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Exploring the Determinants of Trust in Official Statistics: Evidence from Luxembourg

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Abstract

This paper investigates public trust in official statistics using original data collected in Luxembourg for the years 2015 and 2018. We analyze two attitudinal surveys with representative respondents in terms of age, gender, education and employment status in Luxembourg in order to detect the level of trust in statistics and its determinants. Using parametric econometric approaches, we show that the perceived political independence of STATEC (the national statistical office of Luxembourg), the importance placed on individual data protection, and individuals' trust in the media are the main factors influencing respondents' overall trust in official statistics. Moreover, individual characteristics such as age and gender significantly influence the level of trust in statistics, although these effects are small. Our study suggests that a general framework for understanding the public trust in official statistics within OECD countries is essential. Micro and macro studies will help national institutes of statistics produce accurate and high-quality data in order to improve public trust in statistics.

Keywords: Trust, trust in official statistics, cognitive science, logit and bivariate regression

JEL Codes: D91, C01

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Introduction

In this study, we gathered and analyzed data from two representative surveys on trust[1] conducted for in 2015 and 2018 by Luxembourg's national statistics institute, STATEC, through a pooling company (TNS-ILRES). We sampled around 2700 individuals for each wave, administering a questionnaire that contained a set of questions measuring individual trust in institutions (parliament, government, central bank, STATEC, etc.), measured according to the OECD manual for measuring trust. The questionnaire also asked respondents about the perceived political independence of STATEC, the use of official data, and respondents' participation in official surveys. In addition, the questionnaire collected demographic data on education, income, gender, professional activity, and age.

In the first part of the paper, we aim to explain why statisticians should focus on perception, thus underscoring the subjective view of "official figures" and the functioning of national statistics institutes (NSIs). Perception, with all of its cognitive defects and biases described in the emerging literature on cognitive science, is an essential element in assessing the trustworthiness of official statistics—both of the figures (outcome) and of the organizations producing them. The second part of this paper describes the available data and the relevant variables used in a set of logit regressions. The results of the analysis of data from each year are then compared. Overall, the findings confirm that, all else being equal, personal data protection and the perception of political independence have a positive and significant impact on the probability of trust in official statistics and in STATEC. Unfortunately, the segregation of knowledge is observed: highly educated people have more trust in numbers than less educated people.

We conclude by recommending that a systematic, comprehensive, and detailed analysis of micro data on the different dimensions of trust in statistics and their determinants, over time and across countries, is crucial. The success of "fact-checking", training, and tailor-made communications could also be evaluated by systematic and representative surveys on trust. Meanwhile, to gain a better understanding of trust in the broader context and share recommendations amongst countries, a broadly applicable questionnaire (such as within the OECD framework, for example) should be developed.

1. Cognitive Barriers and Trust in Official Statistics

"***Damned lies and statistics***"[2]- funny jokes about statistics are popular, and stories about how unabashed politicians or ruthless advertisers misuse statistics are well known. Trust in official statistics—both in official figures and in the organizations that produce the figures—depends on *trustworthiness,* i.e., the credit given for the respect of standards according to which the numbers are collected and processed. This also concerns the availability of data relevant to the public.

Trust is a complex phenomenon and concept that has been widely studied over the past decades. In this paper, we use the concept of trust as defined by the OECD manual (OECD, 2017):[3] *"a person's belief that another person or institution will act consistently with their expectations of positive behavior"*. Furthermore, although the concept of trust in statistics involves a complex relationship between institutions and their users, it is usually framed as a simple linear univariate communication between the official statistical institution and the public, following a basic "sender–receiver" model.

There have been a few empirical studies on trust in statistics and their determinants. The recipients of statistical information are very heterogeneous, with different statistical and social science knowledge, different expectations, and different money constraints. In this study, we propose to deepen our understanding of trust in statistics through an analysis of the public's self-reported trust. We study the "*demand view*", so as to focus on the perspectives of actual or potential users of statistical figures, and more specifically, we assess the trustworthiness of official statistics produced by STATEC, the national statistics institute in Luxembourg. Data and information communication has changed dramatically over recent decades, and the internet and social media are today seen as the main channels of access to information. Trust in official statistics should thus be considered in a broad context, in particular when accounting for public trust in institutions (government, parliament, bureaucracy) or merely the concept of trust in others. We therefore investigate the public's level of trust in various factors that may influence trust in official statistics, such as trust in the media and other institutions (e.g., the police,

[2] Mark Twain has attributed this phrase to Benjamin Disraeli, even though most of people refer as a phrase of Mark Twain itself.

[3] The OECD manual (2017) for measuring trust proposes a working definition of trust, which is a quite an elusive concept. For instance, the manual acknowledges that the distinction between the concepts of *trust* and *confidence* is blurred. Some languages do not even distinguish between the two terms. For instance, the French, Spanish, and German languages have only one word for trust: *confiance*, *confianza*, and *Vertrauen*, respectively. An experiment carried out by the UK's Office for National Statistics (ONS) on a British sample has empirically shown that respondents do not make distinctions between different types of trust and between this concept and confidence.

parliament), the perception of political independence of the NSI, and the importance of individual data protection.

The concept of trust in official statistics is by nature linked to trust in science, and people's attitudes to the latter are potentially relevant for our analysis. There is increasing concern about the growing mistrust of science and expertise in general, despite the increasing levels of education in most countries. A study by Drummond and Fischhoff (2017) analyses factors predicting beliefs regarding various topics such as climate change, the Big Bang, stem cell research, and human evolution. Their econometric results show that level of education and science knowledge of individuals are weakly related to the acceptance of scientific consensus. However, respondents with higher levels of science literacy are more likely to agree with the scientific consensus. Respondents self-identified as liberal-leaning on the political spectrum tend to support scientific progress in the fields mentioned above, and respondents scoring low on the religious fundamentalism scale also tend to support scientific tenets. Moreover, the study found that the public opinion in the US is polarized along religious and political lines, and that this polarization increases with the level of education.

