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Biased beliefs on the short-term economic consequences of leaving the EU.
Can information treatments correct these misperceptions?

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Abstract:

This research project focuses on the observation of whether, among a sample of individuals residing in Italy, in the Netherlands, and in Belgium, biased beliefs exist concerning the economic consequences of leaving the European Union. We are interested in observing whether such misperceptions exist, and whether the provision of corrective information is able to affect these biases, potentially eliminating them. The experiment conducted consists in a survey which was distributed to individuals of all ages, to collect data on the beliefs of these individuals regarding the economic consequences of leaving the EU. Two different information treatments are provided to different groups of respondents, one under the form of text, and one under the form of graphics which were to be interpreted by the readers. In total, 275 responses were collected and analysed, leading to several insights. First, the same biased beliefs which contributed to driving the outcome of the Brexit referendum of June 2016 appear to be significantly present within our sample of respondents. Next, the results concerning the effectiveness of the information treatments provided to correct for these biased beliefs are ambiguous, and would require further research.

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1. Introduction

Five years have passed since the infamous Brexit referendum, a phenomenon which took everybody by surprise, profoundly upsetting the European and global economy. The unexpected result of the referendum, which took place on the 23rd of June of 2016, has since then been a very important topic of debate amongst researchers and economists. From a purely economic point of view, the outcome of the referendum was completely shocking. Indeed, this was the case as the broad consensus amongst experts was that Britain would suffer important economic losses in the eventuality of a victory by the “leave” side (Hobolt, 2016).

As mentioned above, the economic consequences of Brexit are several and, as agreed upon by the experts, they have and will have a significantly detrimental impact on the British economic activity for several years. Despite most economists reaching a consensus on this matter and informing the British voters of the implications of the outcome of the referendum, the leave side came out victorious. This unexpected outcome is in fact irrational and driven by a political campaign by the leave side which effectively mobilized the ever-growing concerns about the cultural and economic threats of globalization, immigration, and European integration of the less educated people (Hobolt et al, 2016). It appeared clear that votes were not only driven by the conventional macroeconomic metrics, but also, and mainly, by several socioeconomic elements (Britton et al, 2019).

The outcome of the Brexit referendum is an unprecedented event, yet the Euroscepticism sentiments that led to it are not exclusive to the British population, as also highlighted by Hobolt (2016). These sentiments are very widely spread across many European countries, where the populist political parties are gaining credibility and supporters (Inglehart et al, 2016). Indeed, as the outcome of the Brexit referendum led to significantly detrimental economic consequences for the British economy, the eventuality of a similar phenomenon happening in another EU country is highly undesirable. The countries within the EU and their governments should therefore put in place policies and set agendas to prevent this from taking place again by sensibilizing their population to the real implications of such an event. In order to do this, it is of interest to analyse whether people from selected European countries such as Belgium, the Netherlands and Italy recognize the economic costs involved with Brexit or whether they have biased beliefs on the matter additionally to whether providing information is effective in correcting these potential misperceptions. The choice of these countries is justified by the interest in the beliefs and behaviour of individuals from a country like Italy, where populist forces are strongly supported, compared to these same beliefs and behaviours of individuals residing in Belgium and in the Netherlands where, relatively to the size of the population, populist political parties obtain significantly less votes (Boros et al, 2016). Because of

this similarities in the political sector, throughout this research, the data from the individuals residing in Belgium and in the Netherlands is pooled together, and compared with the data from Italian respondents.

Therefore, the research question which will be answered throughout this paper is:

Do individuals living in Belgium/the Netherlands and in Italy have biased beliefs on the short-term economic consequences of leaving the EU? Can information correct these misperceptions?

From the observation of the results obtained from the analysis performed to provide an answer to our research question several conclusions are made. First, the tests carried out reveal that the individuals within the sample analysed do have significantly biased beliefs concerning the economic consequences of leaving the EU. These misperceptions are significantly present among individuals residing in all three countries observed. Particularly, it is of great interest to mention that the respondent residing in Italy, on average, underestimated more the economic consequences of such a phenomenon than those living in Belgium and in the Netherlands.

Next, it is possible to state that the information which was provided under the form of text appears to be considered more reliable and more effective towards influencing the beliefs of our respondents than the information provided by the graphics which were to be interpreted. Indeed, providing the treatment in a direct, clear and simple manner appears, unsurprisingly, to be the best method to correct an individual's biased beliefs and misperceptions. Despite this, the results concerning the corrective power of the information treatments provided are ambiguous. Further research would be necessary to determine whether these treatments actually significantly influence individuals to correct their biased beliefs more than they would in the absence of information.

2. Literature Review

1. Causes and Consequences of Brexit referendum

➤ Causes

In these five years following the Brexit referendum, a lot of literature has analysed the factors which played a role in the voting, additionally to several research papers studying the implications and the consequences of the outcome of the vote.

As already mentioned in the introduction, the population of urban centres, younger and more educated, voted to stay, whilst the less well-off and less educated voted in large majorities to leave. (Hobolt et al, 2016). A very similar finding is also discussed by Goodwin et al. (2016) who state that support for Brexit was strongest in areas where a large percentage of the population did not have any qualifications to thrive amid an increasingly competitive economy that favours those with skills and a high level of education, and areas with a larger number of pensioners. 51.9% of the population voted leave, whilst the remaining 48.1% voted to remain, but voting patterns across the UK largely varied across different regions and areas. First, it is possible to observe that the leave side won in England and Wales, whilst the majority in Northern Ireland and Scotland voted to remain. Additionally, within England, the leave side won in 24 out of the 28 districts excluding London, where more than 70% of the population voted to remain (Becker, 2017). Individuals from the most urbanized areas had a higher probability of voting to stay in the EU than the individuals living in more rural zones.

Next, post-referendum polls revealed that the probability of an individual voting to leave increased with their age. Indeed, data shows that almost 75% of the 18- to 24-year-old individuals voted to remain and this fraction decreases as older individuals are observed. The majority of individuals over the age of 45 voted to leave (Britton et al, 2019). Additionally, it is important to mention that the older population was larger, with the over-55 accounting for close to 40% of the total population, and that the turnout rate amongst older individuals was considerably higher than amongst the young (Britton et al, 2019). Both these factors played a significant role in guiding the outcome of the referendum towards the victory of the leave side. The highest level of education attained also plays a significant role in the voting pattern within the British population. Indeed, the higher the level of education completed, the lower are the probabilities of the individual voting leave (Becker, 2017).

Hobolt (2016) emphasizes the significant impact on the determination of the final outcome of the referendum vote of the biased beliefs of many voters in the UK, and in Europe, who wrongly perceive the EU as part of the problem rather than the solution to protecting ordinary citizens from

an ever more integrated and globalized world and economy. Additionally, and very importantly, the outcome of the referendum was greatly influenced by the political campaign of the British populist groups, who framed the referendum as a conflict between the “elites” and the “ordinary people”. Indeed, in this same paper from Hobolt (2016), the author reveals that these anti-elite sentiments encouraged by the populists portrayed the fact of voting leave as a mean to “fight” the government taking back control from the establishment and from the EU. Additionally, Inglehart et al. (2016) state that Britain’s decision to withdraw from the EU could potentially become an important factor threatening to strengthen populist forces and support across Europe.

➤ **Consequences**

As the UK only actually left the EU on the 31st of January 2021, its long-term consequences are yet to be observed, therefore this paper will mostly focus on its short-term effects, only mentioning some estimates concerning the long-term effects. The short-term economic implications of Brexit became immediately apparent as the outcome of the voting was revealed. Indeed, a study by Baker et al. (2016) provides significant evidence of the uncertainty about economic policy being extremely detrimental towards economic activity. The short-term implications of the referendum outcome involve the economic policy uncertainty (EPU) index compiled by Baker et al. (2016) to reach an all-time high value in the month following the voting, remaining at a high level since then. Indeed, as predicted, this translated itself into a significant negative effect on the British economic activity. A study by Born et al. (2017) has found that the output loss caused by the Brexit vote in the third quarter of 2017 amounted to approximately 1.3%, equivalent to a cumulative loss in GDP close to 20 billion pounds. The cumulative loss grew to more than £50 billion by year-end 2018.

Furthermore, the biggest impact of this referendum on the British economy is estimated to be related to the important slowing down in the growth rate of the UK economy due to the uncertainty over Brexit. Indeed, observing data from the UK Office for National Statistics it is possible to observe a drop in GDP growth from 2.4% in 2015 to 1.0% in 2019. Similarly, Dhingra et al (2016) find that the decrease in trade due to Brexit and the now limited trade agreements with EU countries will cost the UK considerably more than the gains related to the decrease in contributions to the EU budget. The short-term effects of Brexit are estimated to lead to a considerable fall in income of between 1.3% and 2.6% (£850 to £1,700 per household per year), whilst, when including the long run effects, this decline is expected to increase in magnitude to between 6.3% and 9.5% (£4,200 to £6,400 per household per year).

The British pound fell from \$1.48 on the day of the referendum to \$1.36 the next day, its lowest price against the US dollar since 1985 (Federal Reserve System. “Historical Rates for the

U.K. Pound”). Similarly, the price of the British pound against the Euro dropped from 1.31€ to 1.24€. During the 1-year period following the referendum, the average price of the pound dropped to 1.16€. In this same period its value never exceeded the 1.24€ level and reached a low at 1.10€ (European Central Bank. “Euro foreign exchange reference rates”). Experts argued that the inflation increase following the post-referendum pound depreciation lead to about a 400-pound consumption loss for the average British household in the first year following the referendum Breinlich et al. (2017).

2. Survey and information treatment experiment

In the previous section, the detrimental consequences of Brexit and its referendum on the UK’s economy have been thoroughly discussed and, additionally to this, as mentioned in the introduction, Euroscepticism sentiments are widely spread across many European countries by the growing populist parties (Inglehart et al, 2016). In the context of the Brexit referendum, the British populist parties’ political campaign had a major impact on the people having biased beliefs concerning the actual consequences of voting “leave” on the UK’s economy (Hobolt et al, 2016). In another paper from 2016, Hobolt finds that, despite a broad consensus among experts, a large share of the population had misperceptions concerning the economic impact of leaving the EU. Many underestimated the consequences, some even believed that Brexit would’ve improved the economic conditions and living standards in the UK.

