Diesel or petrol? Proenvironmental preferences, attitudes to uncertainty and the power of money[‡]

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Abstract

People differently rank factors they see as important when making decisions with potential environmental impact. Both in a survey and theoretically, we investigate the relative importance of monetary and non-monetary factors and how and whether attitudes to uncertainty affect this ranking. Risk and ambiguity aversion explains the ranking of decision factors that involve uncertainty about future outcomes but often uncertainty is neglected: e.g. possible changes to standards and regulations are seen as a factor of uncertainty, while data manipulation by car manufacturers, as manifested in the recent Dieselgate scandal, is not seen as such. Responses in our sample overwhelmingly reject consumers' indifference with respect to environmental issues, however when it comes to individual consumption choices, these are strongly dominated by monetary factors. Our data highlight an important role of institutions as collective commitment devices to help promote proenvironmental behaviour.

Keywords: proenvironmental behaviour, monetary incentives, non-monetary incentives, risk, ambiguity.

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1 Introduction

Proenvironmental behaviour of individuals is known to depend on individual characteristics such as age, gender, education and income, as well as on the system of values[1], although the link from individual characteristics to behaviour remains largely a black box. On top of the above, psychology and economics pay much attention to attitudes in uncertainty, yet the role of these attitudes in decision-making with respect to environment-relevant options is underinvestigated. Obviously, if decisions explicitly deal with risk and ambiguity, one would expect uncertainty attitudes to play a role. However in many situations uncertainty is implicit, and as such may be neglected by researchers, yet matter for decision-makers. For example, the recent "Dieselgate" scandal (Brand, 2016) highlights some environmental characteristics of the product may be unknown at the time of decision-making.[2] Besides, decision problems are multi-dimensional: consumers consider many relevant aspects, including personal preferences (e.g. time-, risk-, and environmental preferences on top of consumption), monetary factors (such as prices, discounts, and future resell values of durable goods), information from various sources (e.g. advertisement, education, propaganda, etc.), among others. These decision factors may be of different importance to different consumers. To elucidate the link(s) between individual characteristics and proenvironmental behaviour, in this paper we investigate the relative importance of factors consumers see as relevant for decisions with potential environmental impact, and trace the impact of the above individual characteristics on the relative importance of these factors.

We distinguish between four groups of factors: (1) monetary, such as prices and discounts, (2) environmental impact, (3) willingness to take on responsibility, and (4) uncertainty. Instead of focusing on observable behaviour (actual choices), as is more common in the literature, we wish to elicit how important these factors are for decisions, and what individual consumer characteristics determine their importance relative to each other.

[1] Citeblankenberg2018determinants provide a thorough review of the literature that shows importance of these and other factors. Uncertainty attitudes are remarkably missing from the list.

[2] A few studies show that regulatory compliance procedures may invoke verification errors (Andreoni, 1991; Heyes, 2000; Almer and Goeschl, 2010), or there is a randomness element in inspections (Duflo et al., 2014), the possibility of which dramatically changes decisions, and more so the more uncertainty averse are decision-makers (Vinogradov and Shadrina, 2018).

To do this, we conduct two field experiments in which respondents report which factors, out of a list of six, are more or less important for them in a particular consumption situation. Given the recent media attention to the "Dieselgate"[3], we framed the situation of choice as a decision to buy a diesel or a petrol car. By the design of he experiment, we assign subjects randomly to two groups, one control, and one treatment. In the two experiments, the control condition is the same, the treatment is different. In the first experiment, we amend the list of options (decision factors) the treatment group faces; this allows us to assess the impact of the wording and the inclusions or the omission of some of the options on the importance of key factors. In the second experiment, the treatment primes respondents with a brief information on Dieselgate; this highlights the uncertainty element in one of the options.

Our key result is that despite some importance of environmental factors, the key dominating decision factor is monetary - the majority of our respondents place price and resell value of cars on top of anything else. This result is robust to inclusion of a second monetary factor, discounts, which becomes second most important on average. Interestingly, respondents strongly reject the option "I just need a good car, let the government deal with emissions", but accept the factor "new diesel cars meet all necessary standards", which suggests that while environmental factors are important (rejection of the first option), delegation of responsibility to standardization and certification bodies is desirable. Younger people see monetary factors as less important, and are less willing to delegate responsibility to government and standardization bodies. This is consistent with other literature that generally finds "environmental beliefs decline with age" (Blankenberg and Alhusen, 2018). Female participants are more concerned about CO2 emissions and standardization. More education in our sample somewhat increases the likelihood of delegating the responsibility to the government (the literature, reviewed in Blankenberg

[3]To give some perspective, here are a few recent headlines: "33m polluting cars still on EU roads after Dieselgate scandal" (The Guardian, May 28, 2019, https://www.theguardian.com/environment/2019/may/28/dieselgate-33m-polluting-cars-still-on-eu-roads), "Porsche fined EUR 535m over 'dieselgate' scandal" (The Telegraph, May 7, 2019, https://www.telegraph.co.uk/business/2019/05/07/porsche-fined-535m-dieselgate-scandal/), "Volkswagen says it may face U.S. SEC lawsuit over 'Dieselgate'" (Euronews, Mar 14, 2019, https://www.euronews.com/2019/03/14/volkswagen-says-it-may-face-us-sec-lawsuit-over-dieselgate), and more recently "Volkswagen in 'dieselgate' talks with motorists" (BBC, Jan 2, 2020, https://www.bbc.com/news/business-50971156).

and Alhusen (2018) offers a mixed evidence with regards to education). Controlling for uncertainty attitudes shows that only potential changes in environmental standards are seen as an uncertain factor.

To achieve the above result with respect to uncertainty, we need to elicit individuals' attitudes toward risk (uncertainty with known probability distribution) and ambiguity (uncertainty with unknown distribution of probabilities). It is not easy to identify risk and ambiguity attitudes in a short survey. Typically, in economics experiments such an elicitation involves a series of incentivized choices between lotteries or between lotteries and certain outcomes, where participants can win real money. This option is often unavailable in surveys for a number of reasons. First, a survey that covers thousands of respondents becomes overly costly if it includes payments to participants. Second, confronting respondents with complicated questions puts at risk their participation (in Vinogradov and Shadrina (2013) the drop-off rate jumps when subjects face questions involving probabilities and expected values). Third, keeping surveys short helps keep respondents motivated and reduce attrition, especially in online surveys (Vinogradov and Shadrina, 2013). This is a non-exhaustive list of obstacles. To overcome them, we resort to a two-question test of both risk and ambiguity attitudes by asking respondents about their willingness to accept a payment for a lottery that wins with probability $1/2$, and for a lottery for which the probability of winning is unknown. The first question is used to characterize subjects' risk premiums, while the difference between their answers to the first and the second question characterizes their ambiguity premiums.

