What sort of Brexit do the British people want? A longitudinal study examining the 'trade-offs' people would be willing to make in reaching a Brexit deal

Abstract: In a referendum in March 2016, the British public voted by a margin of 52 per cent to 48 per cent to leave the European Union. Unfortunately, the referendum question provides little information on the sort of relationship Britons desire with the EU. The purpose of this study is to use stated choice experiments (CEs) to understand and quantify what aspects of the relationship between Britain and the EU are important to the public and what trade-offs they would be willing to make. The CEs are undertaken with a random probability sample of the public at two points in time, 2017 and 2018, to allow us to explore how preferences might have changed over time. We developed a series of discrete choice models ranging from Scaled Multinomial Logit models (SMNLs) to Latent Class models (LCMs) to understand and quantify public preferences and to explore how they vary across the population. The results are used to assess how positively or negatively the public value different plausible Brexit negotiation positions.

Keywords: Brexit; stated choice experiments; discrete choice modelling; political science; longitudinal study.

1. Background of the study

In a referendum in March 2016, the British public voted by a margin of 52 per cent to 48 per cent to leave the European Union. Unfortunately, the referendum question provides little guidance on the sort of relationship Britons desire with the EU. Moreover, it encouraged the view that the UK's relationship with the EU was a binary choice, that there was one simple thing called 'Leave' and another simple thing called 'Remain'. In reality, a number of possible options exist for the UK's relationship with the EU, ranging from full membership (which may itself not be a static option as the EU continues to evolve) to having no formal relationship at all. A country can be outside the decision-making structures of the EU and yet be a member of its Single Market, or of its Customs Union, or of both.

But these intermediate relationships require trade-offs and compromises, as illustrated by the variety of existing arrangements the EU has with other countries. The EU insists that a country cannot be a full member of the Single Market without accepting freedom of movement of people. And that a country cannot be a member of the Customs Union and retain an unrestricted power to make its own trade deals. Discussion of these trade-offs was not prominent in the debate leading up to the referendum vote and, in the months since, there has been little discussion of how they might play out in creating different kinds of relationships with the EU.

The purpose of this study is to go beyond the political rhetoric, starting from the premise that compromises will have to be made, and to try and understand what the British public think about these trade-offs. This study uses stated choice experiments (CEs) to explore and quantify what is important to the public regarding Britain's relationship with the European Union (EU).

To date, CEs have not been widely used to explore political issues (Hainmüller et al. 2014). Hainmüller and Hopkins (2014) used a choice experiment to quantify American's preferences for the characteristics of immigrants. The experiment tested the influence of nine immigrant attributes in generating support for admission to the US, finding attributes like education level and profession, for example being a research scientist or doctor favourably. In a study closer to the context of our study,

Dermont and Stadelmann-Steffen (2019) conducted a three-wave survey, each including a choice experiment to quantify voters' preferences for a change in energy policy in Switzerland that was tested through a referendum. The experiments were described by the energy source (hydro power or not and presence of nuclear power options), source of funding for measures, energy and funding policy measures, additional costs, exceptions and the position of differing political parties. Interestingly, they found that the proportion of undecided voters decreased as the voting day drew closer, presumably because more people became informed of the issues. Further, they found that rarely did the campaign change an already formed option about energy law. Only very few voters altered their vote intention over the period of study.

The present study applies CEs to understand and quantify a population's preferences for a country's future relationship with other countries based on a large and national representative sample. The CEs incorporate trade-offs which are highly political and about which the population are very divided. We know of only one other attempt to use this form of analysis in these circumstances (Hobolt, Leeper and Tilley 2017), a paper that did not use the range of models or attempt as clear a quantification as the one we offer here. For the present study, we have survey responses at two points in time - 2017 and 2018 - allowing us to explore how preferences have changed over time. We develop a series of discrete choice models ranging from Scaled Multinomial Logit models (SMNLs) to Latent Class models (LCMs) to understand and quantify public preferences and to explore how they vary across the population, specifically focussing on variation across observed voting patterns in the referendum. We use the results to assess how positively or negatively the public values different plausible Brexit negotiation positions.

The remainder of the paper is organised as follows. Section 2 briefly describes the thinking behind and the design of the choice experiments and survey questionnaire. Section 3 summarises the data collection. Section 4 sets out the theoretical basis for discrete choice models, Latent Class models and the methodology for calculating attribute values and values for different negotiating positions. Section 5 compares model results for different model formulations and provides values for key attributes and levels. Section 6 concludes the paper with a discussion of its policy implications.

2. Research method

2.1 Limitations of revealed preference data on the 2016 referendum

The 2016 referendum in effect generated revealed preference (RP) information about people's preferences for Britain's relationship with the EU. Specifically, people answered the question:

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

While RP data is considered the most accurate approach for measuring people's behaviour (see Harrison, 2014), there exists a number of important shortcomings in the use of this information in this case.

The main problem is that while 52 per cent of voters voted to leave the EU, this information does not tell us anything about the sort of relationship the population desire in the future. As noted above, there are a range of relationship options that might constitute 'leaving the European Union' and the referendum result provides no information about which of these was considered most desirable.

Moreover, each vote reflects a decision about a preference between two perceived packages of outcomes but does not tell us how a voter would rank other more detailed options were those packages to be unravelled for the purpose of deciding what to do next. For example, a voter who ranked 'leave' above 'remain' might nevertheless rank 'remain' above leaving with no formal relationship with the EU's Single Market or Customs Union and a voter who voted 'remain' might rank leaving with membership of both the Single Market and the Customs Union above remaining. Voters might have assumed when choosing between 'leave' and 'remain' that leaving with no relationship was a very low probability event but if faced with that prospect of no relationship as an option in its own right would reject it. Conversely, a voter who voted remain might have considered a leave option consisting of both Single Market and Customs Union membership to be have been a very low probability event but faced with leaving on precisely those terms might prefer them to remaining.

Further, a referendum of this kind can only reveal a respondent's first preference, but in achieving the kind of compromise that is required to reach a Brexit deal, it is important to understand what people would be willing to accept, even if it is not their first choice. This is where stated choice experiments (CEs) can provide a richer insight - by asking people to trade-off between different aspects of a future relationship, we can provide an evidence base to help break through the polarisation which dominates the discourse around Brexit.

In addition, voting in referendums might be subject to gaming. Summarising research evidence on referenda voting patterns, Hobolt (2016) identifies two sorts of voting behaviour: an 'issue-voting' approach, where individuals vote on the basis of their values and beliefs and a 'second-order' approach where voters use their vote as a means of signalling their dissatisfaction with the government or domestic political class more generally. She concludes that the Brexit vote was, at least in part, driven by populist attitudes and a general dissatisfaction with the 'political class' or the 'elite' and that voters may have used the ballot to punish them. In a decision about what to do next, that populist urge might fall away, or might not.

In analysis of people's voting behaviour for the referendum, Clark et al. (2017) find a mixture of drivers for people's choices, including explicit assessment of the cost and benefits of the different choices (to leave or remain), risk assessment and emotional reactions to EU membership. Models for cost-benefit calculations and risk assessments pointed to the strong influence of negative attitudes towards immigration as well as loss of economic sovereignty and national identities. However, they also note the important influence of other cues, specifically images of leaders of the Remain and Leave campaigns, in people's voting decisions.

2.2 Specification of choice experiments and their attributes

In this study, we use CEs to quantify people's preferences for Britain's relationship with the EU to overcome many of the shortcomings of the EU referendum. The CEs explicitly explore the importance of specific aspects of the relationship between the UK and the EU. The choices in the experiments are described by relevant attributes, so it is clear to respondents what the relationship entails. The description of attributes and their levels and the choice structure is specified to minimise bias (as discussed below). Our aim is to strip out the influence of gaming and other cues and to ask people to focus on trade-offs between key attributes – the assessment of costs and benefits identified by Clark et al. (2017) - that describe the future relationship between the UK and the EU.

However, we acknowledge that a key drawback of the CE approach is that the data is generated from what individuals state they would do in hypothetical situations, not from real-world choices (i.e. Hypothetical bias, see Carlsson et al., 2005; List et al.,2006). We emphasise that our aim is not to predict how people may vote, for example in a second referendum, but rather to help understand the relative importance of key dimensions that will form part of the UK's future relations with the EU. We also acknowledge the criticism since the results are derived from hypothetical choices, including not from real payments, they may overestimate people's willingness-to-pay. We therefore use the valuations to quantify the ***relative*** importance of the attributes and to provide only an order-of-magnitude estimate of the value of different relationship options to citizens.

We identified seven attributes for inclusion in the experiments, as shown in Figure 1 based on their relevance to the population and the plausible options the UK faced. They were movement of people (treated separately for holidays and working and living), ability to make trade deals outside the EU, trade in goods and services within the EU (again treated separately), sovereignty (the degree to which the UK is able to make its own laws) and contributions to the EU budget. Each attribute was described by between two and four levels, reflecting different possible options for each attribute. The first level reflects the pre-referendum status quo, namely the value of remaining in the EU, except for the contribution attribute, in which the second level is the status quo.

The attributes and levels were developed at an expert seminar in November 2016 involving academics beyond the project team. Fields of expertise included European and EU politics, EU law and European and British history. We focussed on including those attributes that were judged to be most important to the population and that were important in terms of the UK's relationship with Europe. We judged that seven attributes was the maximum that could be considered in the choice experiments. This was confirmed by respondent's assessments of the complexity of the experiments (discussed later). One issue that emerged as important in the negotiations between the UK government and the rest of the EU was keeping completely open the border between Ireland and Northern Ireland. We were not able to include the border issue as an attribute. The Irish border issue, although crucial in terms of international relations, was far less significant than other issues for British voters (YouGov 2018).

A key assumption in the definition of the attributes and levels is ***reciprocity***. For example if work visas would be required for European citizens to work in the UK, we assume visas would also be required for Britons to work in EU countries. To date this has been a key component of any position considered for negotiation, albeit one not explicitly considered in other studies, including by the Hobolt study (Hobolt, Leeper and Tilley 2017).