In a democracy, statistics and quantitative analyses are key ingredients in many debates involving experts, partisan decision makers, and other actors playing complex strategy games with the help of the media. The challenge is to organize debates in such a manner as to ensure the full participation of citizens and to guarantee maximum objectivity and transparency.[4]

1.1 The main reasons for "dis"-trust in statistics

When trying to understand what makes people trust or distrust statistics, four main reasons stand out. The first is certainly rooted in the awkward representation of society as a whole, structured around Quetelet's "*average man*" and wiping out the uniqueness of individual characters, particular situations, contexts, and biographies inherent in a single person. Olivier Rey, a French philosopher and mathematician who studied the emergence of numbers as a convenient way of representing life in society, strongly emphasizes the negation of an individual's singularity or distinctiveness through aggregate numbers, saying that this is a major cause of frustration with official statistics. In the same vein, William Davies (2017) states "both statisticians and politicians have fallen into the trap of talking like a state, giving the impression of having lost touch with single

[4] A recent report by the think tank France Stratégie (Agacinsky 2018) comes up with some recommendations for the French case.

citizens".[5]

The second reason for doubt in statistics is that the science of statistics itself is a branch of mathematics, and thinking in terms of probabilities, for example, implies a way of thinking that is distinct from everyday thinking. Our brains are built in such a way that conscious effort is required to change from our default mode of reasoning; for example, the use of Bayes theorem does not come to mind spontaneously and many of its solutions are counter-intuitive. In short, thinking statistically is difficult, as Daniel Kahneman (2011) demonstrated through many experiments described in his famous book *Thinking, Fast and Slow*. This does not mean that statisticians and experts should give up, however. In the case of Bayesian calculus, some academics such as Gigerenzer and Hoffrage (1995) have shown that instead of using complex formulas, complex probabilistic inference may be simplified considerably by resorting to absolute frequencies. The authors show that this simple trick increases the comprehension of correct results.[6]

In this context, is important to highlight that trust in statistics is the result of a long and painful history. In his book entitled *Trust in numbers*, Theodor Porter (1996), clarifies that official statistics cannot be properly understood if they are not examined through the lens of the history of science. The authority of official statistics is linked to the progressive emergence of quantification, the standardization of measures, and the validation of social numbers. Objectivity—synonymous with realism—has been cultivated by promoting rules of fairness, impartiality, and impersonality. Since a genuine ontological "*absolute objectivity*" is not possible, scientists must cultivate proxies such as "*disciplinary objectivity*", guaranteed by specialists, or "*mechanical objectivity*", obtained by following rigorous rules that reduce personal prejudices or preferences. As Porter shows through examples such as the engineering of official statistics, "*mechanical objectivity*" is difficult to achieve fully because tacit knowledge, experience, wisdom, intuition, skills, and craft play an important role in scientific activity. "*In public affairs, reliance on nothing more that seasoned judgment seems undemocratic… Ideally, expertise should be mechanized and objectivised. It should be grounded in specific techniques sanctioned by a body of specialists"* (Porter 1997, p.7). *"The faith in objectivity tends to be associated with political democracy or at least with systems in*

[4] How statistics lost their power: https://www.theguardian.com/politics/2017/jan/19/crisis-of-statistics-big-data-democracy
[6] Gigerenzer and Hoffrage (1995) claim that Bayesian reasoning can be immensely simplified by using absolute frequencies instead of probabilities, which they label as "natural sampling".

which bureaucratic actors are highly vulnerable to outsiders". He recognizes that the *"objectivity of science is often confused with elitism"* (p.75) and that quantification is a *"technology of distance"*.

The struggle to establish bureaus of statistics in Western Europe and to confer on them legitimacy for decision-makers and the public has been a long process, as described by Alain Dérosières (2010). The institution of statistics is a political, social, and cultural process that is based on broad consensus and the convenience of the language of quantification. This consensus, which underpins official statistics, might fray if the broader social fabric on which it is based were to unravel.

The third reason for distrust in statistics is elucidated through new insights from the field of cognitive science regarding how we use information and eventually turn it into decisions.[7] A set of complex mechanisms riddled with various biases block "pure reasoning" from working perfectly. Effective users or potential users of official statistics understand figures and their interpretations through the lenses of altering cognitive mechanisms. Mercier and Sperber (2019) reject the dogma that takes *"for granted that the job of reasoning is to help individuals achieve greater knowledge and make better decisions"*. They state that reason is *"hopelessly biased and lazy"*. According to their interpretation, the bias of reason and laziness are rather imperfect tools for social interaction but developed to help people find *"reasons that support their point of view because this is how they can justify their actions and convince others to share their beliefs"*. This is a huge mental hurdle to overcome in order to properly process and extract information from data.[8] In the same vein, Jonathan Haidt (2013) underlines that the *"mind is divided, like a rider on an elephant, and the rider's job is to serve the elephant. The rider is our conscious reasoning—the stream of words and images of which we are fully aware. The elephant is the other 99 percent of mental processes—the ones that occur outside of awareness but that actually govern most of our behaviour"*. Sentiment dominates reasoning and facts (numbers). Behavioral economics offers additional explanations of how information is processed and decisions are made, in contradiction to the canons of the omniscient *"homo economicus"*. For example, Tirole and Bénabou (2017) propose three concepts to deal with

[7] "Cognitive science is a network of interrelated scientific disciplines engaged in researching human cognition and its brain mechanisms. Cognitive science is made up of experimental psychology cognition, philosophy consciousness, neuroscience, cognitive anthropology, linguistics, computer science and artificial intelligence" (Marina Bogdanova, 2017**).** We would add behavioral economics to this list.

[8] We will refrain from delving deeper into the concept of rationality, which is quite complex. See the theory of Raymond Boudon described in his work. People do what they do because they have reasons to act like this.

irrational thinking and explain decision-making patterns: strategic ignorance, self-signaling, and reality denial.

In psychology, the concept of self-deception is related to the way our self plays with data and information. Self-deception has a long history in psychology and philosophy and continues to inspire new perspectives and explanations of the paradox it entails. The idea that the mind can conceal information is puzzling and disturbing, producing different conceptions of self-deception and different views of its consequences (Bachkirova, 2016).

Human beings act with limited rationality when constructing up their beliefs or taking decisions. The usual linear communication pattern of NSIs, which in order to allow objective facts and rational decision-making confronts the supply of accurate, timely, and reliable figures, on the one hand, and the demand for objective information on the other, is naive and therefore useless.