Starting from these findings, this research will focus on observing whether these biased beliefs concerning Brexit are also present in other countries, such as Italy, Belgium and the Netherlands, and whether information provision can correct these misperceptions. A survey will be used to elicit the beliefs of the population observed ex-ante and ex-post the information provision. This particular survey design is chosen as, as found by Clifford et al. (2020), pre-post designs increase the accuracy and validity of the results without introducing significant biases. Similarly, Broockman et al. (2017) affirm that eliciting prior beliefs of respondents significantly increases the power for estimating the learning rates from the information provided. Haaland et al. (2020) state that eliciting the prior beliefs of individuals is particularly important if the focus of the research is put on the influence of information on their beliefs, which is exactly the point of interest of this paper. After answering an initial set of questions concerning the individuals’ baseline characteristics and their prior beliefs, the survey respondents are automatically divided into three groups, a pure control group and two treatment groups. Two different treatment groups are included as it is of interest to observe how and whether providing the same information through different channels differently influences the respondents’ beliefs, in order to find the most effective one at doing so. The inclusion of a pure control

group is justified, as also argued by Armona et al. (2017), by the fact that the simple fact of taking part to a survey might influence the respondents' answers, regardless of the information received. Indeed, this design allows for an analysis of how, compared to the pure control group where individuals do not receive any kind of stimulus, the information provided in the treatment groups influences beliefs.

Grigorieff et al. (2018) conduct a study where they find that providing information treatments affects people's attitude and beliefs towards immigration, but not their policy preferences and voting behaviour. They state that individuals tend to update their beliefs more when their priors are in direct contrast with the corrective information and tend to fail to do so when their beliefs are compatible with it. Similarly, Barrera et al. (2020) argue that, the fact checking's success in correcting an individual's factual knowledge and beliefs does not translate into an impact on their voting intentions. Armantier et al. (2016) find that individuals tend to update their beliefs consistently with Bayesian updating. This is additional evidence of what is abovementioned concerning people's updating behaviour. The further away their beliefs are from the corrective information, the stronger their updating behaviour will tend to be. Additionally, the stronger the individual's baseline uncertainty, the more will they update their beliefs. On the other hand, another important finding must be taken into consideration. Indeed, Nyahn et al. (2010) highlight how individuals who are strongly committed to their beliefs tend to fail to update them based on the new information acquired. In this situation, the corrective information can actually strengthen the misperceptions considered.

The design of this survey and information treatment experiment has been chosen in order to allow for the observation of several phenomena. As previously mentioned, the formation of three experimental groups allows the observation of whether and how corrective information provided via different channels differently affects an individual's beliefs compared to his own priors. Similar research has already been performed but, to the best of my understanding, a unique analysis on the biased beliefs concerning a phenomenon like Brexit, its economic consequences and whether the provision of information can correct for these misperceptions is yet to be carried out. Additionally, this information treatment experiment is performed using a sample of population from three European countries, Italy, Belgium and the Netherlands. Indeed, the observation of whether the beliefs or the effect of the information treatments provided significantly differ between individuals residing in these countries also represents an innovative aspect of this research towards the existing literature.

3. Hypotheses and Methodology

In this section of the paper a discussion on the hypotheses which will be tested, and the corresponding methodology of such analyses will be presented. This paper focuses on observing the beliefs people have of the scale of the potential consequences of a phenomenon like Brexit on a country's economy. The population that will be observed for this the research will consist of a sample of individuals from three different countries Italy, the Netherlands, and Belgium.

An information treatment experiment consisting of three separate parts will be performed. First, an initial survey will be distributed to a sample of individuals in the Netherlands, in Belgium, and in Italy. The survey will be distributed as much as possible via different online platforms to reach the largest sample of individuals possible. Ideally, the sample should be large enough to be representative of the Italian and the Belgian and Dutch population. This survey will contain some general questions about the individual's age, gender, their employment status and whether they reside in an urban or rural area. Additionally, questions asking for the respondents' beliefs concerning the economic consequences of the outcome of the Brexit referendum on the UK will be included.

The surveyed population will be asked to elicit how confident they are in their knowledge concerning the economic consequences of Brexit. Next, similarly to what has been done by the UK Office for National Statistics just prior to the vote, whether the UK's economy was positively or negatively impacted by Brexit in the short term. Other questions will ask respondents to quantify their beliefs regarding the scale of the effects of the outcome of the referendum on several economic factors, such as the GDP, the price of the British pound and household consumption and income.

For the second part of the experiment, the respondents are randomly assigned to three experimental groups. The individuals in the first treatment group will be provided with information under text form aimed at correcting the most common biased beliefs concerning the short-term economic consequences of the outcome of the Brexit referendum on the UK. The second treatment group will receive an information treatment containing the same information that was provided to the first treatment group, but using graphic support.

Lastly, the third group will constitute of a pure control group. The individuals in this group will not receive any kind of information treatment or stimulus and will directly pass to the successive section of the experiment. As the third and final part of this experiment, following the information treatments, the survey respondents will be asked to answer some additional questions. The questions which will be asked will require the individuals to elicit their beliefs concerning the potential economic consequences of a phenomenon like Brexit if it was to take place in their own country. Additionally, respondents will be asked to elicit their policy preferences in two different ways. First, individuals

will play a dictator game, deciding on how to allocate 100€ between a pro-EU NGO (non-governmental organization) and an anti-EU NGO. Successively, respondents will be asked to state whether, in the eventuality of their country holding a referendum to leave the EU, they would vote to leave or to remain.

The outcome of the Brexit referendum was significantly influenced by the biased beliefs that a part of the population had of the economic consequences of leaving the EU on the UK. Indeed, a YouGov (British global public opinion and data company) survey distributed just days prior to the referendum, asked individuals about whether they believed Britain would be economically better or worse off following Brexit. Only 4% of leave voters believed Britain would be worse off. As also discussed by Hobolt (2016), there was a consensus amongst the experts on the extremely detrimental nature of the consequences on the British economy of Brexit, this therefore implies a significant and clear phenomenon of misperception and biased beliefs on the topic amongst a large part of the voting population. Like previously mentioned, the Euroscepticism feelings that led to Brexit and to these biased beliefs are not exclusive to Britain. Furthermore, as mentioned, the real novelty and focus of this paper consist in the analysis of whether such misperceptions and biased beliefs on the detrimental economic consequences of Brexit on the UK are significantly present in the answers collected via the survey discussed above, and whether an information treatment can correct these.

By using a large enough sample, allowing for the creation of a representative sample of the countries' populations, this study would allow to observe whether the same misperceptions which played a strong role in the final outcome of the Brexit referendum are also significantly present in the minds of the individuals from the countries observed. The results of such a study performed on a representative sample could have some very important policy implications. Indeed, in case these biased beliefs were present, the EU, and the respective national governments and politicians should make sure to implement policies to correct these misperceptions, for their nation's economy's good. Biased and wrong beliefs should not be allowed to play a role in the outcome of an impactful and important referendum like it did in the context of Brexit in the UK.

The data collected from the answers provided by the sample of individuals to the survey distributed will be used to answer several hypotheses. The 1st hypothesis will be answered by analysing whether biased beliefs on the topic do exist within the sample of surveyed individuals. The aim is to observe whether the people's perception of the implications of the referendum vote are consistent with reality, or whether individuals have significantly biased opinions which deviate from the truth. The actual statistics of the economic impact of Brexit are the same ones mentioned and discussed in the "consequences section" of the literature review in this paper. This hypothesis is formulated as:

1. H0: *There are no significant misperceptions in the beliefs concerning the economic implications of Brexit on the British Economy.*

Ha: *There are significant misperceptions in the beliefs concerning the economic implications of Brexit on the British Economy.*

Next, several two sample t-tests will be performed to determine whether the prior beliefs of the individuals from Italy and the two other countries of interest significantly differ between each other. This hypothesis tests whether the ex-ante information treatment beliefs of individuals from Italy significantly deviate from those of individuals residing in the Netherlands and in Belgium and is formulated as follows:

2. H0: *There are no significant differences in the prior beliefs concerning the economic consequences of leaving the EU between individuals from Italy and Belgium/the Netherlands.*

Ha: *There are significant differences in the prior beliefs concerning the economic consequences of leaving the EU between individuals from Italy and Belgium/the Netherlands.*

The analysis continues with the statistical testing of whether, between these countries, the ex-ante beliefs on the matter significantly differ among individuals of different age groups, as it did in Britain in 2016. This, like the previous hypothesis, will be verified using several two sample t-tests. The hypothesis is formulated as:

3. H0: *There are no significant differences in the prior beliefs concerning the economic consequences of leaving the EU between individuals under-45 and over-45.*

Ha: *There are significant differences in the prior beliefs concerning the economic consequences of leaving the EU between individuals under-45 and over-45.*

Next in this paper, after eliciting the surveyed individuals' prior beliefs regarding the economic consequences of Brexit, an information treatment experiment is performed on these same survey respondents. These individuals, like discussed above, are allocated between a control group and two treatment groups. A 4th hypothesis is formulated to test whether the information treatments provided to the surveyed individuals have the ability of significantly correcting their potential misperceptions. The hypothesis is formulated as follows:

4. **H0:** *The information treatments provided do not significantly influence the beliefs concerning the economic consequences of Brexit on the UK.*

Ha: *The information treatments do significantly influence the beliefs concerning the economic consequences of Brexit on the UK.*

Continuing with the analysis, the data collected from the surveyed individuals will allow for the testing of whether and how different ways of providing the corrective information differently impacts the respondent's beliefs. This is done by comparing within-groups the evolution between the beliefs of individuals ex-ante and ex-post the information treatment provision. This hypothesis is as follows:

5. **H0:** *The different information treatments provided have the same effect on the beliefs concerning the economic consequences of Brexit on the UK of individuals .*

Ha: *The different information treatments provided do not have the same effect on the beliefs concerning the economic consequences of Brexit on the UK of individuals .*

A sixth hypothesis is formulated to test whether, within our surveyed sample, significant differences exist in the elicited referendum voting intentions and the donations to pro and anti-EU NGOs between individuals from different countries. This section of the analysis is performed by comparing the responses provided by the individuals residing in the Netherlands and in Belgium with the answers of those residing in Italy. The hypothesis is formulated as:

6. **H0:** *No significant differences exist between the elicited voting intentions and the average donations to a pro-EU NGO between individuals residing in Belgium/ the Netherlands and in Italy.*

Ha: *Significant differences do exist between the elicited voting intentions and the average donations to a pro-EU NGO between individuals residing in Belgium/ the Netherlands and in Italy.*

Lastly, a seventh hypothesis is used to analyse whether, similarly to what was done in the previous hypothesis, significant differences are present in the elicited voting intentions and donations to a pro-EU NGO between different groups of individuals in our sample. Here, responses are compared between individuals over and under the age of 45. The hypothesis is:

7. *H0: No significant differences exist between the elicited voting intentions and the average donations to a pro-EU NGO between individuals over-45 and under-45 years old.*

Ha: Significant differences do exist between the elicited voting intentions and the average donations to a pro-EU NGO between individuals over-45 and under-45 years old.

