderline cases). We opted against using multiple-choice questions due to the fact our survey was already rather long (it featured questions on a number of other topics), and we felt that trying to decide between just two possible answers would be less cognitively onerous for respondents. In addition, both open-ended questions and multiple-choice questions may lower respondents' morale, given that they afford less opportunity for guessing. Of course, for precisely the same reason, they tend to be afflicted by less measurement error.

The first nine items were 'ideologically neutral': items 1-3 required respondents to say whether or not certain countries were member states of the EU; items 4-6 required them to recognize important EU figures; and items 7-9 required them to identify the function of important EU institutions. The last six were not ideologically neutral in that one of the two answers could be seen as more 'ideologically convenient' for either Leave voters or Remain voters. Items 10-12 had answers that we deemed more 'ideologically convenient' for Leave voters, whereas items 13-15 had answers that we deemed more 'ideologically convenient' for Remain voters. For example, the case for leaving the EU is arguably stronger if membership entails an upfront cost for the UK, so the answer to item 10 ('true') could be seen as more 'ideologically convenient' for Leave voters. By contrast, the case for leaving the EU is arguably weaker if the UK's net contribution constitutes a relatively small proportion of government spending, so the answer to item 13 ('false') could be seen as more 'ideologically convenient' for Remain voters.

Our decisions concerning what items to include in the quiz were motivated by three main considerations. First, we wanted there to be items of varying difficulty level, the better to demarcate individuals with particularly high or low EU knowledge from those with moderate EU knowledge. For example, we anticipated that item 2 would prove easier than item 3, given that Switzerland was discussed as a potential model for a post-Brexit UK during the referendum campaign, whereas Malta was hardly mentioned. Second, we wanted there to be items covering different aspects of the EU (member states, politicians, EU institutions), as well as items covering different aspects of the Brexit debate (the UK's net contribution, the size of the EU economy, etc.). Third, as noted above, we wanted to test for evidence of ideological bias in respondents' answers. Based on the literature surrounding motivated reasoning and motivated information seeking (Kahan, 2013; Sunstein, 2009; Iyengar & Hahn, 2009; Flaxman et al., 2016), we expected that Leave voters would be more likely to answer correctly on items 10-12, and that Remain voters would be more likely to answer correctly on items 13-15.



Before the quiz began, respondents read the following preamble:

Now we have a short quiz about the EU – the European Union. This is just for fun: don't worry about getting the answers right (one or two of them are rather tricky!) If you're unsure, just take a guess. *Please note that you only have 30 seconds to answer each question.*

The reason that we limited the response time to 30 seconds was to minimize the possibility of cheating. Given that the survey was administered online, there was no way for us to prevent respondents from looking up the answers on their web browsers. As a matter of fact, cheating is a very real concern in online knowledge surveys. Jensen and Thomsen (2014) conducted an online knowledge survey in Denmark, and assessed cheating by simply asking respondents whether they had looked up any of the answers using the Internet. Remarkably, 22% of respondents admitted to having looked up at least one answer. Similarly, when Clifford and Jerit (2014) randomly assigned participants to take a political knowledge quiz either online or in a lab, they observed a significantly higher average score among those who took the quiz online (and see Shulman & Boster, 2014; Clifford & Jerit, 2016). Several different solutions to the problem of cheating in online surveys have been proposed, including response timers, commitment mechanisms, and forgiving requests (Clifford & Jerit, 2016). However, since both Clifford and Jerit (2016) in one study, and Strabac and Aalberg (2011) in another, found that limiting the response time to 30 seconds significantly reduced cheating, we opted for this approach. Note that respondents in our quiz could not move on to the next item until they had clicked either 'true' or 'false' (or the timer had ran out), and were unable to go back once they had done so. In addition, the order of items was randomized across respondents.

One other key methodological decision we made was to omit a 'don't know' response category. The reason for doing so was to obviate the possibility of biased coefficients stemming from differential guessing propensities. For example, if men are more likely to guess than women, as some evidence suggests is the case, the difference in political knowledge between men and women will be overstated (Mondak & Anderson, 2003; Mondak & Anderson, 2004; Mondak & Canache, 2004; but see Sturgis et al., 2008). Of course, the disadvantage of omitting a 'don't know' response category is higher measurement error: on average, 50% of the respondents who would have answered 'don't know' will get the answer correct purely by chance. Moreover, several recent studies have concluded that biases due to differential guessing are relatively small (Sturgis et al., 2008; Luskin & Bullock, 2011; Jesse, 2017; but see Miller & Orr, 2008). However, given our interest in

accurately gauging differences between Leave voters and Remain voters, we opted to trade-off higher measurement error for lower systematic bias.