In fact, communication between producers and users of official statistics seems much more complex in an information society where citizens, consumers, and businesses are drowned in a deluge of data of all kinds that they generally obtain free of charge from traditional and social media. Lewandowsky, Ecker, and Cook (2017) have made some important contributions regarding how contentious information is used and corrected: *"The post-truth world emerged as a result of societal megatrends such as a decline in social capital, growing economic inequality, increased polarization, declining trust in science, and an increasingly fractionated media landscape. Misinformation in the post-truth era can no longer be considered solely an isolated failure of individual cognition that can be corrected with appropriate communication tools. Rather, it should also consider the influence of alternative epistemologies that defy conventional standards of evidence"*.

A final issue connected to trust in statistics is illiteracy in basic numbers (GDP, inflation, unemployment, etc.), which is probably due to the poor quality of education, particularly in mathematics, statistics, and economics. One's level of literacy and training determines their level of analytical capacity. Inexperience or lack of competence may nurture defiance that can fuel the defiance of official statistics. Laboratory experiments have established that those most lacking knowledge and skills are least able to appreciate their own lack of knowledge. This relationship is known as the Dunning–Kruger effect (Poundstone, 2017).

An OECD study (2016) on literacy and numeracy provides some perspective on information-processing skills and competences. A survey conducted in 33 countries from 2013 to 2015

showed that a significant proportion of adults have insufficient reading and numeracy skills (22.7%, on average). One in four adults have no or limited computer experience or lack confidence in their ability to use one. Literacy and numeracy skills peak around the age of about 25. Older adults have lower scores than younger adults. Steven Sloman and Philip Fernbach (2017) highlight the myth of individual thought and the power of collective wisdom (pp. 4–5). They state that *"individual knowledge is remarkably shallow, only scratching the surface of the true complexity of the world, and yet we often don't realize how little we understand. The result is that we are often overconfident, sure we are right about things we know little about."*

In this context, post-truth is not a dangerous threat, as is generally assumed. "Post-truth", which was announced as the 2016 Oxford Dictionary international word of the year, is defined as *"relating to or denoting circumstances in which objective facts are less influential in shaping public opinion that appeals to emotion and personal belief"*. There is another form of post-truth (or "alternative facts") blend called "bullshit", coined as such by Harvard philosopher Harry Frankfurt. Dieguez (2018) describes this special form of misinformation as a particular form of lies. *"Liars know the truth and try to hide it; bullshitters don't know or care about the truth and try to hide their lack of commitment to it."* Thus, bullshitting is more like bluffing or faking.

Understanding scientific reasoning is quite difficult for most individuals. As Gorman(1989)[9] states, *"We will assert many times that the problem is not simply a lack of information, although that can be a factor. Irrational behaviour occurs even when we know and understand all the facts. Given what we now understand about brain function, it is probably not even appropriate to label science denial as, strictly speaking, 'irrational'. On the contrary, it is largely a product of how our minds work. This means that a simple education will not be sufficient to reverse the denial of science."*

[9] Error and Scientific Reasoning: An Experimental Inquiry Michael E. Gorman Part of the Sociology of the Sciences a Yearbook book series (1989) (SOSC,volume 13)

2. Measuring trust in official statistics

Trust in official statistics is becoming an important topic, as is the credibility of the organizations that produce them as public goods in order to support decision makers and citizens in a society.

Lack of knowledge regarding statistical numbers seems to be quite extensive, with many people having only a very basic grasp of macroeconomic indicators or other official statistics. A recent OECD report assessing adult literacy and numeracy shows that nearly 18.5% of adults in OECD countries have low reading and computational skills and that around one in four adults have little computer experience or lack of confidence in using a computer (OECD, 2016). Another report on financial literacy shows that in G20 countries, only 52% of adults have achieved a minimum target in basic skills, such as budgeting (OECD, 2017). Given this framework, the question arises of whether there exists a level of basic knowledge (in numeracy, for example) essential for understanding official statistics and thus evaluate economic and social policies.

A Eurobarometer (2015) poll showed that only 6% of Europeans correctly estimate their national growth rates, whereas 31% do not know or overestimate these. None of the participants could give the correct answer for inflation, and only 23% correctly estimated unemployment levels.

How does this lack of numeracy correlate with trust in economic statistics? A Eurobarometer (2015) survey on trust shows that 44% of respondents declare having trust in economic statistics, whereas 50% do not and 6% do not know. There is a lot of heterogeneity between countries: a large share of respondents from Sweden, the Netherlands, and Finland declare trusting official statistics (nearly 72% in each country), the highest percentage in Europe. Luxembourg is ranked 6th (59% of people express trust in official statistics), above countries like France (38%), Germany (39%), and Belgium (48%). Respondents from Spain ranked lowest, with only 27% of respondents declaring having trust in official statistics.

There are some particular topics, such as migration, for which statistics are widely distrusted.[10] Grigoreff et al. (2016) examined whether the provision of information on immigrants had an impact on people's attitudes towards immigration. In a vast representative study in several

[10] An online survey by the German Institute for Economic Research (Gesellschaft für Wirtschaftsforschung) carried out in 2016 showed that two thirds of respondents doubt statistics on immigration and less than half trust economic growth figures (Doeblin, 2017).

countries, they show that when people are told the proportion of immigrants in their country, they are less likely to say that they are too numerous. They also conducted two online experiments in the United States, where half of participants were given some immigration statistics and their attitudes towards immigrants were assessed through self-reported and behavioral measures. This more comprehensive intervention improved people's attitudes towards existing immigrants, although it did not change their policy preferences regarding immigration. A similar study by Alesina et al. (2018) realized in six countries found that the average native believes that there are between two and three times as many immigrants as there are in reality. Respondents also had it wrong regarding the share of religious denominations, overestimating the presence of Muslim immigrants, and they had exaggerated perception of the share of poor and low-educated immigrants. This study showed that misperceptions can have dire consequences for redistribution, reducing support for generous programs targeted at immigrants. In laboratory experiments, Nyhan and Reifler (2010) have shown that citizens balk at evidence that contradicts their partisan opinions and ideological attachments. Rather than ignoring information, they are actually even more convinced by their prejudices. This is what the authors called the *"backfire effect"*, reflecting that facts can actually aggravate a lack of knowledge. Further research in the same vein (Porter and Wood, 2017) has shown that the backfire effect can be tenuous. Finally, in his book entitled *Political Brain*, Drew Westen (2008) analyses partisan beliefs and finds that political ideology and political preferences, in terms of contrasting views such as right/left or progressive/conservative, could play a significant role in distorting the figures and the nature of the institutions producing them.