The conclusions obtained from the analysis of the results from this experiment could provide important insights on how to effectively transmit information to correct misperceptions and biased beliefs on this particular topic. These insights could therefore have crucial policy implications or could become an important steppingstone towards other studies and research.

4. Experiment and data description

Information Treatment Experiment – Survey data

For the main section of this research, an information treatment experiment is conducted. This experiment consists in a survey distributed to individuals residing in Belgium, the Netherlands and Italy. The survey was distributed via an anonymous link which was spread around via internet among individuals from all age categories, as the interest of this paper, similarly to the research conducted on the demographics of the voters of the Brexit referendum, focuses on all potential referendum voters. Indeed, the age of respondents to the survey varied between 20 and 82 years old. In total, 346 responses were collected, and, of these, 275 completed the entire survey. Only the data from these 275 individuals who provided an answer to the entire questionnaire will be used towards this research. Within these respondents, 160 reside in Italy, 105 in Belgium and 10 in the Netherlands.

Next, table 1 will present a description of the variables used to obtain some insights on the demographic characteristics of the sample of individuals surveyed. The demographic characteristics are presented in table 2.

Table 1: Summary and description of demographic variables

Variable	Description
Gender	This variable takes on the value of 1 if the individuals is a male, 2 if female.
Age	Age of the individuals in years.
Occupation	This categorical variable takes on the following values: 1= Employed; 2= Unemployed; 3=Student
Level of urbanization	Variable representing the level of urbanization of the place of residence of the individual on a scale from 1=extremely rural area to 5=extremely urban area.

Table 2: Descriptive statistics of demographic variables

Variable	Observations	Mean	Std Deviation	Median	Min	Max
Gender	275	1.375	0.485	1	1	2
Age	275	46.498	11.047	48	20	82
Occupation	275	1.182	0.550	1	1	3
Level of urbanization	275	4.131	1.093	5	1	5

A previously mentioned, the survey consisted of three sections. First, some initial questions used to collect some demographic data of the respondents and some questions aimed at eliciting the beliefs of the surveyed individuals concerning the economic consequences of the Brexit referendum on the UK's economy. Next, the respondents are randomly split in three groups, 1 control and 2 treatment groups, via a system of automatic randomization within the Qualtrics operating system used to create the survey. The individuals assigned to the control group do not receive any treatment, they skip directly to the third section of the survey. The individuals in the two treatment groups receive an information treatment. This information treatment consists of notions concerning the actual economic consequences of the Brexit referendum on the UK's economy and its citizens. The two treatment groups receive similar information but differ in the way its presented to them, one under form of text, and one graphically. Of the 275 respondents to the survey, 96 were assigned to the control group, 90 were assigned to the group receiving the information under the form of text and 89 to the treatment group receiving graphical information. Lastly, the third section contains some additional questions aimed at observing whether the information treatments provided had an impact on the beliefs of the individuals, influencing them and correcting potential biases. The questions are similar to the initial ones but more focused on the beliefs of individuals concerning the future of European unification and the potential consequences of another phenomenon like the Brexit referendum if it was to take place in their own country.

5. Results

Information Treatment Experiment – Survey Experiment

In this following section, the results of the statistical analyses performed on the data collected via the survey experiment conducted, are presented. The data collected includes the answers of the respondents to the questions in the survey and the analysis of this data will be used in order to tests the hypotheses previously formulated. The questions and the other variables used towards this research are listed and described in table 3, whilst table 4 contains the descriptive statistics of the variables used. Both these tables can be found in the appendix.

Next, showed below is table 5, which is used to present the descriptive statistics regarding the demographic characteristics of the individuals in the three experimental groups.

Table 5: Descriptive statistics of demographic variables by experimental group

	Variable	Observations	Mean	Std Deviation	Median	Min	Max
<i>Control Group</i>	Gender	96	1.396	0.492	1	1	2
	Age	96	47.760	10.967	50	20	82
	Occupation	96	1.156	0.509	1	1	3
	Level of urbanization	96	4.156	0.988	4	1	5
	Benel	96	0.375	0.487	0	0	1
<i>Treatment group 1</i>	Gender	90	1.367	0.485	1	1	2
	Age	90	45.889	11.463	48	20	66
	Occupation	90	1.222	0.595	1	1	3
	Level of urbanization	90	4.067	1.207	5	1	5
	Benel	90	0.378	0.488	0	1	0
<i>Treatment group 2</i>	Gender	89	1.360	0.483	1	1	2
	Age	89	45.753	10.703	46	20	66
	Occupation	89	1.169	0.548	1	1	3
	Level of urbanization	89	4.169	1.090	5	1	5
	Benel	89	0.506	0.503	1	0	1

Several one-way ANOVA tests are performed in order to analyse whether, between the different experimental groups, individuals differ in their underlying demographic characteristics. Table 6 in the appendix contains the results of these tests. The P-values obtained from this analysis reveal that no statistically significant differences can be found in the demographic characteristics of the individuals of the three experimental groups.

▪ **Hypothesis 1**

The analysis performed to test this hypothesis consists in comparing the beliefs of the respondents concerning the impact of the Brexit referendum on the British economy with the actual statistics. This is done to observe whether there are significant differences between the values compared and therefore whether biases or misperception are present in the beliefs of the surveyed individuals. First, Born et al. (2017) state that the output loss caused by the Brexit vote in the third quarter of 2017 amounted to a cumulative loss in GDP close to 20 billion pounds. This loss grew to more than £50 billion by year-end 2018. The next statistics used is that during the 1-year period following the referendum, the average price of the pound dropped to 1.16. (European Central Bank. “Euro foreign exchange reference rates”). The last test performed uses data from Breinlich et al. (2017) showing that the inflation increase following the post-referendum pound depreciation lead to about a 400-pound consumption loss for the average British household in the first year following the referendum. The results of the tests performed are shown in table 7:

Table 7: T-test results on the economic consequences of referendum vote

	<i>1 year Effect on GDP (Q10)</i>	<i>Long term effect on GDP (Q11)</i>	<i>Average price of £ (Q13)</i>	<i>Effect on household consumption (Q15)</i>
<i>Actual statistic</i>	-19.3	-50.0	1.16	-400
<i>Mean response</i>	-4.189	-6.975	1.261	-67.153
<i>(std error)</i>	(0.612)	(1.315)	(0.007)	(11.105)
<i>Difference</i>	-15.111***	43,025***	-0.101***	332.847***
<i>T-value</i>	24.7084	32.7132	15.2987	29.9738
<i>P-value</i>	0.0000	0.0000	0.0000	0.0000
<i>Observations</i>	275	275	275	275

Notes: Star significance is attributed according to: * if $p \leq 0.10$, ** if $p \leq 0.05$, *** if $p \leq 0.01$. The higher the absolute value of the T statistic the higher the significance of the difference between the two means compared.

Observing table 7, respondents, on average, greatly underestimated the magnitude of the negative impact of the referendum on the British economy. The p-values and t-statistics of the tests performed show that the differences observed in the four t-tests are all significant at the 99% level ($P < 0.01$). This is clear proof of very significant differences between the average beliefs and the actual statistics of the economic impact of the Brexit referendum. Therefore, we must reject our first null hypothesis, as biased beliefs or misperceptions are evidently present within the sample of individuals surveyed.

- **Hypothesis 2**

Next, the testing of our second hypothesis is carried on. It is hypothesized that no significant differences are present between the beliefs prior to the information treatment experiment of the respondents residing in Italy, with those residing in Belgium and the Netherlands. This is tested by observing the answers provided by the individuals to several questions of the survey. In particular, table 8, contains the results of the t-tests performed to compare the average values observed in the answers to questions Q8, Q11, Q13 and Q15 between individuals residing in Italy and those residing in Belgium and the Netherlands. The last three questions concern the beliefs of individuals regarding the economic consequences of Brexit, whilst Q8 is used to observe whether the groups of individuals compared differ in the level of confidence concerning their knowledge of the consequences of the referendum vote.

Table 8: T-tests of differences in beliefs between individuals residing in Belgium/Netherlands and Italy

<i>Country</i>	<i>Confidence pre-treatment (Q8)</i>		<i>Long term effect on GDP (Q11)</i>		<i>Average price of £ (Q13)</i>		<i>Effect on household consumption (Q15)</i>	
	Benel	Italy	Benel	Italy	Benel	Italy	Benel	Italy
<i>Mean response (std error)</i>	3.765 (0.111)	3.263 (0.097)	-12.061 (2.285)	-3.319 (1.494)	1.231 (0.009)	1.283 (0.009)	-125.122 (15.600)	-25.488 (14.619)
<i>Difference (std error)</i>	-0.503*** (0.148)		8.742*** (2.618)		0.052*** (0.013)		99.634*** (21.733)	
<i>T-value</i>	-3.3902		3.3388		4.0059		4.5845	
<i>P-value</i>	0.0008		0.0010		0.0001		0.0000	
<i>Observations</i>	115	160	115	160	115	160	115	160

Notes: Star significance is attributed according to: * if $p \leq 0.10$, ** if $p \leq 0.05$, *** if $p \leq 0.01$. The higher the absolute value of the T statistic the higher the significance of the difference between the two means compared.

The results presented in the table above show that, for all questions analysed, there are significant differences in the average responses of individuals from the two groups compared. All coefficients of the differences between the mean values of the responses of the individuals in the two groups are statistically significant at the 99% level as the p-values of all t-tests performed are extremely small ($P < 0.01$). It is possible to observe that, on average, individuals from Italy were less confident in their knowledge of the topic of interest. Additionally, observing the three other questions analysed, it is possible to notice that Italian individuals appear to underestimate the economic consequences of Brexit significantly more than the other respondents. These results lead us to reject

our null hypothesis that no significant differences exist between the beliefs of individuals residing in Italy and those residing in Belgium and the Netherlands.