The precise effects of many of the attributes remain controversial and so we eschewed any attempt to tell respondents what they might be. For example, we did not assess whether being able to make free trade deals without the EU would be more or less successful for the UK.

Figure 1 Attributes and levels tested in the 2018 experiments

Attribute	Level			
	1	2	3	4
Freedom of movement for holidays	UK citizens can go on holiday to any EU country and can use health services in emergencies. People from EU countries have the same rights in the UK.	UK citizens can go on holiday to any EU country, but need health insurance for emergencies. People from EU countries have the same rights in the UK.	UK citizens need a visa to go on holiday to any EU country and need health insurance for emergencies. People from EU countries have the same rights in the UK.	
Freedom of movement for living and working	UK citizens can move to other EU countries to look for work and to work. They can use public services and qualify for benefits on the same basis as locals. Students and retired people can live in other EU countries and use their health services on the same basis as locals. People from EU countries have the same rights in the UK.	UK citizens can go to other EU countries to look for work and to work, but they can access public services only if they have a job in the EU. People from EU countries have the same rights in the UK.	UK citizens need a work permit to work and access public services in the EU. People from EU countries have the same rights in the UK.	
Net contribution to EU budget (taking account of the UK rebate and EU spending in the UK)	The UK government spends £772 billion per year. £18 billion of that goes to the EU (about £13 per household per week).	The UK government spends £772 billion per year. £10 billion of that goes to the EU (about £7 per household per week).	The UK government spends £772 billion per year. £5 billion of that goes to the EU (about £3.50 per household per week).	The UK government spends £772 billion per year. No payment goes to the EU.
Free trade deals outside the EU	The UK can only make trade deals with countries outside the EU when EU countries are also part of the deal.	The UK can make its own trade deals with countries outside the EU.		
Free trade of services in the EU	UK financial institutions are able to provide services in EU countries and EU businesses are able to provide services in the UK. For example, UK banks can operate in Spain and Spanish banks can operate in the UK.	UK financial institutions are not able to provide services in EU countries and EU businesses are not able to provide services in the UK. For example, UK banks cannot operate in Spain and Spanish banks cannot operate in the UK.		
Free trade of goods in the EU	UK businesses can sell goods to people in EU countries without extra costs or barriers. EU businesses have the same rights in the UK.	UK businesses face some extra costs when they trade goods in the EU. EU businesses face the same costs to trade goods in the UK.	UK businesses face high costs when they trade goods in the EU. EU businesses face the same costs to trade goods in the UK.	
Sovereignty	The UK makes most of its own laws, but is subject to EU laws in some areas, for example, trade, employment, the environment and consumer protection.	The UK makes most of its own laws, except around trade, where EU laws apply.	The UK makes all of its own laws.	

Note that the attribute level for Freedom of movement for living and working in the 2018 experiments was extended to say 'to look for work and to work' rather than 'to look for work' only, as in the 2017 experiments.

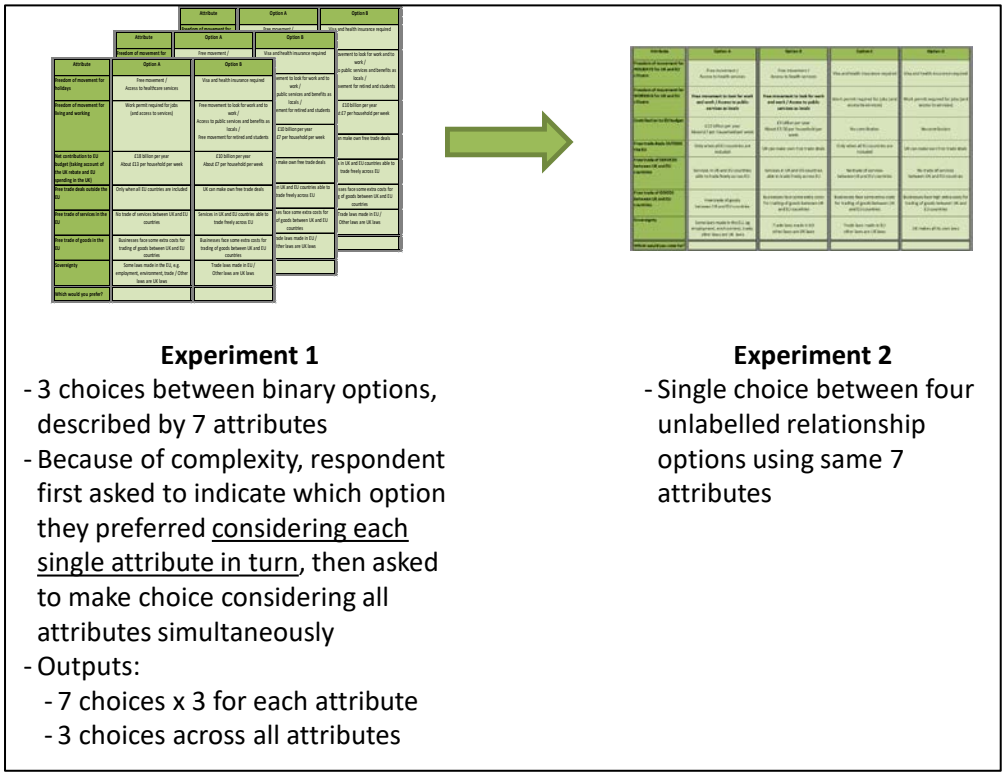
Determining the size or potential size of budget contributions to the EU for different relationship models was difficult (Rohr et al. 2017, Lu et al 2018). Where possible we used official data, but considerable uncertainties remain, and we urge caution in interpreting them as anything more than indicative amounts. Because of this uncertainty and the substantial variation in contributions from one year to the next, all figures have been rounded. The current contribution level was estimated based on the annual total contribution. Both the total contribution and average weekly contribution per household are presented in the experiments. For comparative purposes, total government expenditure was also presented in the experiments (HM Treasury 2016). To reduce the complexity of the experiment, however, only the EU contribution was varied, not the total government budget. In the experiments both increases and reductions in the contribution levels were tested.

The attributes and levels were tested in a variety of settings and with different sections of the public in January 2017 as part of a wider project on public engagement about Brexit in the East of England (Barnard and Ludlow 2017). The aim of the tests was to explore whether the survey and choice experiments were understandable, whether any attributes were missing and whether people were able to make choices described by these attributes. As a result of this exercise we changed the descriptions of some attributes, but no attributes were added or dropped. As part of the 2018 data collection exercise, we again reviewed the attribute level descriptions and made minor amendments (for clarity) to the 'freedom of movement for living and working' attribute.

2.3 Choice experiment design

Respondents participated in two experiments as illustrated in Figure 2. The aim of the first experiment was to quantify the importance of different attribute levels and to explore how importance for those varied across the population. The second experiment was a single choice from a fixed set of options to explore preferences for specific relationship options.

Figure 2 Structure of the choice experiments



In the first experiment, respondents were presented with three binary choices – each with two hypothetical post-Brexit options derived from combinations of the seven attribute levels. Orthogonal design was used to generate the binary choices. Due to the complexity of the first experiment – in terms of both the number of attributes and their abstract nature – respondents were first asked to indicate which option they preferred considering levels for each single attribute in turn, using the longer text description as shown in Figure 1. For example, they were asked to assess which option for freedom of movement of holidays they would prefer: free movement with access to healthcare services, or needing a visa and health insurance for travel. They were then asked to indicate which level they preferred for freedom of movement for living and working, for the net contribution to the EU, for trade deals and so on.

This allowed respondents to become familiar with the attribute levels using the detailed text. After the last attribute choice was presented in this manner, respondents were asked to consider all attribute levels together and indicate which option they would prefer overall. To simplify the presentation, a reduced-text version of the attribute levels was used for the full choice trade-off. An example choice is shown in Figure 3.

Figure 3 Binary choice example, experiment 1

Attribute	Option A	Option B
Freedom of movement for holidays	Free movement / Access to healthcare services	Visa and health insurance required
Freedom of movement for living and working	Work permit required for jobs (and access to services)	Free movement to look for work and to work / Access to public services and benefits as locals / Free movement for retired and students
Net contribution to EU budget (taking account of the UK rebate and EU spending in the UK)	£18 billion per year About £13 per household per week	£10 billion per year About £7 per household per week
Free trade deals outside the EU	Only when all EU countries are included	UK can make own free trade deals
Free trade of services in the EU	No trade of services between UK and EU countries	Services in UK and EU countries able to trade freely across EU
Free trade of goods in the EU	Businesses face some extra costs for trading of goods between UK and EU countries	Businesses face some extra costs for trading of goods between UK and EU countries
Sovereignty	Some laws made in the EU, eg employment, environment, trade / Other laws are UK laws	Trade laws made in EU / Other laws are UK laws
Which would you prefer?		

The second experiment included one choice scenario between four possible negotiation positions, broadly resembling: remaining in the UK, joining the EEA (that is remaining in the EU's single market but not its Custom Union), remaining in the Customs Union but not the Single Market, and no deal, i.e. falling back on WTO regulation. Figure 4 shows this choice scenario. It is emphasised that none of the options was labelled, using labels that are commonly used in the media, like a 'soft' Brexit, a 'hard' Brexit, etc., but rather were described solely by the relevant attributes to force people to make trade-offs between the attributes describing the alternatives and reduce the chance of bias.