In addition to their referendum vote choice, EU knowledge, and socio-economic characteristics (age, gender, education, political interest etc.), we also measured respondents' probability reasoning. Specifically, we asked them following three questions. First, 'If you flip a coin twice, what is the probability of getting two heads? a) 12.5%, b) 25%, c) 50%, d) 75%, or e) Don't know'.<sup>6</sup> Second, 'Suppose you flip a coin four times, and get four heads. Does that mean you are more likely to get tails on the next flip? a) Yes, b) No, or c) Don't know'. And third, 'Suppose you flip a coin four times. Which of the following sequences is more likely? a) Heads, tails, heads, tails, b) heads, heads, heads, heads, c) Both sequences are equally likely, or d) Don't know'. The correct answers are of course b), b), and c), respectively. These three responses were coded as '1'; all other responses were coded as '0'. The short test of probability reasoning served as a rough measure of cognitive ability, which has been identified as a powerful predictor of general knowledge (Furnham et al., 2008).

### 3. Results

We begin by examining the distribution of respondents' scores, which is plotted in Figure 1, alongside the distribution that would be expected if respondents had been guessing on all items. The observed distribution had a mean of 8.8 and a standard deviation of 2.1, whereas the distribution of scores expected under guessing had a mean of 7.5 and a standard deviation of 1.9. Our respondents therefore scored 0.63sd better than if they had been guessing on all items. Less than 1% of respondents answered correctly on all 15 items, which indicates the absence of any ceiling effect. EU knowledge score was standardised for most of our subsequent analyses. Note that the quickest 2% of respondents by total survey time were excluded ( $n = 61$  deletions), since we had reason to believe that many of these respondents rushed through the survey, and hence did not fill it out very carefully (see Figure S1 in the Supporting Information). However, excluding these respondents did not materially affect our results.

[FIGURE 1 HERE]

<sup>6</sup> This question was taken from a 2012 survey of MPs by Ipsos MORI (Easton, 2012).

Next we look at the percentages of respondents answering each item correctly, which are displayed in Table 1, along with the corresponding percentages for Leave voters and Remain voters. 11 out of 15 items were answered correctly at rates significantly better than chance ( $p < 0.01$  in all cases).<sup>7</sup> By contrast, 4 out of 15 items were answered correctly at rates significantly worse than chance ( $p < 0.001$  in all cases), which indicates that public beliefs about some aspects of the EU may be systematically wrong.<sup>8</sup> Note that all three of the items we deemed ‘ideologically convenient’ for Remain voters were answered correctly at rates worse than chance, and that one of three items we deemed ‘ideologically convenient’ for Leave voters was answered correctly at a rate worse than chance.

[TABLE 1 HERE]

We now turn to differences between Leave and Remain voters. Overall, there was no average difference in EU knowledge between the two groups (diff. = 0.01sd,  $p = 0.87$ ). However, those who did not vote in the referendum scored significantly lower than those who did (diff. =  $-0.38$ sd,  $p < 0.001$ ).<sup>9</sup> Looking at Table 1, this explains why the percentages in the column corresponding to the full sample are generally lower than the average of the percentages in the two other columns. Our expectation that Leave voters would be more likely to answer correctly on items 10-12, and that Remain voters would be more likely to answer correctly on items 13-15, was borne out by the data. Leave voters were 27 percentage points more likely to answer item 10 correctly ( $p < 0.001$ ), 14 percentage points more likely to answer item 11 correctly ( $p < 0.001$ ), and 8 percentage points more likely to answer item 12 correctly ( $p < 0.001$ ). Similarly, Remain voters were 22 percentage points more likely to answer item 13 correctly ( $p < 0.001$ ), 5 percentage points more likely to answer item 14 correctly ( $p = 0.038$ ), and 9 percentage points more likely to answer item 15 correctly ( $p < 0.001$ ). Interestingly, Remain voters scored slightly higher than Leave voters on the short test of probability reasoning (diff. = 0.10sd,  $p = 0.039$ ), whereas those who did not vote scored the same as Leave voters (diff. =  $-0.03$ sd,  $p = 0.64$ ).