Some national statistical institutes collect data on trust in their official statistics, based on the OECD framework and guidelines for measuring trust (for example, New Zealand and the United Kingdom), and provide some comprehensive analyses.

Chiche and Chauvrie (2016) carried out an econometric analysis investigating the distrust of the French citizens regarding various statistical records such as economic growth, unemployment, immigration, public deficit, etc. The authors show that the general level of distrust in statistics is explained by individual characteristics such as age, gender, education level, income, and political preferences. Moreover, the study shows that trust in official statistics is highly correlated with trust in political institutions (government, parliament, president). In term of heterogeneity, the study indicates that trust in official statistics increases with income and education and is associated with political orientation. Rich, highly educated,

and left-oriented individuals report more trust in official statistics. Finally, the explanatory patterns also depend on the type of data and statistical areas.

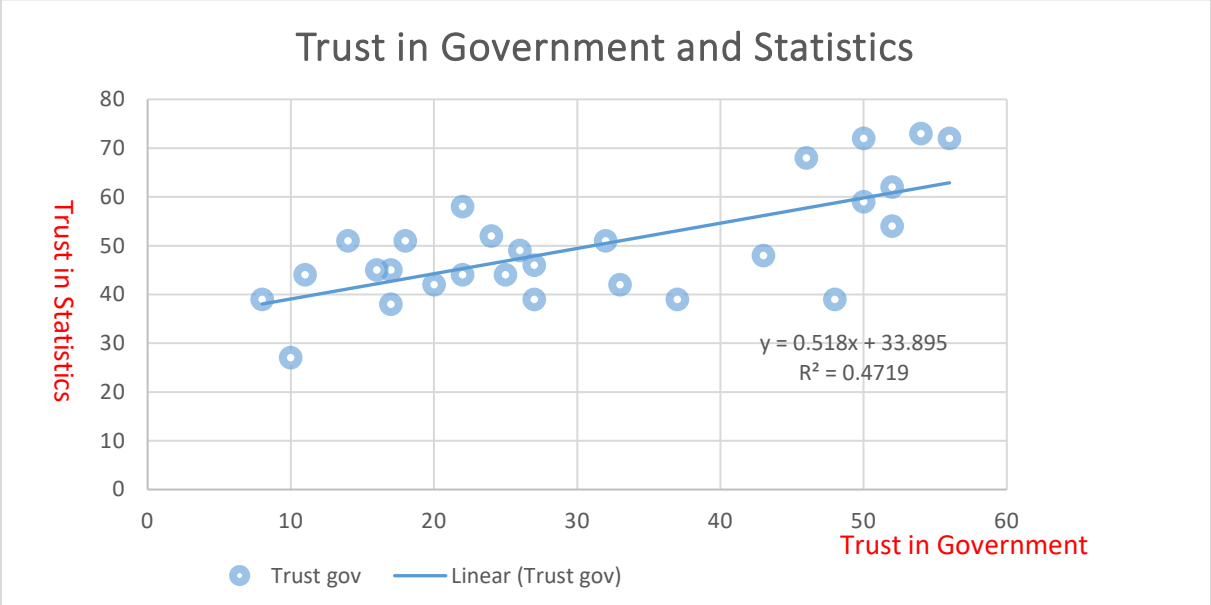

Figure 1: Correlation between trust in government and trust in statistics

Aside from the works mentioned, there are few studies investigating trust in official statistics from both a macro and micro perspective. Using Eurobarometer data, we check for a relationship between the level of trust in official statistics (y-axis) and trust in public authorities (x-axis) for all European countries. Figure 1 clearly shows the positive correlation between these two variables, suggesting that a more general context must be taken into account when investigating trust in official statistics.

3. The Luxembourg Surveys

3.1 Data and summary statistics

The national statistical institute of Luxembourg,[11] STATEC, conducted surveys in 2015 and 2018, based on the OECD's framework for investigating trust in official statistics.[12] The main objective of the surveys was to assess the institute's reputation so as to more effectively promote

[12] Recently, the OECD set up a "Trustlab" combining advanced techniques from behavioral science and experimental economics with an extensive survey on the policy and contextual determinants of trust in others and trust in institutions in six countries. The study "provides evidence that confirms the convergent validity of self-reported measures of both trust in others and trust in institutions, as well as highlights the scope for significantly improving trust via policy action" (OECD, 2018). Luxembourg is planning to join the project for 2020–2021.

its outputs and improve targeted communication.[13] The survey included questions that aim to measure the degree of confidence or trust in statistical numbers, as well as the level of trust in STATEC itself. The survey also comprised a set of questions that measure a respondent's level of trust regarding different features related to official statistics, such as trust in the institute's political independence or in the processing of personal data. Questions measuring the general level of trust in media, as an important channel for the dissemination of statistical information, were also included. Respondents were also asked about the use of official statistics and whether they had participated in other national surveys. Finally, the surveys collected data on sociodemographic characteristics such as age, gender, and education level.

Panels (a) and (b) in Table 1 show average statistics regarding the main individual characteristics for both surveys, 2015 and 2018. Our samples are balanced in terms of gender (51% are male) and age, the average being 46 years for both waves. The sample is also representative in terms of the nationalities of people living in Luxembourg.[14] Furthermore, the survey gathered information on the employment and educational background of participants, which makes our sample quite representative for the general population of Luxembourg.

3.2 Regression analysis

3.2.1 The 2015 survey

Table 2(a) shows the average level of trust in various institutions, such as trust in media, parliament, and others, using a decreasing 1–4 scale where 1 is equivalent to *"full trust"* and 4 is equivalent to *"do not trust at all"*.[15] In Table (3), we further show the correlation matrix of all variables that capture trust in institutions, in order to analyze some initial correlation patterns in the data. As can clearly be seen, all dimensions of trust are highly correlated with each other, with trust in STATEC showing high correlation with trust in parliament, in the central bank, and in the police.

As described above, the survey also included a battery of questions related to the nature of STATEC and the use of official statistics. To address these additional factors, we model the

[13] In addition to "peer review", based on the European code of conduct for official statistics, which aims to assess compliance through agreed quality standards, the surveys presented in this study examine the perception of statistics using a representative sample of people.

[14] The questionnaire was administered in 4 languages (Luxembourgish, French, German, and English).