In total we obtain 2200 responses. The field experiment is embedded in a running periodical (quarterly since October 2017) survey of expectations of the UK general public. The overall survey design is explained in Lamla and Vinogradov (2019); the questionnaire is in Appendix. For the purposes of our project two innovations were made in July 2019 and in October 2019: (1) the uncertainty attitudes block, which earlier included three questions, was amended as described above, freeing up space for one extra question, (2) the extra question was designed to measure the importance of monetary and non-monetary incentives, personal responsibility and uncertainty in a particular choice with potential environmental impact, as described above.

According to our results, individuals care about the environmental impact of their consumption goods but in their individual decisions monetary factors prevail. This may create a commitment problem: a priori, in an abstract setting, individuals may choose to behave proenvironmentally, but once they face a real decision problem, other factors may force them to deviate from proenvironmental behaviour. At the same time, consumers value certification and standardization. The combination of these results indicates standardization bodies may act as a collective commitment device: they deliver on the environmental preferences of consumers, and ensure the actual consumption, even if mostly driven by factors other than environmental considerations, is in line with those environmental preferences.

2 Theoretical background

We first outline a parsimonious model to highlight how uncertainty and uncertainty attitudes interfere with decisions that have environmental impact. Then we formalize our approach to measure risk and ambiguity attitudes in a survey.

2.1 Risk and risk-neutral choices

In a standard consumer choice problem, assume the choice is binary: the consumer may buy either good 1 (say, a car with a petrol engine) or good 2 (a car with a diesel engine). The quantity is thus fixed and normalised at 1: if x is the binary variable that describes the consumer's choice then $x = 1$ corresponds to buying and consuming good 1, achieving utility $u(1, 0)$, and $x = 0$ – to buying and consuming good 2, with utility $u(0, 1)$.[4] Goods differ in their environmental impact. We assume the consumer's utility decreases in environmental impact, which reflects the intrinsic pro-environmental attitude of the consumer. With probability y good 2 may be more environmentally damaging than good

[4]Generally, the consumption bundle includes other goods and services, c, thus we could write the utility function as $u(x, 1 - x, c)$. As consumption of x is binary, the remaining budget is allocated to c. In that sense, the shortened notation $u(1, 0)$ and $u(0, 1)$ covers both preferences with regards to goods 1 and 2, and the monetary factors: e.g. a discount on good 1 would make it possible to consume more c and thus achieve a higher $u(1, 0)$ than without a discount. We assume preferences are fixed but we will vary prices and discounts in the experiment.

1; the opposite holds with probability $1-y$. Having a more environmentally damaging good reduces utility by f. The consumer maximises expected utility

$$U(x,y) = y\cdot(x\cdot u(1,0)+(1-x)\cdot(u(0,1)-f))+(1-y)\cdot(x\cdot(u(1,0)-f)+(1-x)\cdot u(0,1)), \quad (1)$$

and thus chooses $x = 1$ when benefits from consuming good 1 (relative to consuming good 2) exceed the expected extra harm (difference between the expected damage $(1-y)f$ caused by consuming 1 and expected damage yf caused by consuming 2):

$$x = 1 \Leftrightarrow u(1,0) - u(0,1) > (1-2y)f. \quad (2)$$

The choice is thus driven by preferences with respect to goods 1 and 2 (if both were environmentally friendly), as given by $u(1,0) - u(0,1)$, pro-environmental attitudes f and uncertainty about the environmental impact, given by y. In this particular case, if f is close to zero (no perceived environmental damage, or environmental indifference of consumers), preferences and monetary factors strictly dominate (the choice is almost surely dictated by them). Similarly, if $y = \frac{1}{2}$, the expected environmental damage is symmetric across the two goods, and hence environmental considerations become less important for the choice. If $y > \frac{1}{2}$, good 2 is more likely to have a negative environmental impact, thus environmental considerations in (2) become important for the choice.

The core idea of our theoretical construct is not to characterize the optimal choice, but rather to highlight factors that are relevant for this choice. The comparative statics in the discussion above demonstrates that (a) if risk of environmental damage is roughly equal for the two opportunities, then the key decision factors are preferences and monetary benefits, (b) the same holds if environmental preferences are nil.

2.2 Risk attitudes

Note that assuming linearity of $u(x,1-x)-f$ in environmental damage f is equivalent to risk-neutrality with respect to this uncertainty. To incorporate non-neutrality to the risk of environmental damage, re-write the state-contingent utility as $u(1-f,0)$ for the case

good 1 is environmentally damaging, and $u(0, 1-f)$ for the case good 2 is environmentally damaging:

$$x = 1 \Leftrightarrow u(1,0) - u(0,1) > (1-y) \cdot (u(1,0) - u(1-f,0)) - y \cdot (u(0,1) - u(0,1-f)), \quad (3)$$

If $u(1,0) - u(1-f,0) = u(0,1) - u(0,1-f) = f$, we are in the risk-neutral case (2). If risk-neutrality does not hold, pro-environmental attitudes f are at interplay with risk attitudes, given by the curvature of u. Without further assumptions, it is impossible to judge wither the right-hand side in (3) is greater or smaller than $(1-2y)f$. Generally, however we would expect that risk-averse and risk-neutral subjects differ in the likelihood to report environmental impact and the uncertainty about it as factors that matter for their consumption choices.