<sup>7</sup> Note that item 2 was essentially identical to one of the three questions featured in the spring 2015 wave of the Eurobarometer, which were analysed by Hix (European Commission, 2015). In that survey, 59% of British respondents answered ‘false’, 24% answered ‘true’, and a further 17% answered ‘don’t know’. Apportioning the respondents who answered ‘don’t know’ equally across the other two response categories (in order to make the figures comparable to ours) implies that 67.5% of Britons gave the correct answer, which is only 1.5 percentage points lower than the figure we obtained (a non-significant difference). This provides very tentative evidence that Britons’ EU knowledge has not substantially increased since the beginning of the referendum campaign in early 2016.

<sup>8</sup> All  $p$ -values reported in this paper are based on robust standard errors.

<sup>9</sup> Note that, since our sample was nationally representative (or approximately so), the category comprising non-voters includes a small number of people who were not eligible to vote.

Next we use multivariate analysis to identify the individual characteristics most strongly associated with EU knowledge. Table 2 reports estimates from OLS models of EU knowledge score. The model in the first column only includes EU referendum vote choice. As reported above, Remain voters score no higher than Leave voters, but those who did not vote score significantly lower than both Leave and Remain voters. The model in the second column introduces age group, gender, ethnicity, country of birth, level of education, social class, and geographical region. Holding other variables constant: older individuals score significantly higher than younger voters; men score significantly higher than women; whites score significantly higher than non-whites; individuals born abroad score significantly higher than those born in the UK; and individuals with more education score significantly higher than those with less education. These results are highly consistent with the previous literature on political knowledge (Galston, 2001; Clark, 2014; Rapeli, 2014; Jerit & Barabas, 2017; Barabas et al., 2014), which provides evidence for the construct validity of our knowledge quiz. Occupational class has no association with EU knowledge when controlling for the other variables in column 3. Notice that the difference between Leave voters and those who did not vote is reduced to 0.25sd when controlling for the other variables in column 2.

[TABLE 2 HERE]

The model in the third column introduces probability reasoning score, political interest, party identity, and national identity. Holding other variables constant, individuals who are very interested in politics score higher than those who are not at all interested, and individuals who score higher on probability reasoning also score higher on EU knowledge.<sup>10</sup> There are no significant differences by party identity. Note, however, that the unconditional differences between supporters of the three main parties were somewhat larger, Labour supporters scoring lower than both Conservative supporters (diff. = 0.21sd,  $p = 0.001$ ) and Liberal Democrat supporters (diff. = 0.40sd,  $p = 0.001$ ). Neither UKIP, SNP nor Green supporters scored significantly differently from Labour supporters ( $p > 0.10$  in all cases). Once again, the preceding results are highly consistent with the previous literature on political knowledge (Galston, 2001; Clark, 2014; Rapeli, 2014; Jerit & Barabas, 2017; Barabas et al., 2014). When it comes to national identity, those who identify as ‘European’ score significantly

<sup>10</sup> We included a separate 11-item EU knowledge quiz in a previous wave of the survey, but chose to reassess respondents’ political knowledge with our 15-item quiz for methodological reasons. The correlation between scores on the two quizzes was  $r = .23$  ( $p < 0.001$ , unweighted  $n = 2,406$ ). Multivariate analysis of the 11-item quiz yielded similar results to those in Table 2, except that Leave voters scored slightly higher on average (diff. =  $-0.06$ sd,  $p = 0.071$ ; when controlling for covariates, diff =  $-0.08$ sd,  $p < 0.05$ ). See Tables S1 and S2 in the Supporting Information for further details.

higher than those who identify as British, although it is worth noting that this was a rather selective category, comprising just 6.2% of the sample (weighted).<sup>11</sup>

It is worth commenting on the somewhat low *R*-squared value of 0.18 in column 3. This is likely attributable to the fact that, due to the absence of a ‘don’t know’ option and the statement in the preamble encouraging respondents to guess, the scores will have been afflicted by relatively large amount of measurement error (as noted in Section 2). Indeed, with only 15 items, measurement error induced by guessing will not have averaged out very much across respondents—as the distribution of expected scores in Figure 1 indicates. (There may have been additional measurement error due to inattention in the online survey.) By way of comparison, in Delli Carpini and Keeter’s (1996) multiple regression analyses of the 1989 Survey of Political Knowledge (a US sample, Table 4.1), which included a comparable set of independent variables, *R*-squared values for three broad domains of politics ranged from 0.42 to 0.50.