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Figure 4 Full choice scenario, experiment 2

Attribute	Option A	Option B	Option C	Option D
Freedom of movement for HOLIDAYS for UK and EU citizens	Free movement / Access to health services	Free movement / Access to health services	Visa and health insurance required	Visa and health insurance required
Freedom of movement for WORKING for UK and EU citizens	Free movement to look for work and work / Access to public services as locals	Free movement to look for work and work / Access to public services as locals	Work permit required for jobs (and access to services)	Work permit required for jobs (and access to services)
Contribution to EU budget	£10 billion per year About £7 per household per week	£5 billion per year About £3.50 per household per week	No contribution	No contribution
Free trade deals OUTSIDE the EU	Only when all EU countries are included	UK can make own free trade deals	Only when all EU countries are included	UK can make own free trade deals
Free trade of SERVICES between UK and EU countries	Services in UK and EU countries able to trade freely across EU	Services in UK and EU countries able to trade freely across EU	No trade of services between UK and EU countries	No trade of services between UK and EU countries
Free trade of GOODS between UK and EU countries	Free trade of goods between UK and EU countries	Businesses face some extra costs for trading of goods between UK and EU countries	Businesses face some extra costs for trading of goods between UK and EU countries	Businesses face high extra costs for trading of goods between UK and EU countries
Sovereignty	Some laws made in the EU, eg employment, environment, trade, other laws are UK laws	Trade laws made in EU other laws are UK laws	Trade laws made in EU other laws are UK laws	UK makes all its own laws
Which would you vote for?				

Note that in the 2018 iteration the attribute level for Freedom of movement for living and working for Option A and Option B was extended to say, 'to look for work and to work' rather than 'to look for work' only, as in the 2017 experiments.

2.4 Other background questions

Due to the budget limitation, we were limited to a maximum survey length of 10 minutes. This allowed for three binary choice scenarios, the one 4-choice experiment, plus some follow-up questions on respondents' understanding of the choices (for example, the ease of undertaking the choice task and the ease of making the decision).

Data on gender, age, social grade, education level, household type, economic activity, home ownership and home location (region), as well as interest in politics, political party identification, whether the respondent voted in the referendum and how they voted were provided from other information collected in the British Social Attitudes survey

3. Sample description and data collection

3.1 Sampling approach and data collection

Given the prominence of the topic, it was very important that the survey used a representative sample of the general public. Both the 2017 and 2018 surveys were undertaken with a sample from the British Social Attitudes (BSA) survey, a random probability sample, which is representative of the adult population of Great Britain in terms of gender, age and Government Office Region (GOR) (NatCen/BSA n.d.), excluding Northern Ireland.[1] In addition to the strength of using a random probability sample, two other features distinguish the BSA method from others used in polling. First it uses both web and telephone field work (to boost response rates and provide coverage of those who have no access to the internet). Second it uses a longer fieldwork period to ensure everyone has an opportunity to take part, not just those who are 'readily available'. The BSA survey has some limitations; for example, it under-represents those under 35 years of age and those in larger households (see Curtice, 2016).[2] BSA data are therefore reweighted to reflect the age and gender (though not the social class) profile of the population.

The 2017 surveys were conducted in February 2017 using half of the BSA panel. All members in the half panel were approached to participate in the survey – no quotas were used – thus maintaining the random probability design. The respondents from the same half panel were approached to participate again in the 2018 survey. The fieldwork period lasted one month each year to allow repeated attempts to contact the selected individuals to secure their participation. The total number of interviews conducted in 2017 and 2018 survey is as shown in Table 1.

Table 1 Number of survey responses, by year

Survey/Wave	Responses
2017, Wave 1 (2 February–3 March)	917
2018, Wave 2 (19 April–20 May)	916
Completed Wave 1 and Wave 2 (referred to as the 'common' sample)	752

[1] More information on the recruitment of the sample and the survey process is available at: http://bsa.natcen.ac.uk/media/39018/random-sampling.pdf

[2] Larger households are underrepresented in the BSA before weighting because one individual per household is randomly selected. This means that someone living in a single-person household has a five-times-higher probability of selection compared with someone in a five-person household. This is accounted for in the weighting, which also corrects for underrepresentation of younger people – related to non-response bias.

Proportion of sample interviewed in both 2017 and 2018	82%

Of those who completed the 2017 survey, 752 (82 per cent) also participated in the 2018 survey (they are referred here as the 'common' sample). In the 2018 wave, additional efforts were made to encourage participation among those who are typically under-represented in surveys. In both rounds, a £5 'Love2shop' gift card was sent as a 'thank you' to those who participated in the survey. Given that a great deal is known about panel members from the BSA interview, it was possible to apply a relatively sophisticated weight to account for non-response (see Lu et al. 2018 for more details).

3.2 Socio-economic characteristics

Weights for both years' samples are used to ensure that the reweighted sample is representative of the population across the measured socioeconomic characteristics. Table 2 presents the socio-economic characteristics of the weighted sample for both 2017 and 2018. The 2018 survey sample showed very similar characteristics to the 2017 sample. The weighted samples match BSA population estimates well (comparisons can be found in Lu et al. 2018).

Table 2 Survey sample socio-economic features (weighted sample)

	2017	2018		2017	2018
Sex			**Economic activity**		
Male	49%	49%	Full-time education	4%	4%
Female	51%	51%	Paid work	58%	59%
Age			Unemployed	5%	5%
18–24	9%	11%	Retired	22%	21%
25–34	19%	20%	Other	11%	11%
35–44	16%	16%	**Region**		
45–54	19%	19%	North East	5%	5%
55–64	14%	14%	North West	11%	11%
65+	23%	21%	Yorkshire and The Humber	8%	8%
Household type[2]			East Midlands	7%	8%
Single-person household	17%	17%	West Midlands	9%	9%
Lone parent	4%	5%	East of England	9%	10%
2 adults (no children)	36%	35%	London	13%	13%
2 adults (with children)	21%	22%	South East	15%	14%
3+ adults (no children)	15%	16%	South West	9%	9%
3+ adults (with children)	6%	6%	Wales	4%	4%
Highest level of education			Scotland	9%	8%
Degree	25%	26%	**Tenure**		
Higher education below degree	11%	10%	Owned/being bought	63%	63%
A-level or equivalent	21%	21%	Rented (LA)	9%	8%
O-level/CSE or equivalent	25%	25%	Rented (HA/Trust/New Town)	8%	8%
Foreign or other	3%	3%	Rented (Other)	17%	18%
No qualifications	15%	15%	Other	2%	2%
Total respondents (n)	*917*	*916*		*917*	*916*

3.3 Political characteristics and voting patterns comparison

Both the 2017 and 2018 samples contain a higher proportion of people who are interested in politics and a slightly higher proportion of Conservative Party members compared to the BSA population estimate, although the figures are much more comparable when the weights are applied.

Table 3 Respondents voting patterns in referendum (weighted sample)

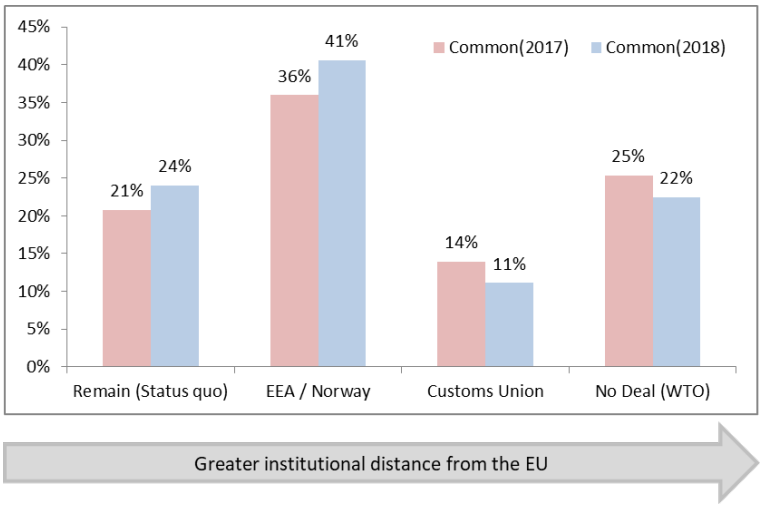
	2017	2018
Whether voted in EU referendum		
Yes	83%	86%
No	17%	14%
How voted in EU referendum (for those who voted)		
Remain a member of the European Union	49%	49%
Leave the European Union	51%	51%

Eighty-three per cent of individuals in the 2017 weighted sample and 86 per cent of the 2018 weighted sample reported that they voted in the referendum. Both figures are higher than the actual referendum turnout, consistent with the sample being more interested in politics than average. Excluding those who did not vote in the referendum, 51 per cent of the weighted sample reportedly voted to leave the EU in the referendum (referred to as Leavers throughout this paper) and 48 per cent reportedly voted to remain in the EU (referred to as Remainers throughout this paper), closely replicating the observed voting shares in the referendum (1 per cent refused to provide information on how they voted).

3.4 Preferences across the four Brexit options

Figure 5 summarises the distribution of respondents' choices in the second experiment (across the four unlabelled alternative choices). The proportion of respondents who selected Options A or B, i.e. those with closer ties to the EU, is higher in 2018 than in 2017, for both the whole sample and the common sample. Nearly two-thirds (66 per cent) of the population opt for EU membership, i.e. to Remain (Option A) or the EEA/ 'Norway-like' option (Option B), an increase of 8 per cent since 2017. The EEA/'Norway-like' option is the most preferred in both years. The second-most-preferred option changed from no deal (Option D) to EU membership (Option A). The least popular option in both years is a Customs Union-only (Option C).