[15] STATEC (Luxembourg's NSI) enjoys the highest level of trust compared to all other institutions (the average is below 2). We later use this variable as our main independent covariate when modelling trust in official statistics by running logistic regressions.

response of trust in official statistics through a logistic framework, where our dummy outcome (trusts or does not trust official statistics) is the main dependent variable. Table (6) reports the regression analysis relative to the 2015 survey wave.

Trust in public statistics is positively influenced by a perception of political independence and by the guarantee of the protection of personal data. Trust in the media, used as the main distribution mechanism of statistics, is positively related to trust in statistics. This is an important feature because media news and reports are often biased, distorted, or contaminated by comments or criticism (as, for example, through online comments).

When using trust in Luxembourg's NSI as the outcome variable,[16] the coefficients for the political independence of STATEC and the protection of data remain highly significant. Both logit regressions for trust in statistics and trust in STATEC are robust when controlling for individual characteristics (gender, age, education, income, and employment dummies) along with regional and nationality dummies.[17]

Finally, we jointly model the response of trust in statistics and STATEC using a bivariate model, since the two outcomes are highly correlated. Nevertheless, when running the bivariate model political independence and trust in media remain significant and positive for the full model specification. Results of the bivariate estimation also show that for the joint trust in statistics and STATEC, gender does not matter anymore, whereas there are still significant effects for some individual characteristics. Younger respondents (aged 25–35) report less trust for the joint trust in statistics and STATEC, whereas middle-income individuals and those in search of employment exhibit a positive and significant effect.[18]

These last results suggest that trust in statistics is highly influenced by the media and that the level of trust in the media is the most important variable for simultaneously explaining individual trust in statistics and in STATEC. Moreover, the bivariate regression analysis suggests a positive role of the political independence of STATEC in increasing the level of trust.

[16] We simplify the distribution of trust from a 4-point scale to a dummy (0–1) in order to run a logit model.
[17] In the 2015 survey, the only categories for nationality are Luxembourgish and foreign.
[18] Coefficients are not reported in the output tables; they are available upon request.

3.2.3 The 2018 survey

The 2018 survey was very similar to the one conducted in 2015, except that in this wave a measure of individual trust, as distinct from institutional trust, was introduced. Table 2 (b) reports the level of trust in different institutions, as in 2015 framework, which allows us to check for changes in institutional trust within the 3-year window. The level of trust in almost all institutions is nearly constant; some slight changes are observed but the level of trust in STATEC is always highest compared to trust in other institutions.

The same logistic regressions are performed as for the 2015 wave, and Table (6) summarizes the results for the four logit and bivariate equations: trust in official statistics, political independence, use of statistics, and trust in STATEC. Trust in official statistics is determined by trust in the institute, political independence, the protection of personal data, and the use of statistics, as well as trust in the media. These results seem to confirm the results of the 2015 survey. Individual trust appears to account for the overall trust in statistics but is insignificant for trust in STATEC.

When modelling the joint distribution of trust in statistics and in STATEC, we see that protection of data, political orientation (left–right), and trust in media remain significant when controlling for all individual and regional variables. Protection of data and trust in the media are positively correlated, whereas an increase in right-wing political views decreases trust in both outcomes. Among the individual covariates, the only significant variable is the level of education, suggesting a positive correlation between an increase in education and trust in statistics.

4. Interpreting the Results and Discussion

The two waves of data related to trust in statistics used in this study are quite rich and provide some useful information, confirming that the perception of the political independence of Luxembourg's NSI increases public trust. Our regression results show that trust in official statistics heavily depends on the institution that represents them and its policy framework. Figure 2 shows the average marginal effects (AMEs) for our first logistic estimation regarding trust in official statistics with respect to the latest survey (2018).

The results show that a 1% increase in trust in STATEC, Luxembourg's national statistics

institute, is correlated with a 20% increase in trust in official statistics. Instead, a 1% increase in trust in the media is correlated with a 10% increase in trust in official statistics. Nearly identical results are obtained when considering trust in STATEC as the dependent variable. With respect to individual characteristics, being male decreases trust in statistics by around 3%, whereas higher education always increases it; for example, having a master's degree or a higher level of education increases trust in statistics by almost 55% compared to a person who has no qualification. Nationality is shown to have little impact on the level of trust in statistics. When modelling both outcomes, namely trust in statistics and trust in STATEC, using a bivariate estimation, we find that that the political independence of the NSI (which increases trust in both by more that 20%) and data protection (which increases trust in both by more that 25%) are the main factors influencing this joint estimation (Figure 4).

Meanwhile, our econometric analysis also confirms the role of the media in determining the overall level of trust in statistics and STATEC, even when controlling for all possible individual characteristics. An increase in trust in media results in a 12% increase in the joint estimation of trust in statistics and trust in STATEC. These results suggest the interrelated nature of trust in statistics and media, and the importance of the transmission of correct and truthful information through media networks.

The overall rate of trust in official statistics in Luxembourg reached around 69% in 2018, which is quite similar to that of 2015. However, more than 30% of respondents still have only limited confidence in official statistics. What can we do about this? Some other authors' ideas on questions of trust in science and objective facts may be relevant to the issue of trust in statistics. In the philosophical context of post-modernism, science is perceived as dangerous and dominated by business—in sum, as flawed. Several popular philosophers flagged the way for post-truth and "alternative facts" approaches. The German philosopher Friedrich Nietzsche summarizes the relativist point of view: *"There are no facts, only interpretations."* This is of direct concern for official statistics, which profess to convey objective facts, or evidence, as a means of assessing objective *reality*. Steven Pinker (2018) in his book *Enlightenment Now*, pinpoints the change of mood in the face of reason, science, humanism, or progress, and the missions of all institutions of modernity, namely schools, hospitals, charities, news agencies, democratic governments, and international organizations. Since the 1960s, confidence in the institutions of modernity has been lost, and the second decade of the 21st century has seen the rise of populist movements that blatantly repudiate the ideals of the Enlightenment. Steven Pinker reminds us that counter-Enlightenment has pushed back the ideals of progress and freedom, such as those

stemming from the Romantic Movement of the 19th century. In this way, the connection between lack of trust in science in the post-modern world and trust in statistics may be a great starting point for investigating this issue. Another avenue for future research is the estimation of the optimal level of trust in statistics at a given point in time and in particular social and economic contexts.