2.3 Ambiguity attitudes

If the probability of environmental damage is not known, subjects make decisions in ambiguity. The simplest way to capture it is to see y as a prior, while decision is made based on the weighted value of this prior:

$$U_w(1) = w_1(y) \cdot u(1,0) + w_1(1-y) \cdot (u(1,0) - f), \quad (4)$$

$$U_w(0) = w_0(y) \cdot (u(0,1) - f)) + w_0(1-y) \cdot u(0,1). \quad (5)$$

The weighting functions $w_x(y)$ have lower indices to reflect the fact that weights are outcome-dependent: ambiguity aversion implies small probabilities of worst outcomes (which in our setting is the higher environmental damage) are overweighted. If the decision-maker chooses $x = 1$ then the worst outcome is associated with the environmental damage produced by this good, which is described by the prior probability $1-y$, hence $w_1(1-y) > 1-y$ but the probability of the good outcome is underweighted,

$w_1(y) < y$. Similarly, for the other good: $w_0(1-y) < 1-y$ but $w_0(y) > y$. The choice is then governed by

$$U_w(1) > U_w(0) \Leftrightarrow w_1(y)\cdot u(1,0)+w_1(1-y)\cdot(u(1)-f) > w_0(y)\cdot(u(0,1)-f))+w_0(1-y)\cdot u(0,1). \tag{6}$$

In the ambiguity-neutral case, $w_1(y) = y$ and $w_0(y) = y$ (and, symmetrically, $w_1(1-y) = 1-y$ and $w_0(1-y) = 1-y$), yielding again (2). In ambiguity-neutrality does not hold, we obtain

$$x = 1 \Leftrightarrow (w_1(y)+w_1(1-y))\cdot u(1,0)-(w_0(y)+w_0(1-y))\cdot u(0,1) > w_1(1-y)\cdot f-w_0(y)\cdot f. \tag{7}$$

Note that ambiguity implies weights do not add up to unity: $(w_1(y) + w_1(1-y) < 1$ and $(w_0(y)+w_0(1-y) < 1$. Moreover, as the degree of ambiguity only relates to the prior probability y and does not depend on the choice x, we may write $(w_1(y) + w_1(1-y) = w_0(y) + w_0(1-y)$. This implies the left-hand side in (7) is smaller than $u(1) - u(0)$.[5] For the right-hand side, again, if probability prior y is close to $\frac{1}{2}$, so are the weights $w_1(1-y)$ and $w_0(y)$, too, hence the importance of environmental considerations vanishes, as in the risk-neutral case. If, however, the prior is that good 2 is more likely to be environmentally damaging, then the typical weighting function implies $w_1(1-y) > 1-y$ (small probability of the bad outcome is overweighted), and $w_0(y) < y$ (large probability is underweighted). It follows that $w_1(1-y) - w_0(y) > 1-2y$ holds for the right-hand side.[6] We can thus write

$$x = 1 \Leftrightarrow u(1) - u(0) > K > (1-2y)f, \tag{8}$$

[5] To obtain $u(1)-u(0) > ((w_1(y)+w_1(1-y))(u(1)-u(0))$ we need to assume additionally $u(1) > u(0)$, otherwise the sign flips.

[6] The same result obtains from the following consideration. The typical inverse-S shape of the weighting function implies the difference $w_1(1-y) - w_0(y)$ is smaller in the absolute value than $(1-y) - y$. Since we assume $1-y < y$, we are in the negative area, where the smaller absolute value of $w_1(1-y) - w_0(y)$ implies $0 > w_1(1-y) - w_0(y) > (1-y) - y = 1-2y$.

where K captures ambiguity around y and ambiguity aversion embedded in w. Again, if $(1-2y)f$ is small, subjects neutral to ambiguity may not report environmental impact and surrounding uncertainty as a factor of decision,as the latter would be based on preferences given by $u(1)$ and $u(0)$. Ambiguity-averse subjects, however, should be more likely to take these factors into consideration, as ambiguity together with ambiguity aversion "amplify" the value $(1-2y)f$. Based on this, we would expect that ambiguity-aversion makes subjects more likely to report environmental impact and the uncertainty about it as factors that matter for their choice.

3 Survey design and data

We administered two rounds of two waves each of a survey to ordinary UK consumers (our question was included as part of a larger inflation expectations survey). The waves are identical in the composition (stratified random sample of UK population aged 18-65) and take place within 3 days one from another (the first wave ran on Tuesday, the second wave – on Friday). As subjects are recruited randomly in each wave with no repetition, their allocation across treatments is random. Each round constitutes one experiment. The time difference of 3 days between the treatment and the control is irrelevant for the experiment.

3.1 Elicitation of risk and ambiguity attitudes

We employ a combination of two questions to get information about subjects' uncertainty attitudes. First question asks "Consider a lottery ticket with a 50% chance of winning $ 100,000 and 50% chance of getting nothing. What is the LOWEST AMOUNT of money you would accept in exchange for this lottery ticket?" and gives a menu of answer options from $ 60,000 (above the mean) to $ 5,000 with step $ 5,000, as well as additional two options of $ 1,000 and $ 500. We have chosen the willingness to accept (WTA) wording as in the willingness to pay (WTP) wording ("what is the highest amount you would be prepared to pay") there is a danger of bias towards responses with very low values. The answer to this question is the certainty equivalent, CE, i.e. the sure amount that

makes subjects indifferent between it and the lottery. This characterises risk attitudes of subjects:

$$u(CE) = \frac{1}{2}u(\$100,000) + \frac{1}{2}u(\$0). \tag{9}$$

The second question we employ is almost identical to the above except that the probability of winning in the lottery is unknown: "Consider the same lottery ticket with a chance of winning $ 100,000 or nothing, but the probability of winning is unknown. What is the LOWEST AMOUNT of money you would accept in exchange for this lottery ticket?" - with the same answer options. The reason for the willingness-to-accept wording is to make this question compatible with the previous certainty equivalent question. We use the combination of the two to elicit ambiguity attitudes. Assume subjects have some probability value π in mind and assign to this probability a weight of $w(\pi)$. The latter captures subjects' attitudes to ambiguity. The question itself returns the value of certainty equivalent CE_A for this ambiguous lottery:

$$u(CE_A) = w(\pi) \cdot u(\$100,000) + w(1-\pi) \cdot u(\$0). \tag{10}$$

Now, using the same considerations as in (Abdellaoui et al., 2011), namely the symmetry of states of the world (and thus events) with respect to the possibility to yield either a win of $ 100,000 or nothing, and applying the result of Chew and Sagi (2008), there exists a unique value of probability of winning, $\pi = \frac{1}{2}$, and thus