Figure 5 Observed choices between the four Brexit options (weighted)



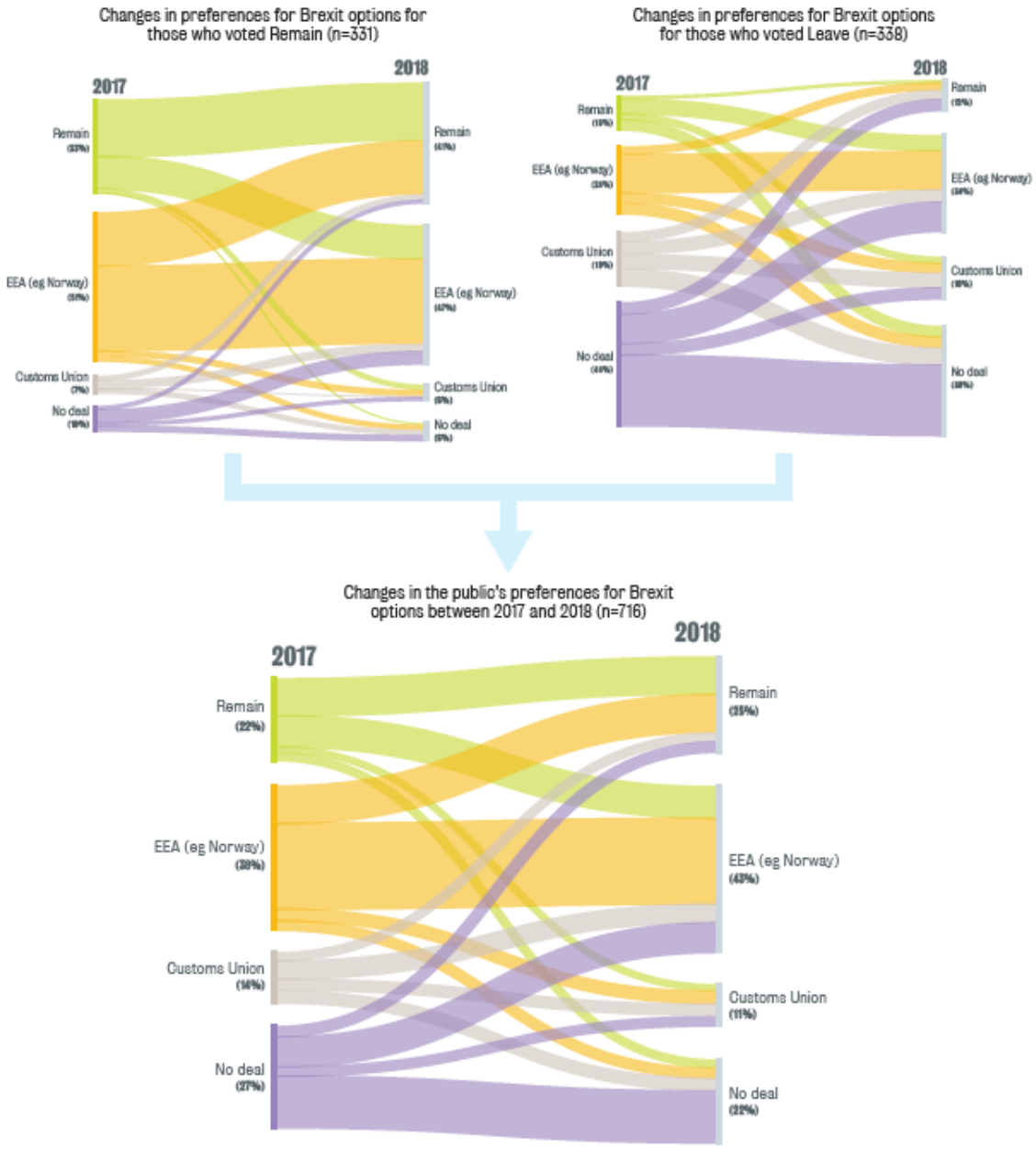
Nearly half of the common sample made the same choice as they did in 2017, specifically in the 2018 survey:

- 47 per cent of respondents made the same choice.
- 21.3 per cent selected a relationship with greater distance from the EU, i.e. a 'harder' Brexit.
- 28.7 per cent selected an option with a closer relationship with the EU, i.e. a 'softer' Brexit option or the status quo.

When looking at people's preferences for the different relationship options by how they voted in the referendum, we find that both Remainers and Leavers moved towards options with a closer relationship with the EU between 2017 and 2018.

Figure 5 shows graphically how choices in the second experiment changed between 2017 and 2018, both at an aggregate level and for those who voted Remain and those who voted Leave in the referendum.

Figure 6 Changes in voting preferences between 2017 and 2018 for four unlabelled options by declared voting patterns in the 2016 EU referendum



3.5 Respondents' understanding of the choice experiments

Respondents were explicitly asked a number of questions around their understanding and ability to undertake the choice experiments. 39.9 per cent of respondents reported that they found the Experiment 1 choice task difficult. The same pattern is observed in both 2017 and 2018. 50.6 per cent

of the respondents found it quite difficult to decide which option they preferred, indicating that this was not an easy choice to make. Across the sample, those who participated in both surveys did not feel that SP choices were any easier in 2018. 51 per cent of the common sample stated the survey was quite or very difficult in 2017, whilst the 54 per cent of the common sample stated that the choices were quite or very difficult in 2018.

While respondent's report that they find the choice tasks difficult (and they are difficult, both in terms of the abstract nature of the attributes and the number of attributes to consider), most indicated that they were able to understand and make the choices.

4. Discrete Choice Models

Discrete choice models (DCMs) were developed using the respondents' stated choices from the experiments. We have estimated all models using unweighted data (each observation has a weight of one) to achieve maximum statistical efficiency (Manski and Lerman 1977).

4.1 Multinomial Logit models

In a DCM it is assumed that the utility for each choice alternative is derived from underlying characteristics or attributes (Lancaster 1966). The prediction of a respondent's choice is represented by the Random Utility Model developed by McFadden (1973) and by Manski (1977), under which utility has a systematic and a random component. The random component may result from unobserved or unobservable attributes, unobserved taste variations, measurement errors or specification errors (Ben-Akiva & Lerman 1985). The basic tenet of discrete choice modelling is utility maximisation, that is, given a set of alternatives, each individual chooses the alternative that brings them the most utility. The estimation can therefore be conducted within the framework of random utility theory, thus taking into account that the analyst has only imperfect insight into the utility functions of the respondents.

Mathematically, the utility function for an alternative, i, being chosen (from a set of J alternatives) is decomposed into the systematic component, labelled $\mathrm{V_i}$, and a random component ε_i:

$$\boldsymbol{U_i = V_i + \varepsilon_i \forall J} \quad \textbf{(1)}$$

The observable part of the utility function ($\mathrm{V_i}$) for each alternative contains the characteristics of the alternatives (the attributes and levels from the choice experiment) and the individual, and can be written as:

$$V_i = \sum_k \beta_{ik} X_{ik} \; J \quad \textbf{(2)}$$

where β_{ik} are coefficients multiplying attributes in the choice experiment and background variables, i.e. $\mathrm{X_{ik}}$. The values of these may vary across alternatives (i) and individuals.

The assumption that the random components are distributed extreme value type 1 (EV1) enables the choice data to be analysed using the closed-form multinomial logit (MNL) model (McFadden 1974). This produces estimates of the model coefficients that best represent respondents' choices. The standard statistical criterion of maximum likelihood is used to define best fit. The model estimation provides both the values of the coefficients (in utility terms) and information on the statistical significance of the coefficients.

The MNL formulation reflects the probability of choosing alternative i from J alternatives as follows:

$$P_{ni} = \frac{e^{\mu V_{ni}}}{\sum_{n_{j \ni J}} e^{\mu V_{nj}}} \quad \textbf{(3)}$$

where μ is a strictly positive scale parameter.

The key assumption regarding the random component is not so much the shape of the distribution as that the errors are independent of each other. This independence means that the unobserved portion of utility for one alternative is unrelated to the unobserved portion of utility for another alternative. Further, the MNL exhibits independence from irrelevant alternatives, which implies proportional substitution between alternatives.

In the second choice experiment each respondent was presented with four alternatives (some of which might be considered as 'similar' in several different dimensions). We therefore tested nested model structures to test for correlation between alternatives, but we did not identify statistically significant nesting parameters. These results are therefore not presented in this paper.

4.1.1 Pooling data across experiments and years[3]

There is a long history of pooling data in order to use all available data to best understand choice behaviour (Morikawa, 1989; Bradley and Daly, 1991, Swait and Louviere, 1993; Hensher and Bradley, 1993; Ben-Akiva et al., 1994; Hensher et al., 1999; Ortuzar and Willumsen, 2002). Indeed, if we have a coherent view of behaviour, then the same mechanisms ought to be observed in different data sets. To make the best use of all of the choice observations, DCMs were developed pooling data across all of the experiments, jointly estimating parameters that are present in both experiments and incorporating scaling parameters to account for different error variance in each data set (Bradley and Daly, 1991), which includes:

- Choices from the first experiment (CE1):
  - seven attribute pair choices (over three unlabelled binary choices, lead to 21 choices in total)
  - three binary choices
- Choices from the second experiment (CE2): one choice from the four fixed alternatives.

In initial model tests, we found variations in the relative values for different attributes across the two rounds/years, however, the values were consistently within 1 or 2 standard deviations indicating that

[3] In the review of the paper, reviewers suggested that we simplify the analysis by presenting results for "experiment 1" choices only (3 choices between binary options described by 7 attributes) and leave out the choices across the different attribute levels (3 choices for each of the experiments, for each of the 7 attributes). In the spirit of addressing this issue, we have undertaken a series of model tests excluding data sets to examine the impact on model parameters. Specifically, we have estimated models using the binary choice data only from the first experiment: the total number of choice observations drops from 42,166 to 5,499 after removing the attribute choice data from the first experiment and the data from the second experiment. Reassuringly, the coefficients from the model using the binary choices are generally in line with model developed from the pooled dataset; but, unsurprisingly, the significance level of the coefficients drops significantly (and the model fit is worse, indicating that the capability of the model to interpret the stated choice behavior is worse). In addition, the reduced dataset would not support an estimation of the LCM model with the two classes with the same membership parameters. This additional analysis is included in the supplementary information provided.

people's preferences were not very different across years (see more details in Lu et al., 2018).[4] Thus we also pooled the data across years and estimated single coefficients for attributes across years.

Scale parameters for data collected from different experiments are measured relative to the scale for the 2017 SP1 binary choices. The scale parameters are inversely related to the square root of the error variance of each data set, so a scale parameter less than one indicates that the data set has a greater level of error variance compared to the reference data set. We name them scaled MNL model (SMNL) in the following analysis and results discussion.