We ran the model in the third column of Table 2 five more times, with interaction terms for referendum vote choice  $\times$  age group, referendum vote choice  $\times$  gender, referendum vote choice  $\times$  ethnicity, referendum vote choice  $\times$  country of birth, and referendum vote choice  $\times$  level of education, respectively. Only one of these interaction terms turned out to be significant at the 5% level or lower. Specifically, the effect of male gender was larger for Remain voters than for Leave voters ( $p = 0.042$ ). However, given the large number of tests, one would expect at least one to be significant just by chance, and we had not predicted this difference in advance. The similarity of political knowledge between Leave voters and Remain voters therefore appears to be something that pervades almost all major demographic groups in the UK.

As a robustness check, we computed two alternative measures of EU knowledge: one using principal components analysis, and one using item response theory. First, we extracted the first principal component from a PCA on all 15 knowledge items. This component had an eigenvalue of 1.9, and explained 12% of the variance. All items had positive loadings except for items 14 and 15. Second, we extracted the latent trait (Theta) from a three-parameter IAT model, which fit the data significantly better than a two-parameter IAT model (likelihood ratio test,  $p < 0.001$ ). All items were positively correlated with Theta except for items 14 and 15. Raw quiz score was correlated with the principal component of EU knowledge at  $r = .79$  ( $p < 0.001$ ), and with the latent trait of EU knowledge at  $r = .79$  ( $p < 0.001$ ). The principal component was correlated with the latent trait at  $r = .98$  ( $p < 0.001$ ). We reran the models in Table 2 using these two alternative measures of EU knowledge as dependent

<sup>11</sup> The unweighted percentage was 3.2%. Note that the question on national identity appeared before the EU knowledge quiz in our online survey.

variables, and the coefficient estimates were very similar to those in Table 2 (see Tables S3 and S4 in the Supporting Information).

Given evidence that the effects of certain predictors may vary across different types of political knowledge (see Barabas et al., 2014), we analysed the nine ‘ideologically neutral’ items and the six ‘ideologically convenient’ items separately. Interestingly, the correlation between knowledge on the nine ‘ideologically neutral’ items and knowledge on the six ‘ideologically convenient’ items was rather weak, namely  $r = .10$  ( $p < 0.001$ ). Remain voters scored slightly higher on the nine ‘ideologically neutral’ items (diff. = 0.09,  $p = 0.061$ ), whereas Leave voters scored slightly higher on the six ‘ideologically convenient’ items (diff. = -0.12,  $p = 0.019$ ). However, one should be cautious in interpreting these differences, given that both are relatively small, one is only significant at the 10% level, and we discovered them post-hoc, as opposed to having predicted them in advance.

Table 3 reports estimates from OLS models of knowledge on the nine ‘ideologically neutral’ items, while Table 4 reports estimates from OLS models of knowledge on the six ‘ideologically convenient’ items. Older age, male gender, higher education, and stronger political interest are all significant predictors of knowledge on the nine ‘ideologically neutral’ items, yet none of these variables is a good predictor of knowledge on the six ‘ideologically convenient’ items. Note that the absence of an effect of education is consistent with Barabas et al.’s (2014) finding that education relates more strongly to “general measures of political knowledge than to policy specific knowledge”. Overall, we are able to explain 20% of the variance in knowledge on the nine ‘ideologically neutral’ items, but are only able to explain 5% of the variance in knowledge on the six ‘ideologically convenient’ items. One possible explanation for this disparity is that ideological bias (i.e., the tendency for partisans to give ‘ideologically convenient’ answers) overwhelmed the advantages that would otherwise have been conferred by higher education, stronger political interest etc.

[TABLES 3 & 4 HERE]

Our main finding is that Leave and Remain voters achieved the same average score on our 15-item EU knowledge quiz. This result is consistent with Hix’s (2015) earlier finding that Britons with a “very negative image of the EU” achieved a similar average score to those with a “very positive image of the EU” on three knowledge items featured in the 2015 wave of the Eurobarometer. However, there are several reasons why our finding could be regarded as surprising. First, at least one study has reported that political knowledge is

positively associated with support for joining the single currency (Gabel & Hix, 2005; but see Tillman, 2012). Second, Remain voters score higher than Leave voters on both education level and reasoning ability—two variables which are among the most reliable predictors of political knowledge (Hobolt, 2016; Online Privacy Foundation, 2017; present study). Third, there is a widespread presumption, as indicated by comments from figures such as Richard Dawkins, Baroness King and Caroline Lucas, that Leave voters were less well informed (King, 2016; Warren, 2017; Pinnington, 2017).