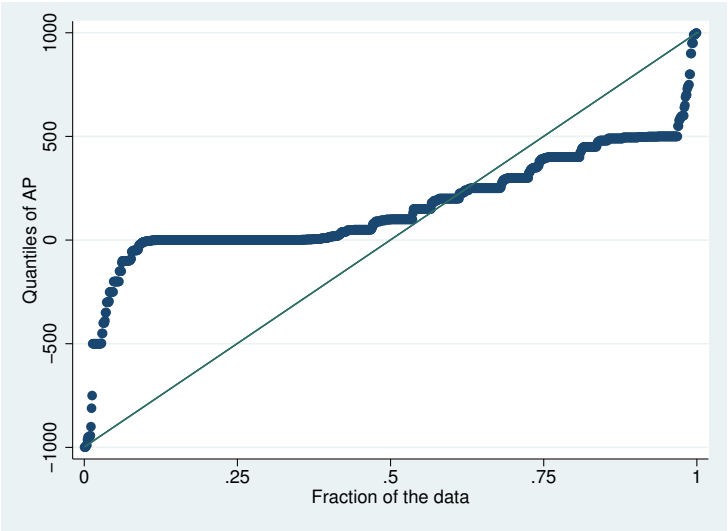
$$u(CE_A) = w(\frac{1}{2}) \cdot u(\$100,000) + w(\frac{1}{2}) \cdot u(\$0). \tag{11}$$

By comparing individual subjects' answers to the above two questions, we can judge on their ambiguity attitudes:

$$u(CE) > u(CE_A) \leftrightarrow \frac{1}{2} > w(\frac{1}{2}). \tag{12}$$

We therefore classify subjects who report $CE > CE_A$ as ambiguity-averse (they underweight probabilities), those with $CE = CE_A$ as ambiguity-neutral and the rest of them as

Figure 1: Distribution of ambiguity attitudes



Notes: Cumulative distribution of ambiguity premia, AP, from ambiguity-seeking ($AP < 0$), through ambiguity-neutrality ($AP = 0$) to ambiguity-aversion ($AP > 0$).

ambiguity-seeking. This approach also allows us to represent ambiguity attitude by a continuous variable $CE - CE_A$, to which we will refer as ambiguity premium, AP. Figure 1 depicts the cumulative distribution of subjects according to ambiguity premia elicited this way: about a 28% subjects are classified as ambiguity-neutral, 62% are ambiguity-averse and some 10% classify as ambiguity-seeking, which is in line with distributions obtained in other studies (e.g. Vinogradov and Shadrina (2013) and Oechssler and Roomets (2015)).

3.2 Experiment design

The experiment is built around the survey question that assesses the relative importance of factors for the choice between a petrol and a diesel car in a hypothetical situation of buying a car. The question asked is "If you were to buy a new diesel or petrol car now, which considerations would be most important to you?" with six options that have to be ranked from the most important, to the least important. The options represent the following factors: (a) monetary incentives, i.e. price, resell value and bonuses, (b) non-monetary incentives, i.e. pro-environmental values, (c) delegation of responsibility, and (d) uncertainty with respect to the future consequences of todays' decisions.

Table 1: Distribution of responses in Experiment 1

Responses from control group (Tuesday)

Numbers in cells are number of responses per rank (1 to 6). Mean indicates the average ranking each item received. Because "1" is the highest ranking, the item with the lowest mean is the one that was ranked most highly on average.

	Answers / Rank	1	2	3	4	5	6	Mean
A1	Price and resell value in the future	186	67	69	83	61	84	3.0
A2	Diesels have lower CO2 emissions	51	116	95	77	113	98	3.7
A3	Diesel fuel produces tiny particles linked to breathing disorders	46	93	101	132	100	78	3.7
A4	New diesel cars meet all necessary standards	73	95	120	125	83	54	3.4
A5	Standards may change, diesels may be banned in the future	111	100	98	64	110	67	3.3
A6	Manufacturers cheat on consumption and emissions, I may end up paying more in the future	83	79	67	69	83	169	3.9

Responses from the treatment group (Friday)

A1	Price and resell value in the future	168	98	98	57	67	62	2.9
A2	Diesels have lower CO2 emissions	74	89	87	95	113	92	3.7
A3	I just need a good car; let the government deal with emissions!	60	81	69	66	93	181	4.1
A4	New diesel cars meet all necessary standards	65	91	101	139	95	59	3.5
A5	Standards may change, diesels may be banned in the future	93	98	85	96	109	69	3.4
A6	Manufacturers offer discounts on their new greener diesels	90	93	110	97	73	87	3.4

We conduct two experiments, each containing one control and one treatment conditions. The control condition is the same in both experiments: we assess the relative importance of six options representing the above four categories of factors. The treatment differs across the experiments. In the first treatment we remove the two options that prove on average the least important from the first wave, and replace them with two new options that "challenge" two of the remaining more important options. The "challenge" is aimed at clarifying the underlying motives for choosing one or another option. Table 1 presents all options and the distribution of answers in the first round.

The least important option in the first wave was "Manufacturers cheat on consumption and emissions, I may end up paying more in the future" – it has the highest average score (meaning lowest average importance), and the distribution of answers is by far more skewed, indicating the vast majority of subjects treat this option as less important than any other. To illustrate the idea behind the treatment condition, note that if consumers see uncertainty arising from the role of the government in setting standards, and from the possible cheating of manufacturers in trying to meet those standards, as substitutes, removing this option should raise the importance of "Standards may change, diesels may be banned in the future", which was the second most important factor in the control condition.