During the model development we also undertook a series of tests to quantify the impact of survey data collection and respondents socio-economic characteristics on the error scales and found that education level (degree relative to no degree), survey year (2018 relative to 2017) and choice experiments (SP1 pairs and SP2 relative to SP1) showed significant impacts. Scaling terms have also been incorporated in the models for these variables.[5]

4.1.2 Attribute specification

In the model specification, all attributes, except for the contribution to the EU budget, are specified as categorical variables. Thus the resulting coefficients reflect the value of the attribute level relative to the base level (this level has a value of zero and is identified in the model results table).

The UK's contribution to the EU budget (measured in British pounds sterling [GBP] per household per week) is modelled as a continuous variable, with an additional constant on the zero-contribution level. The advantage of using a continuous variable is that it provides a measure to quantify the relative importance of all other attributes. Specifically, the ratio of the coefficients of the other attributes and the (continuous) coefficient for the contribution provides a relative measure of the trade-off between the attribute value and contribution to the EU and thus reflects a value of the attribute, in monetary terms.

We do not include alternative-specific constants (ASCs) on either of the binary choice alternatives (SP1), because no specific meaning is ascribed to the alternatives. However we do include constants for those who chose neither option (both in terms of the choices when looking at the specific attributes individually as well as when considering all attributes in the binary choice option).[6] Less than 2 per cent of choices were for neither option in SP1. ASCs are incorporated on the SP2 alternatives and these are measured relative to Option A, i.e. that which is closest to remaining in the EU.

4.2 Latent Class models (LCMs)

One of the aims of the study was to explore how preferences of attribute levels vary across the population. One of the key variables that explained differences in people's valuations of specific attribute in the pooled MNL models was how people voted in the referendum, i.e. whether they voted to leave or to remain (see Lu et al. 2018 for more details). For this paper we also explore how the

[4] It is not possible to undertake a formal statistical test for this because we were not permitted to identify individuals between the two survey years.

[5] Not all scales are significant; however these have been retained in the models for comparison purposes.

[6] A 'neither' option was not provided as part of the experiment, but some respondents did not choose either of the options in some scenarios.

models for Leave and Remain compare to a Latent Class model (LCMs). LCMs account for respondents' preference heterogeneity by assuming that the whole sample can be decomposed into a finite number of different segments or classes in the population. Some studies have found LCMs to be advantageous over mixed logit models that allow explicitly for coefficient heterogeneity (e.g., Greene and Hensher, 2003, Hess et al., 2011, Keane and Wasi, 2013, Hess 2014).

LCM structures assume the existence of 'S' segments or classes in the population, where the individuals within each group are characterised by homogeneous utility functions, while preferences differ between classes (Swait 1994, Swait and Sweeney, 2000, Boxall and Adamowicz, 2002, Greene and Hensher, 2003, Bujosa et al., 2010, Hess et al., 2011). The utility functions of respondents are only partially known to the researcher, and their true class membership is unobservable. Hence, an LCM consists of two separate probabilistic models estimated simultaneously: (1) a choice model that explains individuals' choice among the alternatives in the different choice scenarios, conditional on their membership to a specific class and (2) a class membership model that allocates the decision-makers to the S classes, e.g. based on their socio-demographic or attitudinal characteristics.

In the LCM structure, a probabilistic class allocation model is used, where respondent n belongs to class k with probability $\pi_{\mathrm{n,k}}$, and where $0 \leq \pi_{\mathrm{n,k}} \leq 1\mathrm{b}\ \forall \mathrm{k}$ and $\sum_{\mathrm{k}=1}^{\mathrm{K}} \pi_{\mathrm{n,k}} = 1$. Let $\mathrm{P_n(i|\beta_k)}$ give the probability of respondent n choosing alternative i conditional on respondent n falling into class k. The unconditional (on k) choice probability for alternative i and respondent n is then given by:

$$P_n(i|\beta_1, \dots, \beta_K) = \sum_{k=1}^{K} \pi_{n,k} P_n(i|\beta_k) \quad \textbf{(4)}$$

i.e. the weighted sum of choice probabilities across the K classes, with the class allocation probabilities being used as weights.

Then in the situation with multiple choices per respondent, the log likelihood is calculated by:

$$L_n\left(j_{n,1}, \dots, j_{n,T_n} \middle| \beta_1, \dots, \beta_K\right) = \sum_{k=1}^{K} \pi_{n,k} \sum_{t=1}^{T_n} P_n\left(j_{n,t} \middle| \beta_k\right) \quad \textbf{(5)}$$

Where $j_{n,t}$ gives the alternative chosen by respondent n in the choice scenario t, with T_n giving the total number of choices for respondent n.

The probability of respondent n falling into class k would be parameterised by the characteristics of the respondent n (such as socio-economic characteristics or attitudinal variables – shown by z_n), given by:

$$\pi_{n,k} = \frac{e^{\delta_{k+g(\gamma_k, z_n)}}}{\sum_{l=1}^{K} e^{\delta_{l+g(\gamma_l, z_n)}}} \quad \textbf{(6)}$$

Here δ_{k} is a class-specific constant, $\gamma_{\mathrm{k}}$is a vector of parameters to be estimated and $\mathrm{g}(\cdot)$ gives the functional form of the utility function for class allocation. The class allocation model takes on an MNL form.

In the final models we take account of correlation between responses from the same respondent in any one year. However, as we are not able to identify the common respondents in the 2017 and 2018 overall sample, we are not able to account for correlation between responses for the same individual who have participated both surveys over the two years.

4.3 Attribute values and values for different negotiating positions

From the discrete choice models we calculate the average value that respondents attach to an attribute level from the ratio of the attribute level coefficient and the coefficient on the (continuous) contribution to the EU budget (values are therefore measured in contribution to the EU budget in GBP per household). For the LCM, *a posterior* analysis (see Hess 2014) is undertaken to calculate the sample mean of values for each attribute level.

Using the contribution to the EU budget has a number of shortcomings for use for calculating valuations. First, the levels described the contribution to the EU assuming that the overall level of government expenditure was fixed. So, people may not see this as a saving at all. Second, some people may prefer to make a contribution because it signals a relationship with the EU; others may place a much more negative value on such a contribution, precisely because it is to the EU. We therefore use the valuations to provide information on the relative importance of different attributes, rather than as estimates of true value.

The values for the different attribute levels are then used to quantify the relative value of different Brexit negotiation positions. To calculate the relative value for each possible scenario, we firstly map the attribute level to the negotiation positions as closely as we can. For instance, for the no deal scenario, the 'freedom of movement for holidays' would be 'need a visa and health insurance; the freedom of movement for working and living would be 'need a work permit'. The overall value for each scenario is obtained by aggregating all the relevant attribute levels with the contribution to the EU budget levels.

5. Model findings

In this section we present the model results and compare the attribute valuations resulting from the models. We then present valuations for packages of attributes.

5.1 Model results

In Table 5 we present model results for four models:

SMNL: A scaled multinomial logit (SMNL) model without socio-economic covariates on the experiment attributes. It is noteworthy that we were able to identify significant socio-economic covariates – particularly in terms of education level (specifically having a university degree), country of birth and age – that had a significant impact on the value of some of the attribute values (see more details in Lu et al., 2018). However, for comparison purposes, here we focus on variation explained by referendum voting preferences, particularly whether the respondent voted to leave or to remain in the EU.

SMNL_remain: SMNL model without covariates, from respondents who (reportedly) voted Remain in the referendum.

SMNL_leave: SMNL model without covariates, from respondents who (reportedly) voted Leave in the referendum.

LC-2 classes: LCM model with 2 classes, with age, education and whether born in UK used in the class allocation model. We developed LCMs with 2, 3 and 4 classes, using a range of socio-economic factors in the membership allocation model. We found that in models with 3 and 4 classes some of the key parameters, for example contribution to the EU budget, were not statistically significantly estimated

and/or the class member for one class was very small (e.g. 2 per cent). Therefore we present results for the two-class model only. The important parameters that defined class members were age, education and whether the respondent was born in the UK. In the LCM the constants for the small number of those who did not select any of the choice alternatives and the scale parameters for pooling data are jointly estimated across classes.

5.1.1 Overall model performance

The model fit for each model is summarised in Table 4, showing the final log-likelihood (LL), alongside the number of parameters and the adjusted ρ^2 measure.[7]

Table 4 Model fit statistics

	SMNL (no cov)	SMNL_remain	SMNL_leave	LC-2 classes
Observations	42,166	20,261	17,083	42,166
Final Log-Likelihood	-26,373	-11,782	-9,619	-23,559
DOF	32	32	32	51
Adj. ρ^2	0.179	0.222	0.261	0.500

We are not able to directly test whether the segmentation into remain and leave significantly improves the model fit using a likelihood-ratio (LR) because we exclude those who did not vote and therefore the number of observations is not the same in total as in the SMNL (no cov) model. However, we do observe that the adjusted rho-squared value are higher in the models that incorporate only those who voted remain or those who voted to leave.

Further, we observe that the LC-2 class model is better than the SMNL (no cov) model, gaining in LL by 2814 units with 19 more parameters. The Log likelihood ratio test shows that the LC-2 class model is statistically significantly better than the SMNL (no cov) model ($\chi^2_{0.05}$ = 30.14 with 19 D.O.F).

5.1.2 The relative importance of different attribute levels

Table 6 presents the resulting valuations for each attribute level. The values of each attribute level are measured relative to the status quo (identified as the 'base' level in Table 5) and are measured in units of contribution to the EU budget in GBP per household per week. Positive values indicate the amount, in terms of contributions to the EU, that respondents would be willing to pay to secure that attribute level (relative to the status quo). Negative values indicate the amount, in terms of contributions to the EU, that respondents would be willing to accept as compensation for having to tolerate that attribute level (relative to the status quo).

SMNL (no cov) results

Relative to the status quo, needing both visa and health insurance for holiday travel is the most negatively valued attribute level, at -£16.50 per household per week. In general it is the trade deals and trade in goods and services attributes that are valued most, with high values placed on being able to make trade deals with countries outside of the EU and being able to provide services and sell goods (without extra costs) in the EU (attribute levels that, in practice, might not be obtainable at the same time).