In light of these considerations, a reviewer suggested that our main finding might be attributable to a form of selection bias whereby the Leave voters who agreed to take part in our survey were more positively selected for political knowledge than the Remain voters. In order to test this possibility, we compared Leave and Remain voters with respect to five key predictors of political knowledge: age, gender, education, political interest, and probability reasoning (see Table S5 in the Supporting Information). Although the Leave voters in our sample were more likely to be older, they were slightly less likely to be male, substantially less likely to have a university degree, less likely to be very interested in politics, and less likely to have given the correct answer to all three questions about probability reasoning. While we obviously cannot compare Leave and Remain voters with respect to unmeasured predictors of political knowledge, the foregoing comparison provides evidence against the hypothesis that our main finding is attributable to selection bias. Another possibility, which we are unable to test, is that Leave voters were more likely to cheat by looking up the answers on their web browsers. However, recall that we attempted to minimise the possibility of cheating by limiting the response time to 30s, and by including a reassuring statement in the preamble.

#### 4. Conclusion

Since the UK's vote to leave the European Union, there has been considerable debate about whether voters (particularly Leave voters) were well informed prior to making their decisions (Brett, 2016; 2016; Suiter, 2016; Rose, 2017; Marmot, 2017; Grice, 2017; Rooney, 2016; Holehouse, 2016; Fox, 2018). The present study compared levels of EU knowledge among Leave and Remain voters by administering an online quiz to a large, nationally representative sample of the British population. On average, respondents answered 1.4 more items correctly (0.63sd) than if they had been guessing on all 15 items. Although they answered eleven of the items at rates significantly better than chance, they answered the other four items correctly at rates significantly worse than chance. This indicates that Britons' beliefs about some aspects of the EU may be systematically wrong. Further research is needed to establish the extent of this error, and the mechanisms behind it. Interestingly,

despite the fact that every item was a simple ‘true or false’ question, and we encouraged respondents to guess, there was no evidence of any ceiling effect. Indeed, less than 1% of respondents answered correctly on all 15 items.

Contrary to a presumption made by some commentators (see Rooney, 2016; Holehouse, 2016; Fox, 2018), there was no average difference in EU knowledge between Leave and Remain voters (either before or after controlling for covariates). This was in spite of the fact that Remain voters scored slightly higher on our short test of probability reasoning—a result that accords with what has been previously reported (Online Privacy Foundation, 2017). Just as we predicted, both Leave and Remain voters were more likely to answer correctly on items that were ‘ideologically convenient’ for them. There are two plausible explanations for this finding. First, respondents may have engaged in motivated *reasoning*: when confronted with an item in the quiz to which a particular respondent did not know the answer, he may have selected whichever option was most psychologically comforting for him, given his ideological priors (Kahan, 2013). Second, respondents may have previously engaged in motivated *information seeking*: in the months leading up to the quiz, they may have preferentially consumed sources of information that flattered their ideological priors, leading them to acquire more knowledge about their own side than about the opposing side (Sunstein, 2009; Iyengar & Hahn, 2009; Flaxman et al., 2016).

Consistent with the previous literature, older age, male gender, higher education, and stronger political interest were all significant predictors of EU knowledge (Galston, 2001; Furnham et al., 2008; Clark, 2014; Rapeli, 2014; Jerit & Barabas, 2017; Barabas et al., 2017). Interestingly, however, these variables only predicted respondents’ scores on the nine ‘ideologically neutral’ items; their associations with respondents’ scores on the other six items were generally weak and non-significant. A plausible explanation for this finding is that ideological bias (i.e., the tendency for partisans to give ‘ideologically convenient’ answers) overwhelmed the advantages that would otherwise have been conferred by higher education, stronger political interest etc. Finally, the small number of individuals in our sample who identified as ‘European’ had significantly better EU knowledge than their counterparts who identified as ‘British’ or ‘English’, a difference that was robust to controlling for education, probability reasoning and general political interest. This finding comports with evidence that people are more motivated to invest in learning about the specific subjects that interest them (Tobias, 1994; Renninger, 2000). The effect sizes we observed would generally be considered moderate (Cohen, 1977).<sup>12</sup>

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<sup>12</sup> Note that none of the effects should be taken as causal.