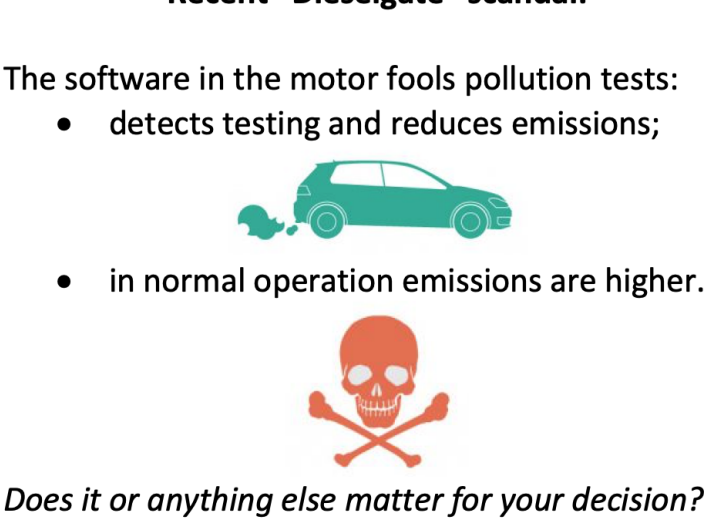
The two second-least important options were those explicitly related to the environmental impact of cars – "Diesels have lower CO2 emissions" and "Diesel fuel produces tiny particles linked to breathing disorders". While the former had slightly more respondents choosing it as a more important option, and it dominates the latter in the top-three list, it was also more frequently chosen as the bottom-two in the importance list, indicating slightly more disagreement among the respondents on this issue. We made a decision to eliminate the option with diesel particles. If the two ecology questions substitute each other, we should see an increase in the relative importance of the remaining emissions question.

The most important option in the control group was "Price and resell value in the future". To challenge the role of monetary factors, in the treatment group this has been complemented with a question "Manufacturers offer discounts on their new greener diesels". The second question explicitly introduces incentives (as discount) that target specific behavior (purchase of a diesel car). If incentives are a substitute to other monetary factors, the importance of "price and resell value" should decrease.

Finally, in the treatment group we introduced the option "I just need a good car; let the government deal with emissions!", which challenges the option "New diesel cars meet all necessary standards" from the first wave.

In the second experiment, the treatment condition does not differ from the control in terms of the wording of the question, however, instead of changing the options (as in

Figure 2: Priming: the Dieselgate pictographics.



Notes: Respondents in the treatment group (second round) were shown this picture before they could proceed to ranking factors.

the first round), we prime respondents by explicitly reminding them about the Dieselgate scandal. To do this, the question is preceded by a picture (see Figure 2) that briefly clarifies the essence of the scandal. The idea is twofold: (1) to emphasize the probability of environmental damage by diesel cars may be higher than that of petrol cars, and (2) to emphasize the probability of manufacturers' cheating is strictly greater than zero.

In each round, the survey is administered in two waves, with random sampling (no repeated participation within 100 days) among UK residents over 18. Subject recruitment and invitation is is via Pollfish (www.pollfish.com), who stratify the sample to match the demographics of the UK general population. Random sampling with no repetition ensures subjects are randomly assigned to one of the four waves. The waves in each round are conducted on a Tuesday and on a Friday of the same week. To ensure there is no day of the week effect[7], we alternate the control condition between Tuesday and Friday in the two rounds. The first round was administered in August 2019, the second round - in November 2019.

Table 2 presents summary statistics of the main variables from both rounds, which take values equal to the rank 1 (highest) to 6 (lowest) subjects assign to the relevant options:

[7]For example, respondents' mood on a Tuesday morning, when the working week just began, might be different from their mood on a Friday morning, when the weekend is about to begin. If mood matters for decisions, the day of the week might affect the outcome of our survey, too.

Table 2: Summary Statistics

	(1)				
	count	mean	sd	max	min
Change	2076	3.278	1.700	6.000	1.000
Cheat	1558	3.938	1.701	6.000	1.000
Price	2076	3.033	1.785	6.000	1.000
CO2	2076	3.759	1.635	6.000	1.000
Particles	1558	3.580	1.613	6.000	1.000
Govt	518	4.075	1.802	6.000	1.000
Standards	2076	3.422	1.603	6.000	1.000
Discounts	518	3.403	1.655	6.000	1.000
CE	2075	0.349	0.277	1.000	0.000
AP	2075	0.153	0.262	1.000	-1.000
age	2076	46.170	14.896	98.000	19.000
Sex	2076	0.511	0.500	1.000	0.000
Treatment	2076	2.503	1.118	4.000	1.000
income	2076	2.087	0.960	3.000	0.000
education	2076	2.393	0.793	4.000	1.000
Observations	2076				

Price = "Price and resell value in the future", CO2 = "Diesels have lower CO2 emissions", Particles = "Diesel fuel produces tiny particles linked to breathing disorders", Standards = "New diesel cars meet all necessary standards", Change = "Standards may change, diesels may be banned in the future", Cheat = "Manufacturers cheat on consumption and emissions, I may end up paying more in the future", Govt = "I just need a good car; let the government deal with emissions!", and Discounts = "Manufacturers offer discounts on their new greener diesels".

4 Results

4.1 Relative importance of factors

In the previous section (Table 1) we have highlighted that on average, the monetary factor (price and resell value in the future) is the most important in our sample. This outcome is robust to a perturbation of the list of available options in treatment 1, and to the priming effect in treatment 2. In contrast, in treatment 1, the availability of the second monetary option, even slightly increases (though statistically insignificant) the importance of price

and resell value: its average score goes from 3.0 in control 1 to 2.9 in treatment 1. The second monetary option (discounts) itself becomes the second most popular on average, confirming that monetary factors are seen as the most important in decisions subjects make.

Environmental factors, such as CO2 and nano-particles emissions, are ranked similarly to each other, as factors of the second-lowest importance. Strikingly, removing one of them in treatment 1 does not improve the importance of the other one, confirming the outcome is not due to people being split between the one or the other.

Somewhat more important is the factor of uncertainty, yet there is an interesting observation: a possible change in the standards, i.e. uncertainty coming from the state, is seen as a more important factor than the uncertainty that potentially comes from the manufacturers. This is despite the recent Dieselgate scandal that underscored the that such an option was well possible.

Turning to the factors that we label as delegation of responsibility, the option "new diesel cars meet all necessary standards" in the control condition appears important (at least more important than environmental factors). Note this option does not specify the type of standards, is not focusing on environmental issues, and implies there is a different body that determines which standards is necessary, and how it is determined if diesels meet those standards. When we formulate the same more directly, as "I just need a good car, let the government deal with emissions", respondents rank this option as the least important, even though it is hard to assume respondents do not "need a good car". We interpret this outcome as an indication that "just" a good car is not enough, and that implicitly respondents place a great value on existing standards even though they do not exactly what those standards represent.