SMNL_Remain/Leave models

[7] This is a further goodness of fit measure derived from the log-likelihood, which 'adjusts' for the number of parameters in the model

We observe that those who voted to Leave (Leavers) are much more sensitive to the level of contribution to the EU and thus their resulting valuations are lower.

Remainers (those who voted Remain in the referendum) value freedom of movement with access to healthcare and strongly and dislike the requirement for a visa for holiday travel. Relative to the status quo (free movement / can use health insurance) Leavers place the highest value on the requirement for health insurance for holiday travel, but also place a value on the requirement for visas (although the coefficient is not significant). Both Remainers and Leavers prefer to the status quo a situation in which EU citizens working and living in the UK (and UK citizens working in the EU) need a job to access public services. Leavers prefer a situation in which a work permit is required (again, relative to the status quo), whereas Remainers strongly dislike this option.

Both Remainers and Leavers favour options in which the UK can make trade deals with countries outside the EU without involving the EU. They also favour options where the UK can sell goods and services without any extra costs in the EU (and vice versa), although for Leavers, the impact is lower.

However, Leavers and Remainers have very different preferences regarding sovereignty. Leavers dislike being subject to EU laws in trade, labour, environment, etc., and particularly those without university degrees want the UK to make all its own laws. In contrast, Remainers favour being subject to EU laws in trade, labour, environment, etc., and dislike options where the UK makes all its own laws.

Latent Class model results

There are significant variations in all the coefficients across the two classes. From Table 6, Class 1 shows a strong aversion, relative to the status quo, to a more distant relationship with the EU for freedom of movement for holidays and for living and working and for sovereignty. In contrast, Class 2 shows a preference for a more distant relationship with the EU (although the parameter for value for needing a visa and health insurance is not significant at the 95% confidence interval). Although a similar pattern of preferences (in terms of both the sign and order of magnitudes) is observed for trade deals outside the EU, and trade of goods and services within the EU between class 1 and class 2, the magnitudes of the valuations are different. This is consistent with a higher value placed on the net contribution to the EU budget for those in class 2.

The pattern of the 2 class LC attribute level valuations are generally in line with those of the SMNL_Leavers and SMNL_Remainers models in terms of the signs of the attribute coefficients and the order of magnitude of the valuations. More specifically, the values of class 1 attribute levels are similar to those of the SMNL_Remainers model except for level 2 of the freedom of movement for living and working, where we observe differences in the signs. The attribute valuations for class 2 are similar to the SMNL_Leavers model across all the attribute levels. It is noteworthy that the sample shares are, however, different with class 2 reflecting a larger sample share than reflected by the Leavers sample. Notwithstanding this point, we find that the class described by respondents socio-economic characteristics is a strong differentiator in how people value the different attributes.

The three socio-economic variables examined (degree, born in UK and age) significantly explain the class allocation model, with class 2 being characterised by respondents who hold no university degree, who were born in the UK and are aged 65 or above**.** The class membership shares are calculated based on the three socio-demographic characteristics, as shown in Table 6.

Table 5 SMNL and LCM results

Coefficient	Description	SMNL (no cov)		SMNL_remain		SMNL_leave		LC - 2 classes			
		Estimate	rob t(0)	Estimate	rob t(0)	Estimate	rob t(0)	Estimate	rob t(0)	Estimate	rob t(0)
								Class 1		Class 2	
Freedom of movement for holidays											
holid1	Free movement /Can use health service (base)	0	NA	0	NA	0	NA	0	NA	0	NA
holid2	Need health insurance	0.15	5.2	-0.121	-3.1	0.532	11.3	-0.342	-5.5	0.531	8.4
holid3	Need a visa and health insurance	-0.565	-19.0	-1.053	-23.2	0.045	1.0	-1.541	-19.5	0.040	0.6
Freedom of movement for living and working											
livig1	Can go to EU countries for work and live (base)	0	NA	0	NA	0	NA	0	NA	0	NA
livig2	Need a job to access services	0.173	3.8	0.072	3.4	0.563	8.9	-0.097	-2.7	0.648	10.5
livig3	Need a work permit	0.053	3.4	-0.291	-4.9	0.486	8.2	-0.628	-7.7	0.651	9.0
Net contribution to EU budget											
contr	Contribution as a continuous variable	-0.034	-6.0	-0.015	-2.5	-0.076	-10.2	-0.020	-7.0	-0.071	-9.7
contr_C	Constant terms on the zero contribution	-0.229	-5.8	-0.211	-2.4	-0.126	-4.3	-0.481	-8.8	-0.108	-4.1
Trade deals outside the EU											
deals1	Can only make deals with EU (base)	0	NA	0	NA	0	NA	0	NA	0	NA
deals2	can make own trade deals	0.375	9.1	0.446	8.3	0.410	6.5	0.197	6.0	0.515	8.1
Free trade in services in the EU											
servi1	Able to provide service in EU (base)	0	NA	0	NA	0	NA	0	NA	0	NA
servi2	Not able to provide service in EU	-0.29	-7.1	-0.496	-9.1	-0.093	-1.5	-0.562	-5.5	-0.299	-6.9
Free trade in goods in the EU											
goods1	Can sell goods in EU (base)	0	NA	0	NA	0	NA	0	NA	0	NA
goods2	Face extra cost to sell goods in EU	-0.207	-11.0	-0.254	-9.1	-0.207	-6.9	-0.284	-7.4	-0.152	-6.6
goods3	Face high cost to sell goods in EU	-0.559	-12.1	-0.661	-10.2	-0.573	-7.8	-0.733	-7.5	-0.449	-8.3
Sovereignty											
svegn1	Subject to EU laws in trade, environment(base)	0	NA	0	NA	0	NA	0	NA	0	NA
svegn2	Subject to EU laws around trade	0.103	3.4	-0.268	-6.8	0.584	11.8	-0.594	-8.5	0.605	11.3
svegn3	UK makes all of its own laws.	0.181	5.8	-0.654	-16.3	1.279	23.4	-1.363	-12.5	1.256	17.8
Alternative specific constants for SP2 choice											
ASC_EEA	EEA/'Norway-like' deal – constant	0.201	2.4	0.254	2.6	0.190	1.2	0.618	0.6	0.434	2.9
ASC_CU	Customs Union constant	0.019	0.2	0.870	4.5	-0.415	-2.1	1.197	1.2	-0.482	-2.7
ASC_WTO	WTO – constant	0.736	6.6	1.320	6.8	-0.301	-1.4	1.463	1.5	-0.475	-2.4
Class membership parameters											
class_2_prob	constant term for the class 2									0.015	0.1

Bdeg	- with degree									-1.300	-11.3
Bukborn	- who were born in the UK									0.742	3.4
Bage	- who are aged 65 and plus									0.626	4.5
Constants on binary options where no choice was made											
None	Not select any options	-3.908	-28.2	-4.341	-23.5	-2.475	-13.8	-4.634	-19.6		
NoneEE	East England	0.857	3.4	0.000	n/a	0.000	n/a	1.033	2.6		
None_sveg	Pair choice – Sovereignty	-4.172	-25.2	-4.709	-16.2	-3.111	-15.0	-4.060	-21.1		
None_good	Pair choice – Goods	-0.784	-11.0	-0.857	-8.9	-0.908	-7.0	-0.766	-8.3		
None_serv	Pair choice – Services	-0.732	-6.7	-1.071	-7.6	-0.281	-1.5	-0.966	-6.2		
None_deal	Pair choice – Deals	-0.744	-7.0	-1.236	-5.9	-0.560	-4.0	-0.648	-6.1		
None_con	Pair choice – Contribution	-0.874	-5.9	-0.507	-2.4	-1.200	-9.6	-0.947	-10.1		
None_liv	Pair choice – Living and working	-1.007	-3.6	-1.710	-4.9	-1.304	-6.6	-1.747	-8.8		
None_holi	Pair choice – Holiday	-5.176	-21.7	-4.987	-15.3	-4.789	-13.0	-4.919	-20.0		
Scale parameters for pooling data			**rob t(1)***		**rob t(1)***		**rob t(1)***		**rob t(1)***		
Scale_18	Scale parameter for 2018 data	0.942	-3.4	0.933	-2.9	0.967	-1.4	0.979	-0.6		
Scale_17	Scale parameter for 2017 data (base)	1	NA	1.000	n/a	1.000	n/a	1.000	NA		
Scale_H	Scale parameter for respondents with degree	1.009	0.4	1.256	8.2	1.025	0.8	1.125	3.1		
Scale_B	Scale parameter for respondents with no degree (base)	1	NA	1.000	n/a	1.000	n/a	1.000	NA		
Scale_9	SP2	1	NA	1.000	n/a	1.000	n/a	1.000	NA		
Scale_8	SP1 - law_attribute	1	NA	1.000	n/a	1.000	n/a	1.000	NA		
Scale_7	SP1 - goods_attribute	7.332	10.0	6.720	8.2	6.222	6.3	7.250	7.5		
Scale_6	SP1 - service_attribute	7.22	6.0	4.438	6.8	20.013	1.4	5.160	5.3		
Scale_5	SP1 - deals_attribute	5.308	7.2	3.054	5.3	6.855	5.4	5.675	6.5		
Scale_4	SP1 - contribution_attribute	5.214	4.8	8.082	2.1	4.058	7.4	5.021	8.1		
Scale_3	SP1 - living_attribute	4.176	2.8	2.527	3.1	2.566	5.1	2.336	6.1		
Scale_2	SP1 - holiday_attribute	1	NA	1.000	n/a	1.000	n/a	1.000	NA		
Scale_1	SP1 binary choices (base)	1	NA	1.000	n/a	1.000	n/a	1.000	NA		

Table 6 Attribute level values (units = contribution to EU budget in GBP/household/week, 2016 values)