There are of course a number of important limitations to our study. First, our knowledge quiz comprised only 15 items, meaning that there were many aspects of the EU and Brexit that we were unable to cover. It is possible that we *would* have detected a significant difference in average EU knowledge if we had asked about certain other aspects of these phenomena. Second, owing to our decision to omit a ‘don’t know’ response category, the scores are likely to have been afflicted by substantial measurement error. And in fact, this may explain our inability to explain a large portion of the variance in the multivariate models. Third, we surveyed respondents in February and March of 2018, which is more than 18 months after the referendum was held. Given that political knowledge tends to be highest immediately following election campaigns (Gelman & King, 1993; Andersen et al., 2005), our survey may have underestimated voters’ knowledge of the EU around the time of the referendum itself. Fourth, our finding of no average difference between Leave and Remain voters does not imply that voters overall *were* well informed prior to making their decisions. Nor does it rule out the possibility that misinformation had a decisive impact on the result of the referendum, as some commentators have maintained (e.g., Yeung, 2016).

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**Table 1.** Percentage of respondents answering each item correctly.

Item	Full sample	Voted Leave	Voted Remain
1. Austria is a member of the EU [T]	61	56	65
2. Switzerland is a member of the EU [F]	69	77	74
3. Malta is a member of the EU [T]	62	63	66
4. This is a photograph of Donald Tusk, president of the European Council [F]	70	71	73
5. This is a photograph of Jean-Claude Juncker, president of the European Commission [T]	86	91	89
6. This is a photograph of Mario Draghi, president of the European Central Bank [T]	66	68	70
7. The European Central Bank sets interest rates for the Eurozone [T]	69	71	71
8. The European Commission is the name for the EU's parliament [F]	55	53	59
9. The European Council is the name for the highest court in the EU [F]	61	66	63
10. The UK currently pays more money into the EU than it gets back in the form of subsidies and other funds [T]	71	88	61
11. The EU makes up a larger proportion of the world economy today than it did twenty years ago [F]	29	37	23
12. The British government cannot sign free trade deals while Britain is a member of the EU [T]	67	78	70
13. More than ten per cent of British government spending goes to the EU [F]	38	28	50
14. The EU employs more civil servants than the British government [F]	29	24	29
15. The EU is the world's second largest economy [T]	42	34	43

Notes: Correct answers are given in square brackets. Items 10-12 were deemed more 'ideologically convenient' for Leave voters; items 13-15 were deemed more 'ideologically convenient' for Remain voters. Sample weights were applied.

**Table 2.** Estimates from OLS models of EU knowledge score.

	EU knowledge score (standardised)	EU knowledge score (standardised)	EU knowledge score (standardised)
EU referendum vote (ref. = Leave)			
Remain	0.01	-0.02	-0.06
Did not vote	-0.37***	-0.25***	-0.26***
Age group (ref. = 18-24)			
25-34		0.01	0.04
35-44		0.20+	0.25*
45-54		0.32**	0.35**
55-69		0.43***	0.48***
70+		0.51***	0.52***
Gender (ref. = Female)			
Male		0.23***	0.16**
Ethnicity (ref. = Non-white)			
White		0.40***	0.35***
Country of birth (ref. = Born abroad)			
Born in UK		-0.50***	-0.32**
Level of education (ref. = Below secondary)			
Secondary		0.14	0.13
Post-secondary		0.37***	0.33***
University degree		0.51***	0.42***
Occupational class (ref. = Routine or semi-rout.)			
Intermediate occupation		0.04	0.02
Manager or higher grade professional		0.17*	0.12
Other		0.00	0.01
Geographical region (ref. = North East England)			
North West England		0.24+	0.20
Yorkshire & Humber		0.20	0.20
East Midlands		-0.01	-0.03
West Midlands		0.17	0.16
East of England		0.07	0.02
London		0.27*	0.17
South East England		0.35**	0.30*
South west England		0.14	0.10
Wales		0.30*	0.20
Scotland		0.22	0.27+
Northern Ireland		0.16	0.09
Probability reasoning score (standardised)			0.12***
Political interest (ref. = Not at all interested)			
Not very interested			-0.01
Fairly interested			0.16+
Very interested			0.34**
Party identity (ref. = Labour)			
Conservative			0.03
Lib Dem			0.13
UKIP			-0.03
SNP			0.13
Green			-0.20+
Other/Don't know/Prefer not to say			0.03
National identity (ref. = British)			
English			-0.01
Welsh			0.10
Scottish			-0.26+
Northern Irish			0.06
Irish			-0.21
European			0.40**
Other			0.20
Unweighted <i>n</i>	2,892	2,892	2,892
<i>R</i> <sup>2</sup>	0.03	0.14	0.18

*Notes:* Entries are coefficients from OLS models. 'ref.' denotes the reference category for each variable. Standard errors are omitted for the sake of brevity. Sample weights were applied. Significance levels, based on robust standard errors: + 10%, \* 5%, \*\* 1%, \*\*\* 0.1%.