▪ **Hypothesis 3**

Carrying on with the analysis, the third hypothesis formulated is tested. Similarly to the previous one, we want to observe whether there are significant differences between the beliefs of individuals from different groups. In this case, the groups are created based on the age of the respondents. Four t-tests are performed on the data from the same four questions previously analysed, Q8, Q11, Q13 and Q15, comparing the average elicited beliefs of individuals under-45 with those of the over-45.

Table 9: T-tests of differences in beliefs between individuals under-45 and over-45

Age	Confidence pre-treatment (Q8)		Long term effect on GDP (Q11)		Average price of £ (Q13)		Effect on household consumption (Q15)	
	Over 45	Under 45	Over 45	Under 45	Over 45	Under 45	Over 45	Under 45
Mean response	3.661	3.191	-3.945	-11.518	1.261	1.262	-73.588	-57.500
(std error)	(0.103)	(0.099)	(1.740)	(1.929)	(0.009)	(0.011)	(14.183)	(17.876)
Difference	-0.470***		-7.573***		0.002		16.088	
(std error)	(0.150)		(2.650)		(0.014)		(22.688)	
T-value	-3.1368		-2.8573		0.1253		0.7091	
P-value	0.0019		0.0046		0.9004		0.4789	
Observations	165	110	165	110	165	110	165	110

Notes: Star significance is attributed according to: * if $p \leq 0.10$, ** if $p \leq 0.05$, *** if $p \leq 0.01$. The higher the absolute value of the T statistic the higher the significance of the difference between the two means compared.

The results presented in table 9 show that a statistically significant difference in beliefs is only found when comparing the statistics concerning the responses to Q8 and Q11. Indeed, the P-values obtained from the testing of the data from these questions are, respectively, $P=0.0019$ and $P=0.0046$. These statistics imply that the difference in the average level of confidence and in the estimated long-term impact of Brexit on the GDP between the Under-45 and the Over-45 are both significant at the 99% level ($P < 0.01$). Over-45 individuals have, on average, a higher level of confidence in their knowledge of the topic and underestimate the consequences of Brexit more than younger respondents. Inversely, the results of the t-tests performed on the data from Q13 and Q15 provide evidence that there are no significant differences in these specific answers between individuals over-45 and under-45, as the P-values of these tests take on large values ($P > 0.1$). Despite this, finding statistically

significant differences in the beliefs elicited via Q8 and Q11 lead us to reject our 3rd hypothesis. Indeed, significant differences in beliefs are observed between individuals over and under the age of 45.

▪ **Hypothesis 4**

Following the analysis of the data obtained ex-ante the treatment, the focus will now be on the effects of the information treatments provided to the respondents. In order to test this hypothesis, the answers from two very similar questions are compared, Q9 and 29. These questions require the respondents to state whether leaving the EU had a positive or negative effect on the economy of the UK (Q9) and whether they believe their own country would be economically better or worse off by leaving the EU (Q29). To observe whether the two information treatments provided had an effect in correcting the biased beliefs of individuals, we compare the responses provided by the individuals from the control group with those of the respondents assigned to the treatment groups.

Table 10: Proportion of responses to Q9 and Q29 compared between experimental groups.

	<i>Control</i>			<i>Treatment 1 (Text)</i>			<i>Treatment 2 (Graphics)</i>		
<i>Variable</i>	Was Britain better or worse off after Brexit? (Q9)			Was Britain better or worse off after Brexit? (Q9)			Was Britain better or worse off after Brexit? (Q9)		
<i>Response</i>	Better (1)	Same (2)	Worse (3)	Better (1)	Same (2)	Worse (3)	Better (1)	Same (2)	Worse (3)
<i>Proportion of responses in %</i>	13.54	12.50	73.96	16.67	16.67	66.67	13.48	12.36	74.16
<i>Variable</i>	Would your country benefit or lose by leaving the EU? (Q29)			Would your country benefit or lose by leaving the EU? (Q29)			Would your country benefit or lose by leaving the EU? (Q29)		
<i>Response</i>	Benefit (1)	Same (2)	Lose (3)	Benefit (1)	Same (2)	Lose (3)	Benefit (1)	Same (2)	Lose (3)
<i>Proportion of responses in %</i>	7.29	7.29	85.42	5.56	5.56	88.89	6.74	6.74	86.52
<i>Nr. of observations</i>	96			90			89		

Table 10 contains data concerning the percentage proportions of the three values answered to Q9 and Q29. These proportions are compared between the three experimental groups and they provide evidence of the fact that a larger percentage of individuals in the two treatment groups corrected their biased beliefs ex-post the information treatment compared to individuals in the control group. Indeed, answering “1” or “2” to either Q9 or Q29 consists in a clear misperception of the real consequences of leaving the EU on a country’s economy. The unbiased, correct, answer to these two questions

would be “3”, and, as mentioned, a larger proportion of individuals from the two treatment groups corrected their biased answer provided in Q9 than the individuals in the control group.

Next, to further test this hypothesis, several t-tests are performed to observe whether the average change in the answer provided to Q9 and Q29 is different for individuals who are in the control group and those in the treatment groups. Additionally to these, the magnitude of the effects of being in the two treatment or in the control group are estimated using the Cohen’s D statistic.

Table 11: Differences in the evolution of beliefs between individuals in control group vs in treatment group.

Evolution of beliefs – Economic consequences of leaving the EU on the UK vs own country

Experimental group	Control group		Treatment groups (treatment 1 and 2)	
	Was Britain better or worse off after Brexit? (Q9)	Would your country benefit or lose by leaving the EU? (Q29)	Was Britain better or worse off after Brexit? (Q9)	Would your country benefit or lose by leaving the EU? (Q29)
Mean response	2.604	2.781	2.553	2.816
(std error)	(0.073)	(0.058)	(0.056)	(0.039)
Difference	-0.177*		-0.263***	
(std error)	(0.093)		(0.068)	
T-value	-1.8983		-3.8635	
P-value	0.0592		0.0001	
Cohen’s D	0.274		0.408	
Observations	96		179	

Notes: Star significance is attributed according to: * if $p \leq 0.10$, ** if $p \leq 0.05$, *** if $p \leq 0.01$. The higher the absolute value of the T statistic the higher the significance of the difference between the two means compared. The higher the value of Cohen’s D, the more significant the difference between the two means compared.

The results presented in table 11 show that there are significant differences in the average answer provided in Q29 compared to the answer given in Q9, both for individuals in the control and in the two treatment groups. Despite this, it is possible to observe that the difference observed for the individuals in the control group is less significant than the one found for those in one of the treatment groups. Indeed, the difference in the control group is significant at the 90% level of confidence ($P < 0.1$), whilst the difference observed in the two other groups is significant at the 99% level ($P < 0.01$). On average, individuals who received one of the information treatments appear to correct their biased beliefs more than those in the control group. Additionally to this, the table also contains the Cohen’s D statistics of the two tests performed. Cohen’s D is an effect size which tells how many standard deviations lie between the two means compared, the higher the value of this statistic, the larger the effect size. Observing this data it is easy to observe that the value of Cohen’s D is larger for individuals within the two treatment groups ($0.408 > 0.274$).

Continuing with the testing of this hypothesis, a linear regression is performed. This model is created in order to estimate whether, on average, being assigned to one of the treatment groups has a statistically significant influence on the evolution and correction of the beliefs of the respondents. The equation of this model is as follows:

$$Y_i = \beta_0 + \beta_1 * T1_i + \beta_2 * T2_i + \beta_3 * Gender_i + \beta_4 * Age_i + \beta_5 * Benel_i + \beta_6 * Urbanization_i + \varepsilon_i$$

The outcome variable, Y, within this model represents the difference between the elicited beliefs ex-post the information treatment and the ex-ante beliefs (Y=Q29-Q9). This, in practice, represents how the beliefs concerning the economic consequences of leaving the EU of the respondents evolve throughout the survey. The other variables included in our model consist of several independent variables, such as the individual's elicited age, the level of urbanization of their place of residence, their gender, and their country of residence, which are all used as control variables. The variable used to control for the respondent's country of residence consists of the Benel dummy variable. Next, the two main variables of interest within this model are the T1 and T2 dummy variables. The T1 variable takes on a value of 1 if the individual was assigned to the first treatment group, receiving the information under the form of text, and 0 otherwise. Similarly, the T2 variable only takes on a value of 1 if the individuals was assigned to receive the second treatment, obtaining the information through graphics.

Additionally to this model, another similar regression is performed using the same independent variables, but, this time, estimating the evolution in the level of confidence of the individuals concerning their knowledge of the economic consequences of leaving the EU.

$$Y_i = \beta_0 + \beta_1 * T1_i + \beta_2 * T2_i + \beta_3 * Gender_i + \beta_4 * Age_i + \beta_5 * Benel_i + \beta_6 * Urbanization_i + \varepsilon_i$$

The model is the same, but, here, the outcome variable Y consists in the difference between the ex-post and the ex-ante elicited level of confidence of our respondents (Y=Q26-Q8). This is done to observe whether being assigned to one of the treatment groups has a statistically significant impact on the evolution of confidence of the surveyed individuals. Indeed, this allows us to observe whether our respondents believe that the information provided to them is reliable and leads them to better, less biased beliefs.

The results obtained from the estimation of the two model are presented in the table below.

Table 12: Linear regressions of the evolution of beliefs and confidence on independent variables.

Dependent Variable	Evolution of beliefs (Q29-Q9)	Evolution of Confidence (Q26-Q8)
<i>Constant</i>	0.584* (0.303)	1.091** (0.505)
<i>Treatment 1</i>	0.147 (0.099)	0.499*** (0.166)
<i>Treatment 2</i>	0.018 (0.100)	0.374** (0.167)
<i>Gender</i>	-0.108 (0.087)	0.050 (0.145)
<i>Age</i>	-0.002 (0.004)	-0.016** (0.006)
<i>Benel</i>	-0.085 (0.085)	-0.099 (0.141)
<i>Urbanization</i>	-0.036 (0.038)	-0.208*** (0.063)
<i>Observations</i>	275	275

Notes: Linear regression models estimating the evolution of beliefs and the evolution of the confidence in these beliefs. The values reported in the table represent the coefficients of the independent variables included in our regressions, with the standard errors reported between brackets. Star significance is attributed according to: * if $p \leq 0.10$, ** if $p \leq 0.05$, *** if $p \leq 0.01$.