To sum up, the distribution analysis indicates that while monetary factors are crucial, non-monetary factors such as environmental preferences and uncertainty do play a role, especially as highlighed by the drastic rejection of the option "I just need a good car" (and don't want to care about the rest). We are now interested to see to what extent these aggregate observations are universal for the society.

4.2 Heterogeneity

We first investigate a simple linear relationship between the score (rank) assigned to the factor by an individual respondent and that respondent's characteristics. Results of this exercise are in Table 3.

The first observation is the significance of uncertainty attitudes for the evaluation of the "Standards may change" option (variable Change): subjects with higher risk aversion (lower CE) and higher ambiguity aversion (higher AP) are, on average giving a lower rank (hence higher importance) to this factor. The fact both appear significant indicates subjects perceive the risk of changing standards as non-negligeable, yet there is a large bit of uncertainty surrounding it. The role of uncertainty attitudes is robust to inclusion or exclusion of the gender variable (our focus is on it because prior research indicates there may be significant differences between men and women in their attitudes to risk and ambiguity).

Strikingly, the second uncertain option "manufacturers may cheat" does not trigger significance of uncertainty attitudes. This suggests respondents see less uncertainty about this, though we cannot claim they reject such a possibility or, on the contrary, take it as an almost certain fact. Other options are not perceived as related to uncertainty either. Younger people (higher year of birth, YoB) see monetary factors Price and Discounts as less important (higher score) - the positive coefficients for both these factors confirms our design, in which we assumed the common [monetary] nature of them. The sign of the YoB coefficient for Govt and Standards supports the same conjecture with regard to these two factors, too, although significance for Standards is lacking. Strikingly, however, we obtain the two environmental factors are seen differently: younger people see CO2 emissions as more important, while the emissions of nano-particles is, on average, the less important the younger is the respondent . The latter may be due to the lack of knowledge on different types of emissions.

Table 3: Effects of demographic variables and uncertainty attitudes on the importance of decision factors: linear model.

	(1) Change	(2) Change	(3) Cheat	(4) Price	(5) CO2	(6) Particles	(7) Govt	(8) Standards	(9) Discounts
CE	0.408*	0.437**	-0.291	0.00878	-0.117	-0.291	-0.364	-0.0265	0.319
	(1.95)	(2.09)	(-0.89)	(0.04)	(-0.57)	(-1.09)	(-1.17)	(-0.14)	(1.09)
AP	-0.534**	-0.516**	-0.255	0.00867	0.253	0.231	0.466	0.176	-0.264
	(-2.54)	(-2.46)	(-0.81)	(0.04)	(1.23)	(0.90)	(1.43)	(0.94)	(-0.87)
YoB	0.000913	0.000213	0.000395	0.00624*	-0.00850***	0.00732*	-0.00817*	-0.00245	0.00948**
	(0.30)	(0.07)	(0.08)	(1.88)	(-2.80)	(1.88)	(-1.74)	(-0.88)	(2.16)
Treatment	0.140	0.137	0	-0.123	-0.0543	0	0	0.126	0
	(1.37)	(1.35)	(.)	(-1.14)	(-0.55)	(.)	(.)	(1.39)	(.)
Gender		-0.224**	-0.153	-0.0315	0.165*	-0.119	-0.134	0.219**	0.147
		(-2.18)	(-0.96)	(-0.29)	(1.65)	(-0.92)	(-0.87)	(2.38)	(1.02)
Constant	1.426	3.140	3.494	-9.244	20.22***	-10.51	20.45**	7.874	-15.57*
	(0.23)	(0.51)	(0.37)	(-1.41)	(3.36)	(-1.36)	(2.20)	(1.43)	(-1.79)
r2	0.00820	0.0125	0.00717	0.00488	0.0123	0.0115	0.0103	0.00957	0.0117
df_r	1095	1094	545	1094	1094	545	545	1094	545
bic	4297.4	4299.6	2265.6	4445.7	4251.7	2036.3	2222.2	4059.0	2147.9
N	1100	1100	550	1100	1100	550	550	1100	550

t statistics in parentheses

* p<0.10, ** p<0.05, *** p<0.010

4.3 Probit estimates

Table 3 considers effects within the first round only and measures them within a basic linear model. We now turn to the whole pool of data and analyze the relationship within a probit model. Results are in Table 4. While the sign of the effects of uncertainty attitudes on the Change variable indicates the same effects as in the linear model, statistically the result of the non-linear estimation is insignificant. With somewhat higher, although still low, significance, the effect of ambiguity aversion pops up for CO2 and Govt factors (positively) as well as for monetary factor Price (negatively), unaccompanied by risk aversion. On the one hand, the rather inexplicable and inconsistent effects picked up by the non-linear model, make us believe the true relationship (if any) between factor importance and uncertainty attitudes is closer to linear. On the other hand, due the low levels of significance, this result should be taken with a pinch of salt, and more investigation might be needed.

The significant effect of age on CO2 confirms the finding of the linear model (note variable age represents the age of respondents, hence younger age corresponds to lower *age* while to higher YoB). The same holds for Particles and Govt, confirming robustness. Other relationships do not appear robust to the model change.

Similarly, Gender (denoted as Sex in 4) largely confirms (with improved significance) the findings of the linear model.

To further investigate the role of demographic factors, we add household income and individual education level as potential explanatory variables (see Table 5). These appear largely insignificant and do not change the main conclusions. In particular, the opposite effect of age on the importance of CO2 and Particles remains unchanged even after controlling for education and income, which suggests the difference between CO2 and Particles cannot be attributed to general education, and is perhaps some sort of special knowledge obtainable with experience (age).

Table 4: Effects of demographic variables and uncertainty attitudes on the importance of decision factors.