**Table 3.** Estimates from OLS models of knowledge on the nine ‘ideologically neutral’ items.

	Knowledge on ‘ideologically neutral’ items (standardised)	Knowledge on ‘ideologically neutral’ items (standardised)	Knowledge on ‘ideologically neutral’ items (standardised)
EU referendum vote (ref. = Leave)			
Remain	0.09+	0.05	0.01
Did not vote	-0.32***	-0.16*	-0.18*
Age group (ref. = 18-24)			
25-34		-0.01	0.01
35-44		0.09	0.16
45-54		0.30*	0.34**
55-69		0.44***	0.49***
70+		0.61***	0.63***
Gender (ref. = Female)			
Male		0.24***	0.18***
Ethnicity (ref. = Non-white)			
White		0.43***	0.39***
Country of birth (ref. = Born abroad)			
Born in UK		-0.50***	-0.25*
Level of education (ref. = Below secondary)			
Secondary		0.14	0.12
Post-secondary		0.41***	0.36***
University degree		0.58***	0.49***
Occupational class (ref. = Routine or semi-rout.)			
Intermediate occupation		0.04	0.01
Manager or higher grade professional		0.12	0.06
Other		-0.04	-0.03
Geographical region (ref. = North East England)			
North West England		0.14	0.10
Yorkshire & Humber		0.09	0.07
East Midlands		-0.06	-0.08
West Midlands		0.11	0.10
East of England		0.01	-0.05
London		0.25*	0.14
South East England		0.22+	0.17
South west England		0.06	0.01
Wales		0.18	0.10
Scotland		0.25*	0.27+
Northern Ireland		0.14	0.06
Probability reasoning score (standardised)			0.13***
Political interest (ref. = Not at all interested)			
Not very interested			0.07
Fairly interested			0.26*
Very interested			0.40***
Party identity (ref. = Labour)			
Conservative			0.01
Lib Dem			0.05
UKIP			-0.13
SNP			0.13
Green			-0.03
Other/Don't know/Prefer not to say			0.06
National identity (ref. = British)			
English			0.01
Welsh			0.05
Scottish			-0.20
Northern Irish			-0.03
Irish			-0.07
European			0.47**
Other			0.35*
Unweighted <i>n</i>	2,892	2,892	2,892
<i>R</i> <sup>2</sup>	0.03	0.16	0.20