		SMNL (no cov)	SMNL Leavers/Remainers			LC1 - 2 classes		
		All	Remainers	Leavers	All	Class 1	Class 2	All
	sample share		**48%**	**52%**		**37%**	**63%**	
Holidays	Can use health service (base)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Need health insurance	4.4	-8.1	7.0	-0.2	-17.5	7.4	-1.7
	Need a visa and health insurance	-16.5	-71.0	0.6	-33.8	-79.0	0.6	-28.7
Working and living	Can go to EU countries for work and live (base)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Need a job to access services	5.0	4.9	7.5	6.2	-5.0	9.1	3.9
	Need a work permit	1.5	-19.6	6.4	-6.1	-32.2	9.1	-6.1
Trade Deals	Can only make deals with EU (base)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Can make own trade deals	10.9	30.1	5.4	17.3	10.1	7.2	8.3
Services	Able to provide service in EU (base)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Not able to provide service in EU	-8.5	-33.5	-1.2	-16.7	-28.8	-4.2	-13.2
Goods	Can sell goods in EU (base)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Face extra cost to sell goods in EU	-6.0	-17.1	-2.7	-9.6	-14.6	-2.1	-6.7
	Face high cost to sell goods in EU	-16.3	-44.6	-7.6	-25.3	-37.6	-6.3	-17.8
Sovereignty	Subject to EU laws in trade, environment(base)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subject to EU laws around trade	3.0	-18.1	7.7	-4.7	-30.5	8.5	-5.9
	UK makes all of its own laws.	5.3	-44.1	16.9	-12.4	-69.9	17.6	-14.6

5.2 Using the model outputs to calculate the values for different negotiating positions

The values for the different attribute levels can be used to quantify the relative value of different Brexit negotiation positions. To calculate the relative value for each possible negotiation scenario, we firstly map the attribute level to the negotiation positions. The overall value for each scenario is obtained by aggregating all the relevant attribute levels with the contribution to the EU budget levels.

5.2.1 The value of 'no deal' compared to 'status quo'

We can calculate the value of 'no deal' compared to 'status quo', namely remaining in the EU, by summing the relevant attribute levels (see Table 7 for details) as well as taking account of savings in contribution to the EU budget. The valuations are in units of contribution to the EU budget. While the population perceive some positive benefits of a 'no deal' option, in terms of being able to make trade deals with countries outside the EU, these are outweighed by the negative aspects of needing a visa[8] (and health insurance) for travel and added costs of access to the EU market for goods and services.

Comparing the valuations from the models, the value of a 'no deal' option to the public is in the SMNL joint models about £13.50-£16.50 per household per week worse than the current relationship with the EU. In other words, the average household would want around £13.50-£16.50 per week in EU contributions to compensate it for the loss of EU membership without any kind of deal about the UK's future relationship with the EU. The overall values calculated from the Leavers and Remainers model and the LC models are much lower at around £60 per household per week worse than the 'status quo' option.

5.2.2 The value of 'EEA/Norway-like' compared to 'status quo'

The value of an EEA/'Norway-like' deal is about £11 per household per week ***more valuable*** (in EU contributions) than the current relationship with the EU from the SMNL joint model (see detailed calculations in Table 8). This is largely a result of the ability to make trade deals with countries outside of the EU without the EU. It is noteworthy that in the SMNL_Leave/Remain model and the LC model the values for 'EEA/Norway-like' are slightly lower, especially for the LC model where the overall value is very close to zero due to the lower value of the free trade in goods and especially sovereignty (subject to EU laws around trade) , indicating that respondents treated this option similar as remaining in the EU option.

5.2.3 The value of 'EEA/Norway like' compared to 'no deal'

The value of a EEA/'Norway-like' deal from the SMNL joint model is about £25 per household per week (in EU contributions) higher than a 'no deal' option (see detailed calculations in Table 9), largely as a result of not needing visas for travel and businesses being able to provide goods (albeit at some extra cost because of non-membership of the Customs Union) and services in the EU. For the SMNL_Leave/Remain model and the LC model, the values are much higher, at over £60 per household per week. Negatively valued aspects of the EEA/'Norway-like' option include freedom of movement for working and living, being subject to EU laws around trade and EU contributions, but these are far outweighed by the positive aspects.

[8] Although visa-free travel might be available, the ETIAS system will apply to UK nationals, reproducing many of the effects of a visa system.

Table 7 The value of 'no deal' compared to 'status quo' (units = contribution to EU budget in GBP/household/week)

Attribute level for 'no deal' compared to 'status quo'	SMNL (no_COV)	SMNL_Leave/Remain	LC_2classes
Freedom of movement for holidays: Need a visa and health insurance	-£16.47	-£33.80	-£28.72
Freedom of movement for working and living: Need a work permit	£1.54	-£6.10	-£6.07
Trade deals outside the EU: Can make own trade deals	£10.91	£17.30	£8.29
Free trade of services in the EU: Not able to provide service in EU	-£8.45	-£16.70	-£13.25
Free trade of goods in the EU: Businesses face high costs to sell goods in EU	-£16.27	-£25.30	-£17.82
Sovereignty: UK makes all of its own laws	£5.26	-£12.40	-£14.59
EU contribution (savings)*	£10.00	£10.00	£10.00
Total (£/household/week)	-£13.50	-£67.00	-£62.15

* It is not straightforward to estimate the EU contribution. The value of £10 per household per week approximately represents the UK's net payment to the EU budget, i.e. gross contribution minus the rebate. However, it does not take account of the moneys received by the public sector from EU spending programmes or UK private-sector receipts from the EU, which would reduce the savings, increasing the negative value attached to the 'no deal' option.

Table 8 The value of 'EEA/Norway like' compared to 'status quo' (units = contribution to EU budget in GBP/household/week)

Attribute level for 'EEA/Norway like' 'compared to 'status quo'	SMNL (no cov)	SMNL_Leave/Remain	LC_2classes
Freedom of movement for holidays: Can use health service in the EU countries	£0.00	£0.00	£0.00
Freedom of movement for working and living: Can go to EU countries for work/living	£0.00	£0.00	£0.00
Trade deals outside the EU: Can make its own trade deals	£10.91	£17.30	£8.29
Free trade of services in the EU: Able to provide service in EU	£0.00	£0.00	£0.00
Free trade of goods in the EU: Businesses face some extra costs to sell goods in EU	-£6.03	-£9.60	-£6.71
Sovereignty: Subject to EU laws around trade	£2.99	-£4.70	-£5.85
EU contribution (savings)*	£3.50	£3.50	£3.50
Total (£/household/week)	**£11.38**	**£6.50**	**-£0.77**

* Norway's annual EU payments are estimated as £140/person, compared to £220/person for Britain (Full Fact 2016). This figure does not take account of how much Norway gets back from the EU (see Subsection 2.1.2 for a discussion of the Norwegian contribution figures). This is converted to an approximate contribution of £6.50 per household per week, which is a saving of £3.50 per household compared to the status quo.

Table 9 The value of 'EEA/Norway like' compared to 'no deal' (units = contribution to EU budget in GBP/household/week)

Attribute level for 'EEA/Norway like' compared to 'no deal'	SMNL (no cov)	SMNL_Leave/Remain	LC_2classes
Freedom of movement for holidays: Can use health service in the EU countries	£16.47	£33.80	£28.72
Freedom of movement for working and living: Can go to EU countries for work/living	-£1.54	£6.10	£6.07
Trade deals outside the EU: Can make its own trade deals	£0.00	£0.00	£0.00
Free trade of services in the EU: Able to provide service in EU	£8.45	£16.70	£13.25
Free trade of goods in the EU: Businesses face some extra costs to sell goods in EU	£10.25	£15.70	£11.11
Sovereignty: Subject to EU laws around trade	-£2.26	£7.70	£8.73
EU contribution (savings)*	-£6.50	-£6.50	-£6.50
Total (£/household/week)	**£24.87**	**£73.50**	**£61.38**

6. Summary and policy implications

Choice experiments are increasingly being used in political science research (see Hainmueller et al.). This is one of the first times that we are aware that CEs have been used to quantify population preference for different aspects of a possible relationship between countries or jurisdictions.

Using CEs has allowed us to collect evidence on people's preferences for different components of the UK's relationship with the EU. Such information was not available from the referendum itself. Whilst we acknowledge that the use of CE methods may be imperfect, because people may not take the experiments seriously (something we did not find to be a problem in this study) or because there are no implications of the choices in the real-world, they have allowed us to gain understanding on people's views on these important aspects of the UK's relationship with the EU.

Whilst CEs may be subject to biases, for example if respondents want to game the choices in the experiments, it must be acknowledged that choices from referenda may be biased, where people may game their vote to send a message to government, rather than providing their real preferences. A further advantage of the use of stated choices is that the format means that people are presented with a detailed description of the alternatives – in this study in terms of aspects like freedom of movement, access to the Single Market, ability to make free trade deals and sovereignty. It is not known what level of knowledge people had when participating in the referendum, where no information was provided on what each alternative meant in terms of the details of the UK's relationship with the EU.

Below we set out detailed findings regarding the use of CEs for a study of this nature followed by policy findings. We finish with a discussion of caveats and limitations of the method in this context.

6.1 Methodological findings and learning

We learned a number of points regarding the use of CE to address political questions like Brexit. First, we observe that people were able to undertake choice experiments even though they were complex, both in terms of the abstract nature of the attributes and levels and the number of attributes. Respondents reported that it was quite difficult to decide between the choices, even though most found the choices themselves quite easy or neither easy nor difficult to understand. Undertaking the choice tasks was probably aided by going through the attributes one at a time in the binary choice experiments – and these data also provided valuable information for the model parameters. Very few people declined to answer the choice experiments.

Second, we found that, perhaps unexpectedly, respondents were relatively insensitive to the level of the UK's contribution when compared to other attributes (and those with degrees are about half as this sensitive to this expenditure as the rest of the population). One reason that this might be the case is that overall level of government expenditure was constant across all choices (£772bn per year) and only the component sent to the EU varied – and so respondents might have seen the contribution as less important in the context of the overall budget. Another reason might be that the contribution levels were described both in terms of total contribution relative to the total government expenditure and the cost per household per week – and perhaps when presented as costs per household these were seen to be less significant (the largest level was £13 per household per week, between the average household's weekly electricity bill [£11.50] and what it spends per week on eating out [£17.30]).