	(1) Change2	(2) Cheat	(3) Price	(4) CO2	(5) Particles	(6) Govt	(7) Standards	(8) Discounts
main								
CE	1.206	0.831	1.101	0.910	0.998	0.725	1.010	1.252
	(1.17)	(-1.01)	(0.60)	(-0.59)	(-0.01)	(-1.03)	(0.06)	(0.71)
AP	0.764	1.272	0.746*	1.351*	0.918	1.744*	1.042	0.952
	(-1.60)	(1.21)	(-1.72)	(1.78)	(-0.44)	(1.65)	(0.24)	(-0.14)
age	0.995*	1.001	0.997	1.010***	0.989***	1.011**	1.004	0.990*
	(-1.75)	(0.42)	(-1.10)	(3.84)	(-3.77)	(2.06)	(1.37)	(-1.88)
Sex	0.846**	0.821**	1.014	1.247***	0.907	0.833	1.254***	1.140
	(-2.15)	(-2.19)	(0.18)	(2.84)	(-1.09)	(-1.15)	(2.91)	(0.83)
Treatment	0.948	0.960	1.070*	1.065*	0.903*	1	0.952	1
	(-1.54)	(-0.74)	(1.94)	(1.80)	(-1.88)	(.)	(-1.40)	(.)
/								
cut1	0.165***	0.101***	0.435***	0.249***	0.0580***	0.184***	0.208***	0.141***
	(-10.34)	(-8.98)	(-4.86)	(-7.91)	(-11.53)	(-5.65)	(-9.08)	(-6.61)
cut2	0.423***	0.268***	0.871	0.784	0.171***	0.517**	0.574***	0.350***
	(-5.05)	(-5.29)	(-0.81)	(-1.44)	(-7.38)	(-2.31)	(-3.29)	(-3.65)
cut3	0.844	0.560**	1.566***	1.620***	0.382***	0.913	1.239	0.817
	(-1.01)	(-2.34)	(2.63)	(2.85)	(-4.08)	(-0.32)	(1.27)	(-0.71)
cut4	1.616***	1.045	2.986***	3.325***	0.837	1.461	3.012***	1.808**
	(2.83)	(0.18)	(6.35)	(7.03)	(-0.76)	(1.33)	(6.48)	(2.08)
cut5	4.437***	2.413***	6.722***	9.528***	2.344***	2.971***	8.338***	4.067***
	(8.56)	(3.56)	(10.77)	(12.80)	(3.57)	(3.79)	(12.01)	(4.80)
Observations	2075	1558	2075	2075	1558	517	2075	517

Exponentiated coefficients; t statistics in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Table 5: Effects of demographic variables and uncertainty attitudes on the importance of decision factors.

	(1) Change2	(2) Cheat	(3) Price	(4) CO2	(5) Particles	(6) Govt	(7) Standards	(8) Discounts
main								
CE	1.194	0.834	1.089	0.927	0.993	0.763	1.012	1.259
	(1.10)	(-0.98)	(0.53)	(-0.47)	(-0.04)	(-0.86)	(0.08)	(0.72)
AP	0.776	1.266	0.752*	1.323*	0.922	1.709	1.037	0.948
	(-1.50)	(1.18)	(-1.66)	(1.65)	(-0.42)	(1.59)	(0.21)	(-0.16)
age	0.995*	1.001	0.997	1.011***	0.988***	1.014**	1.004	0.990*
	(-1.92)	(0.43)	(-1.27)	(4.10)	(-3.79)	(2.48)	(1.37)	(-1.79)
Sex	0.847**	0.815**	1.023	1.255***	0.909	0.832	1.247***	1.139
	(-2.14)	(-2.27)	(0.29)	(2.92)	(-1.07)	(-1.15)	(2.83)	(0.82)
income	0.999	1.052	0.935	0.952	0.980	1.152*	1.049	1.005
	(-0.04)	(1.07)	(-1.62)	(-1.19)	(-0.43)	(1.70)	(1.14)	(0.07)
education	0.944	1.012	0.945	1.090*	0.976	1.229*	1.010	1.020
	(-1.14)	(0.21)	(-1.11)	(1.70)	(-0.42)	(1.88)	(0.20)	(0.18)
Treatment	0.946	0.960	1.066*	1.070*	0.901*	1	0.954	1
	(-1.61)	(-0.73)	(1.82)	(1.94)	(-1.91)	(.)	(-1.36)	(.)
/								
cut1	0.139***	0.116***	0.321***	0.292***	0.0516***	0.469	0.236***	0.151***
	(-7.76)	(-6.56)	(-4.49)	(-4.81)	(-9.05)	(-1.48)	(-5.63)	(-3.84)
cut2	0.356***	0.305***	0.643*	0.921	0.152***	1.324	0.653*	0.376**
	(-4.10)	(-3.65)	(-1.76)	(-0.33)	(-5.85)	(0.55)	(-1.68)	(-2.02)
cut3	0.711	0.640	1.157	1.905**	0.340***	2.341*	1.409	0.877
	(-1.36)	(-1.38)	(0.58)	(2.56)	(-3.38)	(1.68)	(1.35)	(-0.27)
cut4	1.361	1.193	2.210***	3.913***	0.745	3.757***	3.425***	1.941
	(1.23)	(0.55)	(3.14)	(5.38)	(-0.92)	(2.60)	(4.82)	(1.36)
cut5	3.739***	2.757***	4.974***	11.23***	2.088**	7.676***	9.481***	4.366***
	(5.20)	(3.14)	(6.28)	(9.40)	(2.30)	(3.97)	(8.67)	(3.00)
Observations	2075	1558	2075	2075	1558	517	2075	517

Exponentiated coefficients; t statistics in parentheses

* p<0.10, ** p<0.05, *** p<0.01

5 Conclusion

Theoretically, both monetary and non-monetary factors matter for decisions, yet their importance is different. An intuitive way to define "importance" is by negating the lack of importance: a decision factor is not important if it is irrelevant for the decision. In a parsimonious theoretical model we have demonstrated that basic preferences are (including monetary benefits) are important decision factors for all decision-makers, while risky and uncertain conditions may be neglected by risk- and ambiguity-neutral subjects, yet turn important for risk- and/or ambiguity-averse people. An important mechanism through which ambiguity-aversion may amplify importance, is through raising the perceived probability of negative outcomes. Theoretically, the same may be achieved by providing information that suggests elevated levels of this probability.