Analysing the results of these linear regression models, it is possible to make several observations. First, we obtain evidence of the fact that, on average, none of the independent variables included in our model appear to have a statistically significant effect on the evolution of an individual's beliefs. Indeed, only the constant appears to be significant at the 90% level. Despite this, it is of interest to mention that the P-value of the coefficient of the treatment 1 dummy variable (0.140) is significantly smaller than the P-value of the coefficient of the treatment 2 dummy variable (0.854). Indeed, this implies that despite not being statistically significant, receiving the information treatment 1 appears to have a relatively larger effect on the evolution of an individual's beliefs than receiving the second information treatment.

Next, the results of our linear regression on the evolution of the individual's confidence in their beliefs regarding the economic consequences of leaving the EU must be discussed. Here, it is possible to observe that the coefficients of several of the control variables included are statistically significant. Indeed, the coefficients of the age and the treatment 2 dummy variable are both significant at the 95% level. On average, the confidence of the respondents, measured on a scale from 1 to 6, decreases by 0.016 for every additional year of age, and increases by 0.374 if they are assigned to the treatment group 2. Additionally to this, the coefficients of the level of urbanization variable and the

treatment 1 dummy variable are statistically significant at the 99% level. On average, being assigned to the treatment group 1 increases the level of confidence by almost 0.5, and decreases by 0.208 for every additional point in the level of urbanization of one's place of residence.

The results of all the analysis performed to test this hypothesis provide ambiguous results. The statistics reported in tables 10 and 11 give evidence which would lead us to reject our fourth hypothesis. Indeed, compared to the data from the control group, the information treatments provided do significantly influence the corrective behaviour towards the biases present in the beliefs concerning the economic consequences of Brexit on the UK. Inversely to this, the results presented in table 12 show that, within our sample, being assigned to either treatment group does not seem to lead to a statistically significant effect on the evolution of beliefs. In conclusion, further research would be necessary in order to determine whether our 4th hypothesis should be rejected or not.

▪ **Hypothesis 5**

Next, the focus is maintained on the effects of the information treatments provided to the survey respondents. The testing of hypothesis 5 consists in comparing and observing whether the treatment effects of the two treatment groups significantly differ between each other. This is done by performing three t-tests. The results of the first two tests are presented in Table 13, where we estimate the within-group difference in the answer provided to Q29 compared to Q9.

Table 13: Differences in the evolution of beliefs between individuals in the two treatment groups.

Evolution of beliefs – Economic consequences of leaving the EU on the UK vs own country

<i>Treatment assignment</i>	Treatment 1		Treatment 2	
	(Text)		(graphics)	
<i>Variable</i>	Was Britain better or worse off after Brexit? (Q9)	Would your country benefit or lose by leaving the EU? (Q29)	Was Britain better or worse off after Brexit? (Q9)	Would your country benefit or lose by leaving the EU? (Q29)
<i>Mean response</i>	2.500	2.833	2.607	2.798
<i>(std error)</i>	(0.081)	(0.053)	(0.076)	(0.058)
<i>Difference</i>	-0.333***		-0.191**	
<i>(std error)</i>	(0.097)		(0.096)	
<i>T-value</i>	-3.4448		-1.9978	
<i>P-value</i>	0.0007		0.0473	
<i>Cohen's D</i>	0.514		0.299	
<i>Observations</i>	90		89	

Notes: Star significance is attributed according to: * if $p \leq 0.10$, ** if $p \leq 0.05$, *** if $p \leq 0.01$. The higher the absolute value of the T statistic the higher the significance of the difference between the two means compared. The higher the value of Cohen's D, the more significant the difference between the two means compared.

The statistics reported in the table above provide evidence of a difference in the statistical significance of the within-group differences computed. Indeed, the difference observed for the individuals in the first treatment group, receiving information via text form, is significant at the 99% level ($P < 0.01$), whilst the difference observed for the individuals in the other treatment group is only significant at the 95% level ($P < 0.05$).

Next, a t-test is performed to compare these two within-group differences, to test whether there are statistically significant differences in the treatment effects between the two treatment groups.

Table 14: Differences in the evolution of beliefs between individuals in the two treatment groups.

<i>Treatment assignment</i>	<i>Difference in treatment effects</i>	
	Treatment 1 (Text)	Treatment 2 (graphics)
<i>Average impact on beliefs</i>	-0.333	-0.191
<i>(std error)</i>	(0.097)	(0.096)
<i>Difference</i>	-0.142***	
<i>(std error)</i>	(0.014)	
<i>T-value</i>	-9.8431	
<i>P-value</i>	0.0000	
<i>Observations</i>	90	89

Notes: Star significance is attributed according to: * if $p \leq 0.10$, ** if $p \leq 0.05$, *** if $p \leq 0.01$. The higher the absolute value of the T statistic the higher the significance of the difference between the two means compared.

The results presented in table 14 reveal that the difference between the within-group differences is statistically significant at the 99% level of confidence ($P < 0.01$). Individuals who received the information under text form appear to correct their biased beliefs significantly more than those who received the information under graphic form. Given these results, our sixth null hypothesis must be rejected as the tests performed reveal a significant difference between the treatment effects of treatment 1 (text) and treatment 2 (graphics).

▪ Hypothesis 6

This hypothesis is used in order to test whether significant differences exist between the elicited behavioural preferences of our survey respondents. The analysis is carried on by performing two separate two sample t-tests suing groups. Here, individuals' answers are compared between those who reside in Italy, with those residing in Belgium and in the Netherlands. The two behavioural outcomes which are compared are the referendum voting intentions of the individuals, who elicit

whether they would vote for their country to leave (1) or remain (2) within the EU, and the proportion of money which they would donate to a pro-EU NGO out of a total of 100€.

Table 15: Differences in behavioural preferences between resident in Benel and in Italy

Differences in voting intentions and donations to a pro-EU NGO

Variable	Referendum voting intentions (Q28)		Donations to pro-EU NGO (Q27)	
	Benel	Italy	Benel	Italy
Group				
Mean response	1.957	1.875	90.470	88.05
(std error)	(0.019)	(0.026)	(2.078)	(1.991)
Difference	-0.082**		-2.420	
(std error)	(0.035)		(2.936)	
T-value	-2.3341		-0.8241	
P-value	0.0203		0.4106	
Observations	115	160	115	160

Notes: Star significance is attributed according to: * if $p \leq 0.10$, ** if $p \leq 0.05$, *** if $p \leq 0.01$. The higher the absolute value of the T statistic the higher the significance of the difference between the two means compared.

The results reported in table 15 provide evidence of the fact that no significant differences appear in the donations between the groups compared as $P=0.4106$. Inversely, it is possible to observe that, when looking at the elicited voting intentions of the respondents, on average, those residing in the Netherlands and in Belgium are significantly more inclined to vote to remain. Indeed, the difference in the average response between the two groups is statistically significant at the 95% level.

Additionally to these tests, two multiple linear regression model are used to analyse how voting intentions and the donations to a pro-EU NGO differ by treatment assignment and by nation. These models focus on the effects of being assigned to one of the treatment groups, additionally to the effect of residing in the Netherlands or in Belgium compared to living in Italy.

The equations of the models are the same, but the outcome variable Y differs between the two. The models are written as follows:

$$Y_i = \beta_0 + \beta_1 * Treatment_i + \beta_2 * Benel_i + \beta_3 * Benel_i * Treatment_i + \beta_4 * Gender_i + \beta_5 * Age_i + \beta_6 * Urbanization_i + \varepsilon_i$$

First, the outcome variable Y is used to represent the voting intentions of the individuals (Q28), and next, in the second model, Y represents the donations to a pro-EU NGO (Q27). The “treatment” dummy variable takes on a value of 1 if the individual was assigned to either if the two treatment groups. Additionally, the model includes an interaction term between this “treatment” variable and the Benel dummy variable. This is done to accurately estimate the differences in outcomes caused by the nations where the individuals resides and their assignment to treatment.

The results of the analysis of this regressions are presented in table 16 in the appendix, which shows that none of the variables included in these models appear to have a statistically significant influence on the two outcome variables observed. Indeed, the p-values of all the coefficients are all relatively large. Therefore, no significant differences in voting intentions and donations to a pro-EU NGO appear to be linked to the assignment to one of the treatment groups or the nation of residence.

Once again, the results obtained lead us to make ambiguous conclusions concerning this hypothesis. Indeed, the results obtained from the t-tests performed would lead us to reject the hypothesis that no significant differences exist in the voting intentions between individuals residing in Italy and those living in Belgium or the Netherlands, but we cannot reject that no differences exist in the donations to the pro-EU NGOs. Despite this, the results obtained from the regression of the two linear models which include a dummy variable for treatment assignment imply that our null hypothesis should not be reject. Further research would be necessary.

▪ **Hypothesis 7**

Similarly to the previous analysis performed, this hypothesis is used to observe whether the same behavioural preferences discussed for the sixth hypothesis significantly differ between individuals from different groups within our sample. Here, respondents' answers are compared between the over-45 and the under-45 years old. Statistical testing is performed using 2 two sample t-tests using groups.

Table 17: Differences in behavioural preferences between under and over 45 years old

Differences in voting intentions and donations to a pro-EU NGO

<i>Variable</i>	Referendum voting intentions (Q28)		Donations to pro-EU NGO (Q27)	
	Over 45	Under 45	Over 45	Under 45
<i>Group</i>				
<i>Mean response</i>	1.897	1.927	87.945	90.736
<i>(std error)</i>	(0.024)	(0.025)	(1.998)	(2.027)
<i>Difference</i>	0.030		2.791	
<i>(std error)</i>	(0.035)		(2.955)	
<i>T-value</i>	0.8544		0.9444	
<i>P-value</i>	0.3936		0.3458	
<i>Observations</i>	165	110	165	110

Notes: Star significance is attributed according to: * if $p \leq 0.10$, ** if $p \leq 0.05$, *** if $p \leq 0.01$. The higher the absolute value of the T statistic the higher the significance of the difference between the two means compared.

Here, the results obtained from our analysis reveal that no significant differences appear between individuals of the two age groups. Indeed, the p-values of both t-tests are large, respectively 0.3936 and 0.3458. Therefore, no statistically significant differences can be found between the behavioural preferences of these two groups. We cannot reject our 7th hypothesis.