Further, sensitivity to the level of contribution might also be influenced by the fact that the money is being transferred to the EU. Some people might view this positively, because it signals a relationship with the EU, whereas others might view it very negatively. Some segments of the population – specifically those with degrees – are less sensitive to contribution expenditure. but those who voted to Leave are more sensitive to it. Finally, cost sensitivity might be understated as a result of the experiment being hypothetical – respondents did not really have to make the payments.

Interestingly, we observed that while respondents disliked paying higher levels of contribution compared to lower levels, more generally (as expected), they also disliked the options where the contribution level was zero. This was surprising, as our intuition would have been that people would prefer not to make a budget contribution to the EU, although it might again reflect its importance as a signal that some kind of relationship exists. Leavers have a positive value on a zero-contribution level, which is more intuitive.

Third, we find very little difference in the attribute valuations between 2017 and 2018, except for the need for a work permit for non-UK nationals to work in the UK and for UK nationals to work in the EU, which was valued slightly less positively in 2018 (relative to not needing a work permit). It is interesting that after a year of sustained discussion and sometimes fierce debate regarding the implications of the referendum result for free movement for travel and working, membership of the Single Market, trade and sovereignty, the value that UK residents place on these attributes remains largely unchanged. That, at the same time, we also see a shift to softer Brexit options is compatible with the notion that the attribute levels are largely derived from the first experiment.

We were able to successfully repeat the experiments because the attributes and their levels remained valid over the two-year study period. This is a testament to the importance of the background research conducted at the start of the study to ensure that the choice tasks incorporated the most important attributes and that the range of levels tested remained relevant to the questions raised in terms of the negotiation process. One issue that was raised between the two studies was whether we should have incorporated an attribute on the importance of the border between the Republic of Ireland and Northern Ireland. Given limits on the number of attributes and that this issue was only included in the top-three Brexit concerns of 18 per cent of voters (Smith 2018), it was judged that this attribute could not be incorporated in the experiments.

In terms of model formulation, we find that the Latent Class models better explain respondent's stated choices and that a 2-class Latent Class model appears to capture the very different views of population segments with very different preferences, which maps very closely to Leavers and Remainers. Membership of these classes is best explained by formal education level (whether the respondent has a degree), age and whether the respondent was born in the UK.

6.2 Policy findings

From the choice experiments, we find that people place a high value on having access to the Single Market for trade in goods and services: they also value the UK being able to make its own trade deals outside the EU without EU involvement. They value options where the UK can make its own laws, but not as much as adding to the costs of trading in the Single Market or the ability to make trade deals. They worry about freedom of movement, but mostly because of concerns about demand for public services. They strongly dislike the idea of having to get a visa to travel for their holidays.

We quantify the average value that people place on each attribute, in terms of EU budget contribution in GBP per household per week. These can then help us quantify the value of "packages" of attributes – or possible negotiated positions – by putting together the values for all attributes. Some of these are shown in Figure 6. Although we emphasise that because these reflect values measured in terms of contribution to the EU, they should be used for comparison purposes and should be treated or order of magnitude estimates only.

Netting out positives and negatives, we find that Britons placed the most value on a Norway-like deal (Norway is not a member of the EU but is a member of the EU's Single Market through its membership of the European Economic Area (EEA)). In fact, people valued it more highly than the current relationship with the EU, largely as a result of the ability to make trade deals with countries outside of the EU. We note, however, that a pure EEA option might not be achievable because of the political requirement that no 'hard' border be created between Ireland and Northern Ireland, to achieve which seems to require membership of the Customs Union as well. That addition would reduce the value of the option quite considerably because it would restrict the ability of the UK to strike independent trade deals.

Remaining in the EU was the second preferred option: further evidence that people valued membership of the Single Market and were willing to trade constraints on freedom of movement and sovereignty for it.

The third preferred outcome was a 'no deal' Brexit, relying on World Trade Organization trading rules, which is valued less positively than remaining in the EU because of the need for visas for holiday travel and increased costs of trade in goods and services, although there are some positive aspects in terms of being able to make trade deals with countries outside of the EU (without the EU); increased sovereignty; and no longer making EU budget contributions.

Of all the relationships we examined, participating in the Customs Union, but not the Single Market, was valued the least. This contrasts with, for example, the finding of a small sample deliberative poll carried out by Renwick et al. (2018), in which participation in the Customs Union was more popular than non-participation in any customs arrangement when those two were the only options, but it is important to note that the Renwick study looks at the Customs Union choice in isolation, separated out from, for example, choices on membership of the Single Market.

Although we cannot identify many differences in people's preferences between 2017 and 2018, we do see a 'softening' of the type of relationship Britons want with the EU. Given the choice of four unlabelled options – specifically the choice between options resembling remaining in the EU, joining the EEA, remaining in the Customs Union (but not the rest of the Single Market), and no deal – the most popular option is joining the EEA with 40 per cent of people choosing this. This is the preferred option for nearly half of the Remainers and nearly a third of Leavers. We also find that half of respondents change their preference for the four unlabelled options between 2017 and 2018, with 30% opting for a softer Brexit and 20% for a harder Brexit.

Lastly, we see substantial evidence of a divide – as illustrated by the referendum in 2016 - in the preferences of people in the UK regarding their relationship with the EU. This divide is best explained by education level, although age and where the person was born also contribute to differences. The

nature of the link with education level is not clear – and it is not possible to draw any conclusions on causality – but it might be an interesting area for future exploration.

6.3 Caveats and limitations of using CEs in this context

Trying to boil down the complex issues of the UK's relationship in Europe into two choice experiments that can be evaluated by the lay public in a ten-minute survey brings a host of challenges and a number of simplifying assumptions have had to be made along the way. Below, we highlight some of these assumptions and other caveats about the work that should be borne in mind when considering the study findings.

As discussed, the attribute levels set out the position that can be negotiated, not what the impact of the position might be. For example, in the experiment we do not discuss the potential impact of not participating in the Single Market on the price of goods, nor do we discuss the likely success of free trade agreements. So, those who are more optimistic about the UK's ability to make future free trade agreements will place a higher value on this attribute than those who are less optimistic.

Because of time limitations for the survey, we also did not provide any background information on the attributes. So, for example, regarding the opportunity for the UK to make its own trade deals, we did not explain that this would also involve the loss of current trade deals with the EU. We also did not collect information on the level of knowledge/understanding that people had on the issues being considered in the survey.

Although we have tried as far as possible to keep the choices around the facts, people will have misperceptions and emotional responses. For example, from other research we know that people's perceptions of the status quo are unreliable: for example, Leavers will tend to think that only 25 per cent of foreign direct investment in the UK comes from the EU, even though the real figure is 48 per cent (Duffy 2018). We also see evidence of this in the valuation of the EU contribution, where on average we find that people placed a negative value on the zero contribution. This counter-intuitive finding suggests that people prefer to make some level of contribution, perhaps because it provides some sort of signal of a relationship with the EU and/or supports activities of which they approve, e.g. aid inside and outside the EU, planning, science, etc.

Given the limits on the number of attributes that we could consider, we did not include an attribute describing the impact of Brexit on the border between Northern Ireland and Ireland. Given the history of Ireland and Northern Ireland, many people there want to avoid introducing a hard border between the two territories. Including an attribute on this specific issue might have influenced people's preferences. However, as noted earlier this issue is only included in the top-three Brexit concerns of 18 per cent of voters in Britain as a whole(Smith 2018); it is eighth in that list of concerns. The impact of excluding this term for our findings depends on whether respondents from across the United Kingdom were thinking about this issue when making their choices. Richards et al., (2018) study also provides further evidence for saying that Northern Ireland border issue is not import for the UK public.

If respondents valued not having any border in Ireland, they might already have attributed a higher valuation to free trade in goods. If this issue were not considered when people were making their survey choices, and it is an issue that is important to people, then it would shift overall opinion in the direction of options that would solve the problem. In the unlabelled options that we used, this means that we would expect a higher proportion of people to have preferred the Remain option. It would

not have an impact on the Customs Union option, as our formulation does not allow freedom of movement and assumes some extra costs of trade in goods (e.g. due to product standard checks), which taken together are not consistent with the absence of a border.

Similarly, the EEA option does not include a solution to the border problem, because being in the EEA but not in the Customs Union implies customs checks, for example for country-of-origin purposes, even if there is full freedom of movement for people (as in Norway), although some believe that there might eventually be technological and administrative solutions. A combination of the EEA and the Customs Union options would result in a completely frictionless border and is a possible solution to the problem. This combination is not directly assessed in the study.

We also note that because of limits in the number of attributes, we do not include an attribute describing the UK's global diplomatic influence through EU membership or its influence on other EU member states. Some respondents might have seen loss of influence as important, which may mean that we over-estimate the value of the EEA option.

Finally, for a number of reasons, we also emphasise the need for caution in the interpretation of the resulting valuations. First, we emphasise that the levels described the contribution to the EU assuming that the overall level of government expenditure was fixed. So, people may not see this as a saving at all. Second, as noted above, some people may prefer to make a contribution because it signals a relationship with the EU; others may place a much more negative value on such a contribution, precisely because it is to the EU. In this regard, we observe that those who voted Remain were less sensitive to such expenditure, whereas those who voted Leave were more sensitive to such expenditure.

Third, although we made efforts to present the figures in a way that was understandable to an individual, specifically in terms of the amount per week per family, the numbers are large and hard to comprehend. We therefore advise that the resulting values for the other attributes should be interpreted relatively, that is, used to compare the relative importance of different attributes, rather than absolutely, and that the values be used to provide order-of-magnitude estimates only.

Notwithstanding the points made above, we believe that this research sets out some much needed evidence on what people want and what they are willing to trade off regarding the UK's relationship with Europe that should be considered by policymakers in this period of negotiation with the EU.

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