These theoretical considerations lead us to design a field experiment in which we investigate the relative importance of factors relevant for decisions in the environmental context. We confront subjects with a situation of choice between a petrol and a diesel car, if they were to buy one. In a survey, we measure subjects' risk and ambiguity attitudes, and the ranking of factors they deem important for their decision. As predicted theoretically, monetary considerations are robustly the most important factor. Environmental considerations (emissions) are least important. Considerations of the uncertain regulatory environment are more important for subjects averse to risk and ambiguity. Finally, we obtain that people do not fully discard environmental factors, yet they prefer decisions on environmental impact to be taken by specialised bodies that establish standards and test conformity. These resuults are robust to the perturbation of factor options available to respondents, which was done in the first experiment: adding a second monetary option (discounts) not only does not diminish the importance of the first ne (price and resell value) but also itself becomes the second most important option. In contrast, an attempt to focus subjects' attention on only one environmental option (CO2 emissions) in experiment 1 was unsuccessful: the low importance of environmental option we observe cannot be attributed to responses being equally split between two similar options.

A surprising result is the low importance of the possibility that manufacturers may manipulate data, as highlighted by the recent Dieselgate scandal. Moreover, estimates indicate this factor is not seen as risky or ambiguous. In a second experiment we primed respondents by reminding them on the key features of Dieselgate. In terms of the theoretical model, this corresponds to distorting the probability of diesels being more damaging for the environment (if they are not damaging, why manipulate data?), and maybe raising ambiguity around it (if data is manipulated, who knows the truth?). In contrast to our expectations, this treatment has no effect, indicating subjects may already believe the probability of such a behaviour is high, hence little uncertainty about it, and yet people care little about such a manipulation with emission data.

Our results thus indicate that although individuals may have pro-environmental preferences, these play little role in decisions taken at an individual level. Educating consumers would have a rather limited effect on their individual choices. Instead, there is a great deal of reliance on certification bodies and legislators who set environmental standards. Our findings support the view that collectively made decisions (de-contextualized and separated from personal choices) are likely to favour pro-environmental behaviour to a larger degree than consumption decisions made individually by each member of the society. This is because of the following argument. Assume consumers are to vote for environmental standards. According to our findings, (1) consumers have pro-environmental preferences, (2) they do prefer to consume goods that meet standards, and (3) when the question has no immediate price/utility implication for consumption, monetary factors are less important. Therefore, if a voting takes place, consumers are likely to vote for pro-environmental standards. This is a well-known commitment problem: one can make rational consumption plans for the future but once the future date is realized, one is tempted to deviate from the plan. Having standardization bodies as a collective commitment device solves the problem: once the consumption choice problem is faced, there is a guarantee in place environmental standards are met.

We therefore argue a way to promote pro-environmental behaviour is rather through institutions that ensure the range of available products is compatible with social preferences, than through motivating individuals towards pro-environmental choices. Incentives,

including monetary, work in the same direction, however their effect is temporary and only relates to the particular consumption problem they apply to. A more sustainable solution ought to involve a gradual change in individual preferences, however, according to our survey, the society is not yet there, and more has to be done towards this objective.

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Appendix

A Survey questionnaire

We want to know your view on prices and interest rates in the United Kingdom. By answering our 15 quick questions you will greatly help our research. No special knowledge is needed. There is no right or wrong answer: any answer is correct as long as it truly reflects your view. Thank you for your help!

1. By how much did prices in general change in the UK during the past 12 months? For example, if you think prices went down by about 5%, enter "-5"; if they went up by 2%, enter "2".

2. How confident are you in your last answer? (1 star = not at all, 5 stars = absolutely sure)

3. What annual interest rate would an average UK citizen be charged, if they take a car loan of £10,000 now? For example, if you think the rate would be about 10%, enter "10".

4. How confident are you in your last answer? (1 star = not at all, 5 stars = absolutely sure)

5. By how much do you think prices in general will change during the NEXT 12 months? For example, if you think prices go down by about 5%, enter "-5"; if they go up by 2%, enter "2".

6. How confident are you in your last answer? (1 star = not at all, 5 stars = absolutely sure)

7. What annual interest rate will an average UK citizen be charged, if they take a car loan of £10,000 IN A YEAR from now? For example, if you think the rate will be about 10%, enter "10".

8. How confident are you in your last answer? (1 star = not at all, 5 stars = absolutely sure)

9. If you had an extra £1,000 now, how would you spend it? Please rank the following options (1 = most important, 6 = least important):

- buy stocks
- buy safe bonds
- keep in my bank account
- repay part of my mortgage or other loan
- buy something that I long wanted (car, jewellery, holiday trip)
- spend on everyday consumption (food, clothing, utility bills, school)

10. Next few questions help us learn about you and your type of thinking. Did you take part in an inflation survey like this before?

Answer options: Never; Yes, this week; Yes, less than 3 months ago; Yes, more than 3 months ago; Other (free text option).

11. Assume you have a lottery ticket with a 1/2 chance of winning £1000 and 1/2 chance of getting nothing. What is the LOWEST AMOUNT of money you would accept in exchange for this lottery ticket?

12. Assume you have a similar lottery ticket, except that the chance of winning £1000 is unknown. What is the LOWEST AMOUNT of money you would accept in exchange for this new ticket?

13. If you were to buy a new diesel or petrol car now, which considerations would be most important to you? Please rank the following options (1 = most important, 6 = least important):

- Price and resell value in the future
- Diesels have lower CO2 emissions
- Diesel fuel produces tiny particles linked to breathing disorders [only in control and in treatment 2]
- New diesel cars meet all necessary standards
- Standards may change, diesels may be banned in the future
- Manufacturers cheat on consumption and emissions, I may end up paying more in the future [only in control and in treatment 2]
- I just need a good car; let the government deal with emissions! [only in treatment 1]
- Manufacturers offer discounts on their new greener diesels [only in treatment 1]

14. During the last week, have you heard any news about the monetary policy of the Bank of England? What did you hear?

Answer options:

- I heard NO news about the Bank of England
- The Bank would raise the official interest rate
- The Bank would keep the official rate unchanged
- The Bank would lower the official rate
- I heard some other news about the Bank:

Note: in both treatment conditions "would raise", "would keep" and "would lower" are replaced with "has raised", "has kept" and "has lowered" respectively.

15. During the last week, what were your main sources of information on economic and business conditions in the UK?

Answer options:

- I searched for news on the Bank of England policy
- I follow the Bank of England on Twitter/Facebook
- I searched for news on the UK economy
- I did not search but came across this news
- I did not come across any information on economic and business conditions
- Other sources of information [free text]

16. How would you rank your understanding of economic and business issues? (1 star = I understand very little, 5 stars = I am an expert)