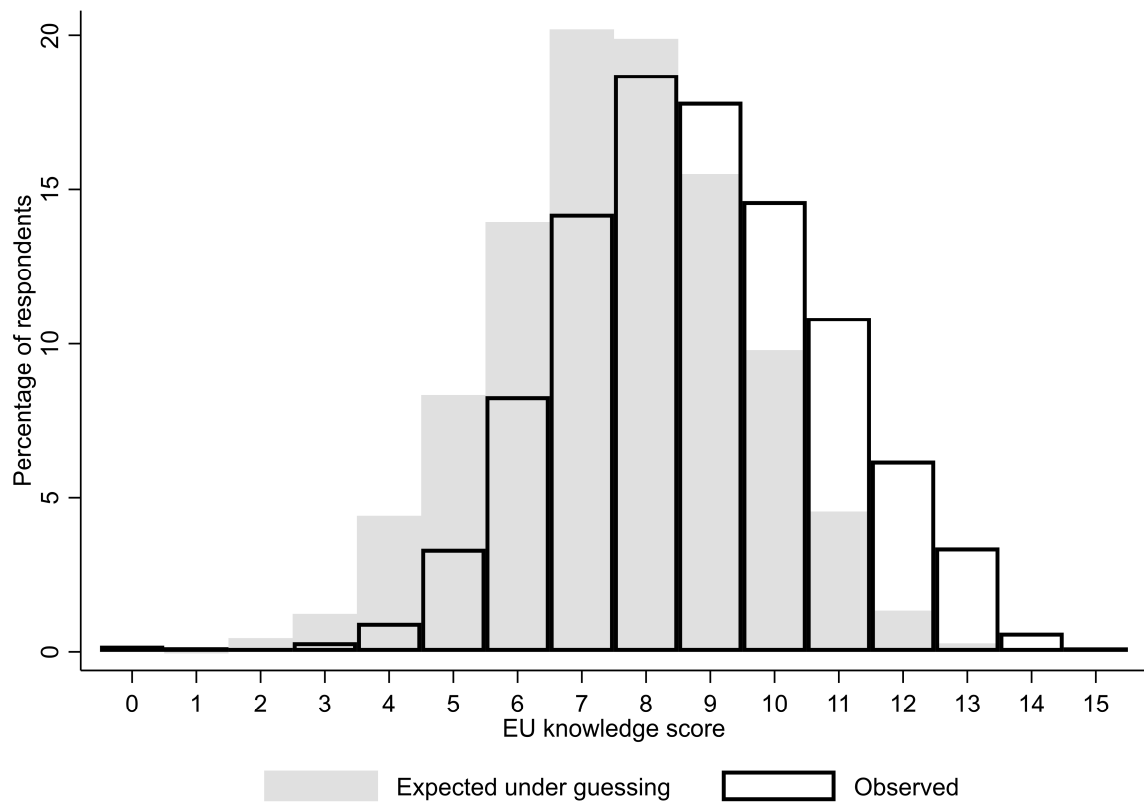
Notes: Entries are coefficients from OLS models. ‘ref.’ denotes the reference category for each variable. Standard errors are omitted for the sake of brevity. Sample weights were applied. Significance levels, based on robust standard errors: + 10%, \* 5%, \*\* 1%, \*\*\* 0.1%.

**Table 4.** Estimates from OLS models of knowledge on the six 'ideologically convenient' items.

	Knowledge on 'ideologically convenient' items (standardised)	Knowledge on 'ideologically convenient' items (standardised)	Knowledge on 'ideologically convenient' items (standardised)
EU referendum vote (ref. = Leave)			
Remain	-0.12*	-0.12*	-0.13*
Did not vote	-0.23***	-0.24**	-0.21**
Age group (ref. = 18-24)			
25-34		0.03	0.05
35-44		0.24+	0.25*
45-54		0.16	0.16
55-69		0.15	0.16
70+		0.03	0.02
Gender (ref. = Female)			
Male		0.06	0.03
Ethnicity (ref. = Non-white)			
White		0.09	0.07
Country of birth (ref. = Born abroad)			
Born in UK		-0.20+	-0.24*
Level of education (ref. = Below secondary)			
Secondary		0.07	0.06
Post-secondary		0.08	0.08
University degree		0.08	0.06
Occupational class (ref. = Routine or semi-rout.)			
Intermediate occupation		0.02	0.01
Manager or higher grade professional		0.16+	0.13
Other		0.06	0.05
Geographical region (ref. = North East England)			
North West England		0.25	0.24
Yorkshire & Humber		0.26+	0.27+
East Midlands		0.07	0.07
West Midlands		0.17	0.17
East of England		0.12	0.13
London		0.13	0.11
South East England		0.33*	0.33*
South west England		0.19	0.18
Wales		0.30+	0.24
Scotland		0.03	0.11
Northern Ireland		0.08	0.09
Probability reasoning score (standardised)			0.03
Political interest (ref. = Not at all interested)			
Not very interested			-0.13
Fairly interested			-0.09
Very interested			0.04
Party identity (ref. = Labour)			
Conservative			0.04
Lib Dem			0.18
UKIP			0.15
SNP			0.05
Green			-0.34**
Other/Don't know/Prefer not to say			-0.05
National identity (ref. = British)			
English			-0.05
Welsh			0.12
Scottish			-0.2
Northern Irish			0.17
Irish			-0.29
European			0.05
Other			-0.15
Unweighted <i>n</i>	2,892	2,892	2,892
<i>R</i> <sup>2</sup>	0.01	0.03	0.05

Notes: Entries are coefficients from OLS models. 'ref.' denotes the reference category for each variable. Standard errors are omitted for the sake of brevity. Sample weights were applied. Significance levels, based on robust standard errors: + 10%, \* 5%, \*\* 1%, \*\*\* 0.1%.



**Figure 1.** Distributions of observed scores and scores expected under guessing.

Notes: Expected scores were simulated using the 'rbinomial' function in *Stata*.