6. Discussion

The results of the analysis performed have been presented and must now be discussed. The data analysed for this section originates from an information treatment experiment conducted via a survey which was distributed to individuals residing in Italy, in the Netherlands, and in Belgium. This second part of the analysis included 5 hypotheses which were used to test whether the same biases and misperceptions which lead to the outcome of the vote observed in Britain in 2016, are also present in our surveyed sample. Additionally, the experiment conducted includes the use of two different types of information treatments, which are provided to our survey respondents to verify whether these are able to correct their biased beliefs and misperceptions.

The 1st hypothesis was tested in order to observe whether significant biases arise in the answers provided by the respondents of the survey. The presence of these biases has also been discussed by Hobolt (2016), who states that political parties are the ones providing information to the voters, therefore influencing their perceptions of the implications of their vote, emphasizing some aspects more than others. Indeed, the findings of Hobolt (2016) reveal that the manipulation of information by the political parties and the subsequent biased beliefs which originated from it have been relevant factors in the determination of the Brexit vote. The analysis of our survey data reveals the presence of similar misperceptions and biased beliefs concerning the economic consequences of Brexit within our sample of respondents. Indeed, on average, the economic consequences of Brexit were significantly underestimated.

Continuing the analysis, the 2nd hypothesis is tested by verifying whether significant differences exist between the average responses provided by individuals in Italy and those living in Belgium or in the Netherlands. Here, we compare between these countries as, as reported by Boros et al (2016), populist support is similar in Belgium and in the Netherlands but is much more significant in Italy. Italian populist Eurosceptic parties are part of the current government, with 2 parties having respectively 26 and 30 percent of the support of Italian voters, whilst support for populist parties in Belgium is at 12%, and in the Netherlands two opposite-wing parties have respectively 14% and 8% of the votes (Boros et al, 2016). Indeed, from this data it is clear that Italy has a significantly larger proportion of populist, Eurosceptic, supporters than the other two countries observed. This information is consistent with the findings from our analysis, individuals residing in Italy had significantly more biased beliefs than those residing in Belgium or in the Netherlands. Italian respondents, on average, underestimated the economic consequences of Brexit significantly more than the other surveyed individuals. This is evidence of the fact that the perceived benefits and costs of leaving the EU are significantly affected by the information provided to voters by the leading, most

supported, local political parties. Indeed, in a country like Italy, where the Euroscepticism feelings are currently strong, people are influenced to emphasize more the negative aspects of being part of the EU rather than understanding the actual extremely detrimental consequences that would derive from leaving.

Next, the 3rd hypothesis is used to perform an analysis focused on observing whether the age of our respondents is a variable which appears to be correlated with their beliefs. Here, we compare the answers provided between individuals over and under the age of 45. We want to observe whether our findings correspond with those of Britton et al (2019), stating that the probability of an individual voting to leave increased with their age. In this situation, we should expect a significant difference between the beliefs of these two groups of individuals. The older are expected to underestimate the consequences of Brexit significantly more than the young but, despite this, our results reveal that this is true only for certain variables. Indeed, individuals in the over-45 group appear to be significantly more confident, and underestimate the long term consequences of Brexit on the GDP significantly more than the under-45 but when analysing the other variables (Q13, Q15), no significant differences between the average responses in the two groups appears.

The 4th and 5th hypothesis are tested in order to determine whether the provision of the information treatments actually had a significant impact on the beliefs of our respondents, potentially correcting the biases present in their perceptions. The 4th hypothesis is used to observe whether there are differences in the responses of those who were assigned to the control group and those assigned to either treatment group. The reason for including a control group is supported by Armona et al (2017), stating that the simple act of taking a survey may make respondents think more carefully about their responses, and may lead them to “correct” for their biases more than they would do outside of an experimental (survey) environment. The results of our analysis reveal ambiguous results. The t-tests performed reveal that the two information treatments appear to have a significant impact on the beliefs of the individuals, but, inversely, the linear regressions performed provide evidence which would lead us to exclude that being assigned to one of the treatment groups has a significant impact on the corrective behaviour of individuals towards their beliefs. Despite this, we observe that, on average, the respondents assigned to either of the treatment groups had the tendency of correcting their biased beliefs more than those in the control group. In conclusion, as previously mentioned, further research would be necessary in order to determine whether the effects of these information treatments are actually statistically significant, and therefore whether our 4th hypothesis should be rejected or not.

The 5th, hypothesis focuses on determining whether there are significant differences in the effects of the two information treatments. The results of the statistical analysis carried on to test this

hypothesis reveal a significant difference in the effects between the two treatments. Individuals who received the information under the form of text (treatment 1) tend to correct their biased beliefs significantly more than those who received the information through some graphs. Indeed, this coincides with the findings of Kim et al (2015), who state that individuals process text information differently than graphic information. In their research, Kim et al (2015) find that text information becomes more effective and easy to process when the graphic information is complicated to interpret. Exactly as supported by these findings, the information provision via text form appears to be the most effective method to encourage individuals to correct their misperception and biased beliefs concerning the economic consequences of the Brexit referendum. Additionally to this, when compared to graphic information, text information also appears to be the relatively more trusted source of information, which leads to a significantly larger increase in individuals' confidence in their beliefs.

The 6th and 7th hypothesis focus on observing whether the elicited behavioural preferences of the surveyed individuals differ between different groups of respondents. The 6th hypothesis is used to test whether such differences exist when comparing the responses of individuals residing in Italy, with those of the people in Belgium and in the Netherlands. The results obtained from this analysis are ambiguous, but are relatively in line with our expectations. Indeed, in a country such as Italy, where populist forces are stronger (Boros et al, 2016), we observe a significantly inferior propensity to vote to remain in the EU in the eventuality of a referendum like the Brexit one. Similarly, the statistics in table 15 reveal that, on average, the donations to a pro-EU NGO are lower for Italian respondents, despite the fact that this difference is not statistically significant. Additionally to these conclusions, it is important to mention that in the analysis of the two linear models including a treatment dummy variable and the interaction term between this variable and the "Benel" dummy variable we find evidence of the fact that no differences in voting intentions and NGO donations seem to be driven by the individual's assignment to treatment or their nation of residence. Additional research would be necessary to further elucidate the mechanics involved in this phenomenon.

Lastly, hypothesis 7 is used to test whether significant differences exist between the elicited behavioural preferences of individuals over the age of 45, compared to those of younger respondents. Here our results are more surprising, and are not consistent with what has been found in the existing literature. Indeed, in a paper from Britton et al. (2019), it was found that, in Britain in 2016, the majority of individuals over the age of 45 voted to leave, whilst younger people had the tendency to vote to remain. This is not reflected in our findings, as our results do not show any significant differences in the voting behaviour between the over 45 and the under 45. Similarly, the donations to a pro-EU NGO do not significantly differ between respondents of different age groups. Further

research would be necessary to test whether our findings are specific to the sample of our survey respondents, or whether these results would be applicable to the underlying populations of the three countries observed.

The limitations in our researchers involved with the analysis of the data collected via the survey could be several. First, it is important to mention that the sample of individuals used is not representative of the underlying population of the three countries, as it is too small. Additionally, access to more resources to perform a more in-depth research of the effects of the information treatments provided would allow for a much better understanding of whether these treatments could have a significant effect on the correction of individual's biased beliefs. Indeed, we cannot state whether our findings would be applicable to the entire populations of the three countries taken into account, or whether they are specific to our sample of respondents. Performing a similar experiment and research on a larger sample of individuals would allow for more externally valid results which would be more useful towards potential policy making.

7. Conclusions

The findings discussed in this research are of very important societal and scientific nature. The same biased beliefs which contributed to driving the outcome of the referendum vote of 2016 are also significantly present in the sample of respondents to our survey experiment. Indeed, interviewed individuals appear to significantly underestimate the economic consequences of Brexit, for all variables (questions) analysed. Next, proof has been found of the fact that survey respondents residing in Italy underestimate these costs significantly more than individuals residing in the Netherlands and in Belgium. This is evidence supporting the claim that the strength of the Euroscepticism feelings within a country significantly influences the way individuals perceive the magnitude of the economic consequences and implications which would derive from leaving the EU.

Continuing with our conclusions, our results provide ambiguous insights concerning the effectiveness of the information treatments used in our experiment. Indeed, it is not clear whether these treatments have a significant effect towards influencing and correcting our respondent's beliefs. Individuals who were assigned to either one of the treatment groups appeared to correct their misperceptions more than the individuals in the control group. Additionally to this, the statistical tests performed provide evidence of the fact that, on average, the respondents who received the information treatments under the form of text corrected their biased beliefs significantly more than those who received the information under the form of graphics. Despite this, the average corrective behaviour of our respondents towards their beliefs does not appear to be statistically significantly affected by the assignment to one of the treatment groups.

In conclusion, this research provides important insights on the topic of interest, which could have important policy implications in the future. Indeed, as supported by the existing literature, our results reveal that the biases which contributed to the determination of the outcome of the referendum vote are also significantly present in other countries. Despite this, our analysis also reveals that the use of information treatments (particularly providing the desired information under the form of text) is relatively effective towards correcting for these misperceptions. Further research on the effectiveness of the provision of information treatments towards the correction of biases within individual's beliefs is necessary, as the external validity of our results cannot be guaranteed because of the limited sample of respondents analysed. The insights which would derive from such a research could be crucial towards the design of a potential intervention aimed at correcting for these biases to ensure that, in the eventuality of a referendum like the Brexit one, a similar, irrational outcome driven by people's misperceptions would not take place.