References

1. Alesina, Alberto, and Stefanie Stantcheva. (2020) "Diversity, Immigration, and Redistribution." ***American Economic Review: Papers and Proceedings,*** NBER Working Paper 26620].
2. Allegrezza, Serge (2014) "La confiance dans les statistiques publiques" ***Economie et Statistiques.***
3. Bachkirova, Tatiana (2016) "A New Perspective on Self-Deception for Applied Purposes" ***New Ideas in Psychology*** **43.**
4. Bénabou, Roland, Jean Tirole. (2016) "Mindful Economics: The Production, Consumption, and Value of Beliefs" ***Journal of Economic Perspectives*** 30 (3) 141-64.
5. Caplan Bryan (2003) "Rational ignorance versus rational irrationality » ***Kyklos*** 54: 3-26.
6. Chiche, Jean, et Flora Chanvril-Ligneel. (2016) "Confiance dans les statistiques publiques : une relation contrariée" 25.
7. European Commission. Eurobarometer. **Science and Technology**. NO.340. July 2010, http://ec.europa.eu/commfrontoffice/publicopinion/archives/ebs/ebs_340_en.pdf.
8. European Commission. Europeans and Economic statistics**. Report. Standard Eurobarometer** 83, 2015. http://ec.europa.eu/commfrontoffice/publicopinion/archives/eb/eb83/eb83_stat_en.pdf.
9. Desrosières, Alain. (2010) *La politique des grands nombres : Histoire de la raison statistique.* Editions La Découverte
10. Dieguez, Sebastian. 2018 *Total bullshit !: Aux sources de la post-vérité.* Paris: Presses Universitaires de France - PUF.
11. Grigorieff, Alexis, Christopher Roth, Diego Ubfal. (2020) "Does Information Change Attitudes Towards Immigrants? Representative Evidence from Survey Experiments", **Demography** 57(2)
12. Gorman, Sara E., Jack M. Gorman (2016) *Denying to the Grave: Why We Ignore the Facts that Will Save Us.* Oxford ; New York: OUP USA
13. Haidt, Jonathan (2013*) The Righteous Mind: Why Good People Are Divided by Politics and Religion*
14. Lewandowsky, Stephan, Ullrich K.H. Ecker, et John Cook. (2017) "Beyond Misinformation: Understanding and Coping with the "Post-Truth" Era" Journal ***of Applied Research in Memory and Cognition*** 6 (4) 353-69
15. Nyhan, Brendan, Jason Reifler. (2010) "When Corrections Fail: The Persistence of Political Misperceptions ». *Political Behavior"* 32 (2), 303-30.
16. OECD (2017) "G20/OECD INFE report on adult financial literacy in G20 countries – OECD", http://www.oecd.org/finance/g20-oecd-infe-report-adult-financial-literacy-in-g20-countries.htm.

17. OECD (2016) Skills *Matter: Further Results from the Survey of Adult Skills*. OECD Skills Studies. Paris, OECD
18. Pinker, Steven (2018) *Enlightenment Now: The Case for Reason, Science, Humanism, and Progress*. New York Edition
19. Porter, Theodore M. (1996) *Trust in Numbers - The Pursuit of Objectivity in Science and Public Life.* Reprint. Princeton, N.J: Princeton University Press.
20. Rey, Olivier (2016) « *Quand le monde s'est fait nombre* » Paris: Stock.
21. Sloman, Steven, Philip Fernbach.(2017) *The Knowledge Illusion: The Myth of Individual Thought and the Power of Collective Wisdom*. Macmillan.
22. Dan Sperber, Hugo Mercier (2018). *The Enigma of Reason: A New Theory of Human Understanding.* Allen Lane Publication
23. Drew Westen (2003) *The Political Brain: The Role Emotion in Deciding the Fate of the Nation: How We Make Up Our Minds Without Using Our Heads*. Public Affairs; Reprint Edition
24. Jonathan Haidt (2018) *The Righteous Mind: Why Good People are divided by Politics and Religion.* Penguin Edition.
25. Wood, T., Porter, E. The Elusive Backfire Effect: Mass Attitudes' Steadfast Factual Adherence. ***Political Behavior*** **41,** 135–163.

Tables and Figures:

Table 1 (a): Summary Statistics-Trust in Statistics 2015

	Mean	S.d.	Min	Max	Obse
Male	0.52	0.50	0.00	1.00	2630
Age	46.77	15.15	19.00	90.00	2627
Student	0.07	0.26	0.00	1.00	2630
In Search of Employment	0.03	0.18	0.00	1.00	2630
Retired	0.20	0.40	0.00	1.00	2630
Housewife/husband	0.06	0.24	0.00	1.00	2630
Public Employee	0.26	0.44	0.00	1.00	2630
Private Employee	0.31	0.46	0.00	1.00	2630
Independent	0.06	0.23	0.00	1.00	2630
Primary	0.03	0.16	0.00	1.00	2630
Secondary, 1 Cycle	0.20	0.40	0.00	1.00	2630
Secondary, 2 Cycle	0.29	0.46	0.00	1.00	2630
Bachelor 3 years	0.20	0.40	0.00	1.00	2630
Master	0.10	0.31	0.00	1.00	2630
Master 2 level	0.16	0.36	0.00	1.00	2630
Other	0.01	0.12	0.00	1.00	2630
Luxembourgish	0.61	0.49	0.00	1.00	2630

Notes: Data came from 2015 Survey in Luxembourg

Table 1 (b): Summary Statistics-Trust in Statistics 2018

	Mean	S.d.	Min	Max	Observ.
Male	0.51	0.50	0.00	1.00	2724
Age	46.07	15.42	18.00	92.00	2724
Student	0.08	0.28	0.00	1.00	2724
In Search of Employment	0.02	0.15	0.00	1.00	2724
Retired	0.22	0.42	0.00	1.00	2724
Housewife/husband	0.05	0.21	0.00	1.00	2724
Public Employee	0.25	0.43	0.00	1.00	2724
Private Employee	0.31	0.46	0.00	1.00	2724
Independent	0.06	0.23	0.00	1.00	2724
Primary	0.02	0.15	0.00	1.00	2724
Secondary, 1 Cycle	0.19	0.39	0.00	1.00	2724
Secondary, 2 Cycle	0.28	0.45	0.00	1.00	2724
Bachelor 3 years	0.22	0.41	0.00	1.00	2724
Master	0.11	0.31	0.00	1.00	2724
Master 2 level	0.15	0.36	0.00	1.00	2724
Other Education	0.02	0.14	0.00	1.00	2724
Luxembourgish	0.68	0.47	0.00	1.00	2724
Portuguese	0.11	0.32	0.00	1.00	2724
French	0.12	0.33	0.00	1.00	2724
Italian	0.04	0.20	0.00	1.00	2724
German	0.03	0.17	0.00	1.00	2724
English	0.01	0.09	0.00	1.00	2724
Belgium	0.07	0.26	0.00	1.00	2724
Dutch	0.01	0.11	0.00	1.00	2724
Spanish	0.01	0.09	0.00	1.00	2724
Other	0.04	0.19	0.00	1.00	2724