8. Appendix

I. Additional tables

Table 3: Summary and description of variables used

<i>Variable</i>	<i>Description</i>
<i>Confidence ex-ante (Q8)</i>	Confidence in the knowledge of the economic consequences of Brexit on a scale from 1 to 6 with 1=completely unsure and 6=completely sure.
<i>Impact on Britain (Q9)</i>	Was Britain economically better or worse off following the vote? 1= Better off; 2=Same situation; 3=Worse off
<i>1-year impact on GDP (Q10)</i>	Estimated impact of Brexit on the UK's GDP in the first year following the referendum, in Billions of £.
<i>Longer term impact on GDP (Q11)</i>	Estimated impact of Brexit on the UK's GDP since the referendum until the end of 2018, in Billions of £.
<i>Average value of pound (Q13)</i>	Estimated average value of the British pound in the 1-year period following the Brexit vote in £.
<i>Impact on household consumption (Q15)</i>	Estimated impact on yearly consumption of the average British household in £.
<i>Confidence ex-post (Q26)</i>	Confidence in knowledge after the information treatment experiment on a scale from 1 to 6 with 1=completely unsure and 6=completely sure.
<i>Money to pro-EU NGO (Q27)</i>	Proportion of money allocated to pro-EU NGO out of 100€.
<i>Money to anti-EU NGO (Q27_2)</i>	Proportion of money allocated to anti-EU NGO out of 100€.
<i>Voting intentions (Q28)</i>	Voting behaviour in the eventuality of a referendum to decide whether to leave or remain in the EU. 1=Leave; 2=Remain
<i>Expected impact on own country (Q29)</i>	Would your country be better or worse off by leaving the EU? 1= Better off; 2=Same situation; 3=Worse off
<i>Benel</i>	Country of residence dummy variable. 1=Resident in BE or NL; 0=resident in IT
<i>Over45</i>	Age dummy variable. 1 if age>45 ; 0 if age=<45
<i>Control</i>	Dummy variable taking value 1 if the individual is assigned to the control group, 0 otherwise.
<i>Treatment1</i>	Dummy variable taking value 1 for individuals who received the information via text form, 0 for others.
<i>Treatment2</i>	Dummy variable taking value 1 for individuals who received the information treatment via graphic form, 0 for others.
<i>Treatment_assignment</i>	Dummy variable taking value 0 if treatment1=1 and 1 if treatment2=1.

Table 4: Descriptive statistics of main variables

Variable	Observations	Mean	Std Deviation	Median	Min	Max
Confidence ex-ante (Q8)	275	3.473	1.236	3	1	6
Impact on Britain (Q9)	275	2.571	0.733	3	1	3
1-year impact on GDP (Q10)	275	-4.189	10.142	-5	-30	30
Longer term impact on GDP (Q11)	275	-6.975	21.811	-10	-80	80
Average value of pound (Q13)	275	1.261	0.110	1.25	1.05	1.62
Impact on household consumption (Q15)	275	-67.153	184.149	-85	-786	597
Confidence ex-post (Q26)	275	3.287	1.236	3	1	6
Money to pro-EU NGO (Q27)	275	89.062	24.003	100	0	100
Money to anti-EU NGO (Q27_2)	275	10.938	24.003	0	0	100
Voting intentions (Q28)	275	1.909	0.288	2	1	2
Expected impact on own country (Q29)	275	2.804	0.538	3	1	3
Benel	275	0.418	0.494	0	0	1
Over45	275	0.600	0.491	1	0	1
Control	275	0.349	0.478	0	0	1
Treatment1	275	0.327	0.470	0	0	1
Treatment2	275	0.324	0.469	0	0	1
Treatment_assignment	179	0.497	0.501	0	0	1

Table 6: One-way ANOVA tests of demographic differences between experimental groups

Variable	Gender	Age	Occupation	Urbanization	Benel
P-value	0.8642	0.3819	0.6906	0.7925	0.1273

Notes: Statistical significance of the difference in the average values of demographic variables between experimental groups: * if $p \leq 0.10$, ** if $p \leq 0.05$, *** if $p \leq 0.01$

Table 16: Multiple linear regression of behavioural variables on treatment assignment and country of residence

Dependent Variable	Voting intentions (Q28)	Donations to pro-EU NGO (Q27)
<i>Constant</i>	1.912*** (0.129)	68.937*** (10.826)
<i>Treatment</i>	-0.016 (0.047)	5.471 (3.922)
<i>Benel</i>	0.058 (0.061)	4.959 (5.108)
<i>Treatment*Benel</i>	0.029 (0.074)	-5.817 (6.215)
<i>Age</i>	-0.002 (0.002)	0.043 (0.135)
<i>Gender</i>	-0.018 (0.037)	3.632 (3.083)
<i>Urbanization</i>	0.022 (0.016)	2.215 (1.353)
<i>Observations</i>	275	275

Notes: Linear regression models estimating the evolution of beliefs and the evolution of the confidence in these beliefs. The values reported in the table represent the coefficients of the independent variables included in our regressions, with the standard errors reported between brackets. Star significance is attributed according to: * if $p \leq 0.10$, ** if $p \leq 0.05$, *** if $p \leq 0.01$.

II. Survey

i. Survey Flow

Standard: Block 1 (2 Questions)
Branch: New Branch If If This survey is conducted as part of a research for a thesis project for the Erasmus School of Eco... I agree Is Selected
Block: Block 2 (5 Questions) Standard: Block 3 (8 Questions)
BlockRandomizer: 1 - Evenly Present Elements
Standard: Block 4 (2 Questions) Standard: Block 5 (7 Questions) Block: Block 6 (1 Question)
Standard: Block 7 (4 Questions)

Page Break

ii. Survey text

Start of Block: Block 1

Q1 This survey focuses on the Brexit referendum and its consequences. Most of this survey focuses on the short term consequences of the vote, as its longer term effects have been overshadowed by the Corona virus pandemic started in 2020 which has put the whole world's economy on hold for already a year and a half. The Brexit referendum took place on 23/06/2016, the actual Brexit was implemented on 31/12/2020.

Page Break

Q2 This survey is conducted as part of a research for a thesis project for the Erasmus School of Economics. If you accept to participate to this questionnaire, you will be asked to answer some questions regarding your beliefs concerning the Brexit referendum and its consequences. The data collected will have the sole purpose of being used towards this thesis research project. Your data will remain anonymous and in no way will it be traceable back to you. There are no obvious physical, legal or economic risks associated with participating in this study. Your participation is voluntary, and you are free to discontinue your participation at any time.

Please select “I agree” to indicate that you have read this consent form and you voluntarily agree that you will participate in this research study and that your anonymised data will be analyzed for research purposes .

- I agree (4)
- I do not agree (5)

End of Block: Block 1

Start of Block: Block 2

Q3 Country of Residence:

- The Netherlands (1)
 - Belgium (2)
 - Italy (3)
-

Q4 Gender:

- Male (1)
 - Female (2)
-




Q5 Age:

Q6 Currently you are:

- Employed (1)
 - Unemployed (2)
 - Student (3)
-

Q7 Is your place of residence located in a rural or an urban area? Select a value on a scale from 1 to 5 with 1=extremely rural area and 5=extremely urban area:

1 2 3 4 5

Level of urbanization ()	
--------------------------	--


Page Break

End of Block: Block 2

Start of Block: Block 3

Q8 On a scale from 1 to 6 how confident are you regarding your knowledge of the economic consequences of Brexit on the UK?
(1=completely unsure, 6=completely sure)

1 2 3 4 5 6

Degree of certainty ()	
------------------------	--

Page Break

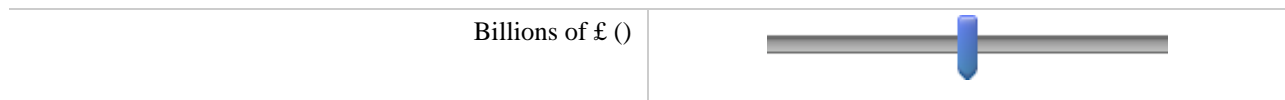
Q9 What are your beliefs concerning the economic consequences of the Brexit referendum of June 2016?
Was Britain economically better or worse off following the vote?

- Better Off (1)
- Same (2)
- Worse Off (3)

Page Break

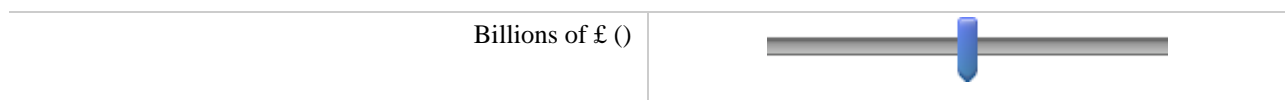
Q10 Please try estimating the impact of Brexit on the UK's economy in the first year following the referendum of June 2016. A positive value implies an increase in GDP and a negative value implies a decrease in GDP following the Brexit):

-30 -20 -10 0 10 20 30



Q11 Please try estimating the impact of Brexit on the UK's economy from the referendum to the end of 2018 (a positive value implies an increase and a negative value implies a decrease in GDP following the Brexit):

-80 -60 -40 -20 0 20 40 60 80



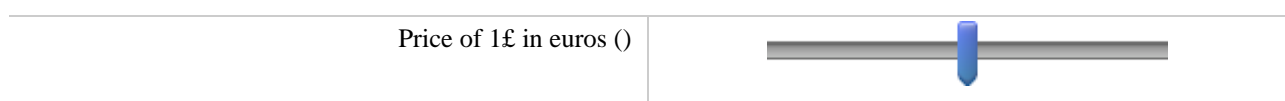
Page Break

Q12 Did the British pound gain or lose value following the Brexit referendum?

- Gained Value (1)
- Lost value (2)
- Kept constant (3)

Q13 Estimate the average value of the British pound in the 1-year period following the Brexit vote. Take into consideration that in the 1-year period preceding the referendum the average price of the pound was 1.34 euros.

1 1 1 1 1 1 1 1 1 1.65

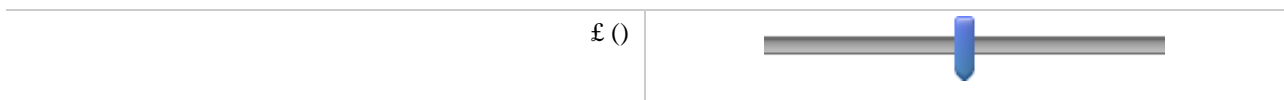


Q14 Was the average British household's income positively or negatively affected by Brexit?

- Positively affected (1)
 - Negatively affected (2)
 - Kept constant (3)
-

Q15 Estimate how the yearly consumption of the average British household changed following the outcome of the Brexit referendum. (A positive value implies an increase in consumption and a negative value implies a decrease)

-800 -600 -400 -200 0 200 400 600 800



End of Block: Block 3

Start of Block: Block 4

Q16 Timing

- First Click (1)
 - Last Click (2)
 - Page Submit (3)
 - Click Count (4)
-

Q17 /

**50
Billion £**

- EN: The economic costs of the Brexit referendum were more than £50 billion by year-end 2018.
- FR: A la fin de 2018, le coût économique du référendum sur le Brexit s'élevait à plus de 50 milliards de livres sterling.
- IT: Alla fine del 2018, i costi economici del referendum sulla Brexit ammontavano a più di 50 miliardi di sterline.

**-13%
£ vs €**

- EN: The average price of the pound against the euro in the 1-year period after the referendum fell from 1.34€ to 1.16€.
- FR: Le cours moyen de la livre par rapport à l'euro au cours de la période d'un an après le référendum est passé de 1,34 € à 1,16 €.
- IT: Il prezzo medio della sterlina nei confronti dell'euro nel periodo di un anno dopo il referendum è sceso da 1,34€ a 1,16€.