Notes: Data came from 2018 Survey in Luxembourg

Table 2 (a): Institutional Trust-Trust in Statistics 2015

	Mean	S.D	Min	Max	Observ.
Level of trust in Media	2.68	0.79	1.00	4.00	2587
Level of trust in Parliament	2.36	0.78	1.00	4.00	2546
Level of trust in Government	2.50	0.85	1.00	4.00	2584
Level of trust in Public Service	2.13	0.68	1.00	4.00	2579
level of trust in STATEC	1.79	0.63	1.00	4.00	2544
level of trust in Police	1.96	0.74	1.00	4.00	2602
level of trust in Central Bank	2.07	0.76	1.00	4.00	2471
level of trust in Financial Institutions	2.38	0.80	1.00	4.00	2584

Notes: Data came from 2015 Survey in Luxembourg. Level of Trust in other is 1-4 scale decreasing in trust

Table 2 (b): Institutional Trust-Trust in Statistics 2018

	Mean	S.D.	Min	Max	Observ.
Level of trust in Media	2.64	0.73	1.00	4.00	2691
Level of trust in Parliament	2.28	0.75	1.00	4.00	2646
Level of trust in Government	2.34	0.79	1.00	4.00	2680
Level of trust in Public service	2.07	0.65	1.00	4.00	2683
Level of trust in STATEC	1.81	0.62	1.00	4.00	2631
Level of trust in Police	1.85	0.70	1.00	4.00	2709
Level of trust in Central Bank	2.07	0.75	1.00	4.00	2528
Level of trust in Financial Institutions	2.37	0.75	1.00	4.00	2687

Notes: Data came from 2018 Survey in Luxembourg. Level of Trust is 1-4 scale decreasing in trust.

Table 3: Pairwise Correlation of Trust in Institutions (Survey 2015)

Variable	Media	Parliament	Government	Public service	STATEC	Justice	Police	Central Bank	Financial Inst.	Statistics
Trust in:										
Media	1.000									
Parliament	0.327	1.000								
Government	0.298	0.647	1.000							
Public service	0.276	0.426	0.362	1.000						
STATEC	0.251	0.333	0.299	0.328	1.000					
Justice	0.247	0.442	0.374	0.377	0.306	1.000				
Police	0.233	0.354	0.313	0.400	0.301	0.422	1.000			
Central Bank	0.274	0.447	0.385	0.337	0.405	0.393	0.338	1.000		
Financial Inst.	0.261	0.322	0.253	0.262	0.243	0.280	0.273	0.508	1.000	
Statistics	0.141	0.245	0.221	0.208	0.304	0.179	0.124	0.249	0.133	1.000

Table 4: Logit and Bivariate Logit Regressions for Trust in STATEC and Trust in Statistics (Survey 2015)

VARIABLES	Logit Trust in Statistics	Logit Trust in Statistics	Logit Trust STATEC	Logit Trust STATEC	Bivariate Logit Trust STATEC and Statistics	Bivariate Logit Trust STATEC and Statistics
Trust STATEC	**0.769*** **	**0.809*** **				
	(0.103)	**(0.108)**				
Trust in Statistics			**0.695*** **	**0.670*** **		
			(0.133)	**(0.133)**		
Political Independence	**0.936*** **	**1.031*** **	**0.927*** **	**0.893*** **	**0.723*** **	**0.649*** **
	(0.0804)	**(0.0866)**	**(0.112)**	**(0.119)**	**(0.0992)**	**(0.111)**
Usage statistics	**0.128** **	0.00625	**0.398*** **	**0.384*** **	**0.499*** **	**0.354*** **
	(0.0525)	(0.0581)	**(0.0853)**	**(0.0943)**	**(0.0727)**	**(0.0812)**
Protection of data	**0.120** **	0.0771	**0.455*** **	**0.449*** **	**0.323*** **	**0.313*** **
	(0.0566)	(0.0600)	**(0.0677)**	**(0.0714)**	**(0.0606)**	**(0.0672)**
Trust in Media	**0.300*** **	**0.400*** **	**0.374*** **	**0.435*** **	**0.227*** **	**0.310*** **
	(0.0712)	**(0.0757)**	**(0.104)**	**(0.108)**	**(0.0850)**	**(0.0919)**
Male		**0.218***		**0.514*** **		0.123
		(0.123)		**(0.181)**		(0.151)
Age Dummies		YES		YES		Yes
Employment Dummies		YES		YES		Yes
Income Dummies		YES		YES		Yes
Regional Dummies		YES		YES		Yes
Constant	6.273***	6.619***	7.475***	8.062***	6.199***	5.440***
	(0.325)	(0.769)	(0.530)	(1.144)	(0.408)	(0.865)
Observations	2,333	2,217	2,333	2,217	2,001	1,892

Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Age 25-34 is negative significant for bivariate regression; Respondents in search of employment have positive and significant coefficient for bivariate regression. None of the education level is significant for bivariate regression. Middle income have a positive and significant effect for bivariate regression.