- £400

- EN: Every British household lost on average 400£ in consumption in the first year after the referendum.
- FR: Chaque ménage britannique a perdu en moyenne 400 £ de consommation pendant l'année suivant le référendum.
- IT: Ogni famiglia britannica ha perso in media 400 sterline in consumo nel primo anno dopo il referendum.

- £1,300

- EN: In the year following the referendum, each British household lost around 1300£ in income .
- FR: Dans l'année qui a suivi le référendum, chaque ménage britannique a perdu environ 1 300 £ de revenus.
- IT: Nell'anno successivo al referendum, ogni famiglia britannica ha perso circa 1300£ di reddito.

**4,200 to
£6,400**

- EN: In the long term, each British household is expected to lose around £4,200 to £6,400 of income yearly.
- FR: Sur le long terme, chaque ménage britannique devrait perdre environ 4 200 à 6 400 £ de revenus par an.
- IT: Sul lungo termine, ogni famiglia britannica dovrebbe perdere circa £ 4.200 a £ 6.400 di reddito all'anno.

End of Block: Block 4

Start of Block: Block 5

Q18 Timing

First Click (1)

Last Click (2)

Page Submit (3)

Click Count (4)

Q19 - Hard Brexit: Complete termination of all trade agreements between UK and EU.

- FTA: Free Trade Agreement with the EU, less inclusive and with more barriers than the European single market.

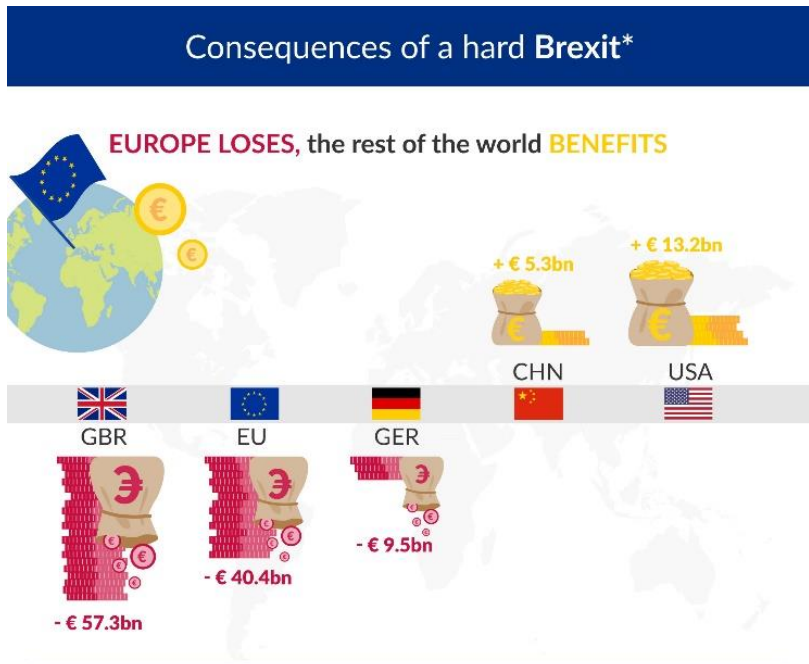
- Soft Brexit: UK remaining in the EU's single market and in the European customs union.

Q20

Consequences of a hard Brexit

Europe loses, the rest of the world benefits.

Annual income losses and gains due to a hard Brexit, in billions of euros:



* Annual income losses and gains due to a hard Brexit, in 2016 prices. Figures based on a simulation model of the global economy from the study 'Estimating the impact of Brexit on European countries and regions'.

Source: Bertelsmann Stiftung

| BertelsmannStiftung

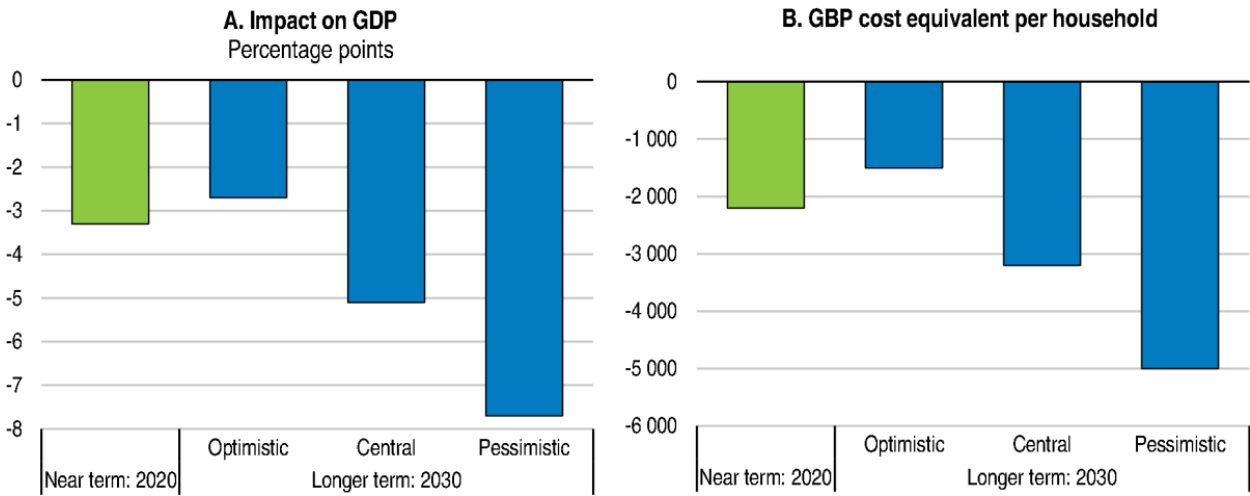
Page Break

Q21 - 1st graph: Impact of Brexit on the British GDP in percentage points.

- 2nd graph: Average cost of Brexit per British household in £.

- In both graphs, the first column presents the short-term effects of Brexit until 2020.

- The other 3 columns show the 2016 estimates of the long-term costs in three different scenarios concerning the conditions of the trade agreement reached with the EU after the implementation of Brexit.



Page Break

Q22 Evolution of the value of one British pound £ against the US dollar \$ and the euro €.

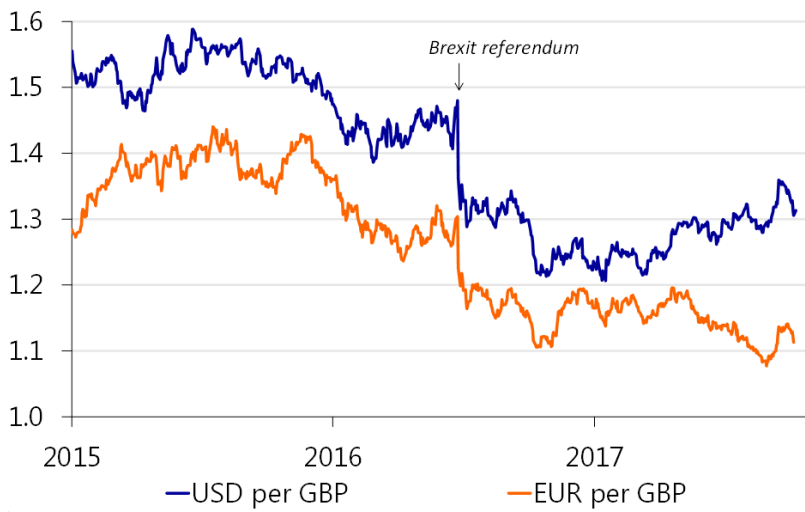
Page Break

Q23 - Evolution of the average hourly wage adjusted for inflation.

- The blue line represents the value of the wage.

- The blue dotted line represents the estimated evolution of the wage in the scenario of Britain not leaving the EU.

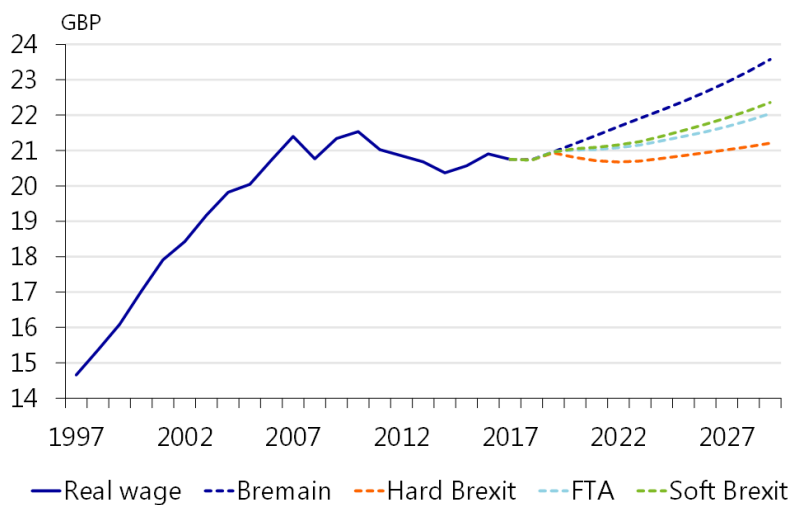
- The three colored lines represent the estimates in the three different trade agreement scenarios, hard Brexit, free trade agreement and soft Brexit.



Q24 - Hard Brexit: Complete termination of all trade agreements between UK and EU.

- FTA: Free Trade Agreement with the EU, less inclusive and with more barriers than the European single market.

- Soft Brexit: UK remaining in the EU's single market and in the European customs union.



End of Block: Block 5

Start of Block: Block 6

Q25 Please, skip this question

End of Block: Block 6

Start of Block: Block 7

Q26 After what you have seen in this survey so far, on a scale from 1 to 6, how confident are you now regarding your knowledge of the economic consequences of a phenomenon like Brexit?

1 2 3 4 5 6

Degree of certainty ()



Q27 If 100 € were given to you to be allocated between a pro-EU NGO (**Non-governmental organization**) and an anti-EU NGO how would you distribute this money?

_____ Money allocated to pro-EU NGO (1)

_____ Money allocated to anti-EU NGO (2)

Page Break

Q28 Imagine a referendum like the Brexit one will be held in your country.
What would be your vote?

Leave the EU (1)

Remain (2)

Q29 Do you think your country would be economically better or worse off if it left the EU?

Better Off (1)

Same (2)

Worse Off (3)

End of Block: Block 7

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