Table 5: Pairwise Correlation of Trust in Institutions (Survey 2018)

Variable	Media	Parliament	Government	Public Service	STATEC	Justice	Police	Central Bank	Financial Inst.	Statistics
Trust in :										
Media	1.000									
Parliament	0.392	1.000								
Government	0.346	0.721	1.000							
Public Service	0.315	0.476	0.449	1.000						
STATEC	**0.336**	**0.424**	0.391	**0.455**	1.000					
Justice	0.334	0.522	0.480	0.425	0.411	1.000				
Police	0.283	0.378	0.373	0.413	**0.361**	0.516	1.000			
Central Bank	0.320	0.484	0.440	0.375	0.472	0.448	0.359	1.000		
Financial Inst.	0.305	0.334	0.352	0.277	0.274	0.375	0.336	0.547	1.000	
Statistics	0.178	0.268	0.266	0.207	0.321	0.213	0.167	0.219	0.113	1.000

Table 6: Logit and Bivariate Logit Regressions for Trust in STATEC and trust in Statistics (Survey 2018)

VARIABLES	Logit Trust in Statistics	Logit Trust in Statistics	Logit Trust STATEC	Logit Trust STATEC	Bivariate Logit Trust STATEC and Statistics	Bivariate Logit Trust STATEC and Statistics
Trust STATEC	**1.159*** **	**1.227*** **				
	(0.114)	**(0.128)**				
Trust Statistics			**1.806*** **	**1.950*** **		
			(0.192)	**(0.225)**		
Political Independence	**0.335*** **	**0.443*** **	**0.201** **	**0.216** **	-0.161	-0.220
	(0.0531)	**(0.0618)**	**(0.0873)**	**(0.102)**	(0.132)	(0.170)
Usage statistics	**0.192*** **	0.0721	**0.185** **	-0.165	**0.294** **	-0.143
	(0.0531)	(0.0620)	**(0.0861)**	(0.102)	**(0.144)**	(0.190)
Protection Data	0.0886	**0.124***	**0.548*** **	**0.593*** **	**0.570*** **	**0.623*** **
	(0.0548)	**(0.0636)**	**(0.0696)**	**(0.0823)**	**(0.104)**	**(0.149)**
Participation Survey	0.0876	0.0195	0.0336	0.0149	0.00827	0.0178
	(0.141)	(0.159)	(0.233)	(0.265)	(0.410)	(0.504)
Political Orientation(left-right)	0.0393	**0.0684** **	**-0.101** **	**-0.130** **	-0.0232	**-0.181***
	(0.0301)	**(0.0343)**	**(0.0460)**	**(0.0535)**	(0.0832)	**(0.108)**
Trust in Media	**0.440*** **	**0.567*** **	**0.954*** **	**1.044*** **	**1.306*** **	**1.528*** **
	(0.0812)	**(0.0925)**	**(0.128)**	**(0.147)**	**(0.218)**	**(0.286)**
Trust Others	**0.480*** **	**0.398*** **	0.366	0.353	0.410	0.110
	(0.133)	**(0.151)**	(0.247)	(0.275)	(0.364)	(0.461)
Male		**-0.355*** **		-0.0842		**0.722***
		(0.134)		(0.215)		**(0.419)**
Age Dummies		YES		YES		Yes
Employment Dummies		YES		YES		Yes
Income Dummies		YES		YES		Yes
Nationality Dummies		YES		YES		Yes
Regional Dummies		YES		YES		Yes
Constant	5.856***	4.580***	6.911***	7.264***	9.636***	6.155**
	(0.374)	(-1.188)	(0.640)	(-1.689)	(-1.038)	(-2.565)
Observations	2,271	2,122	2,271	1,866	1,789	1,789

Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Marginal effects are reported on the figures.
Age is not significant for bivariate regression; all the education levels are significant for bivariate regression.

Appendix A: Average Marginal Effects for Trust in Statistics (2018 Survey)

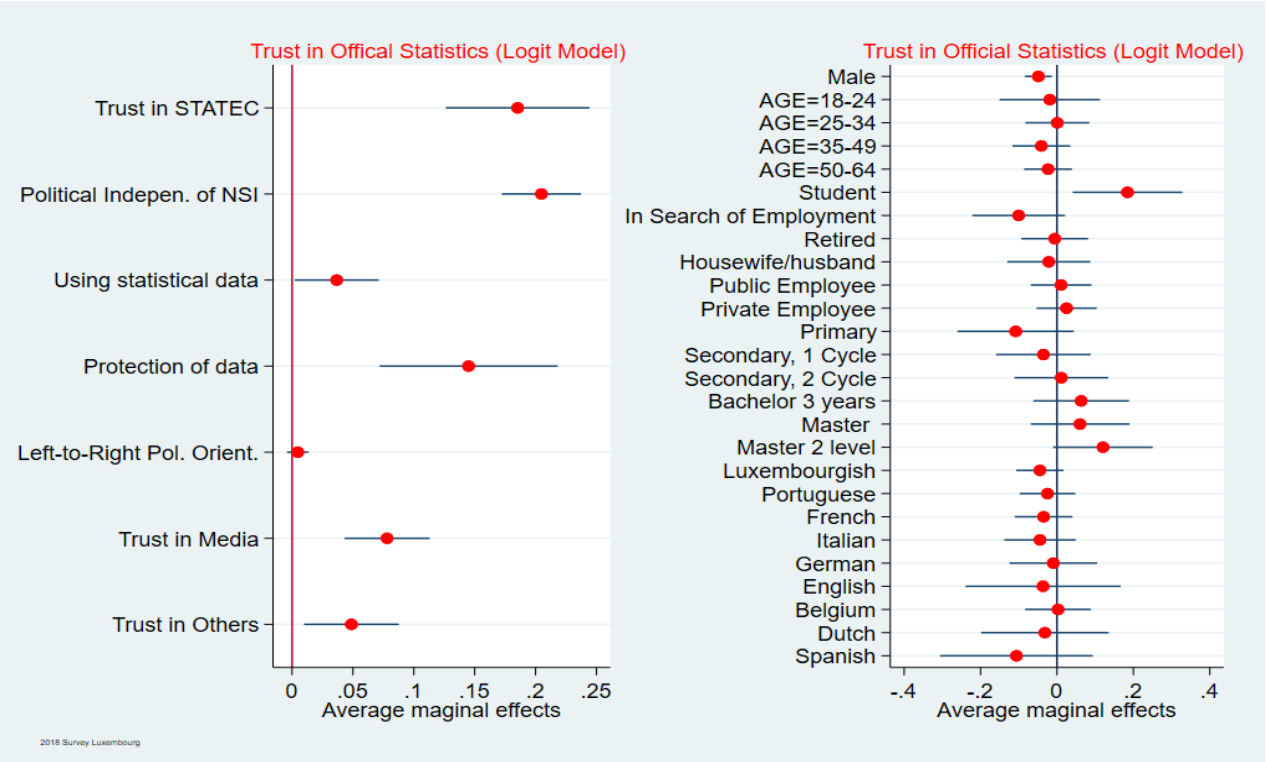

Figure 2: Average Marginal Effects for Trust in Statistic

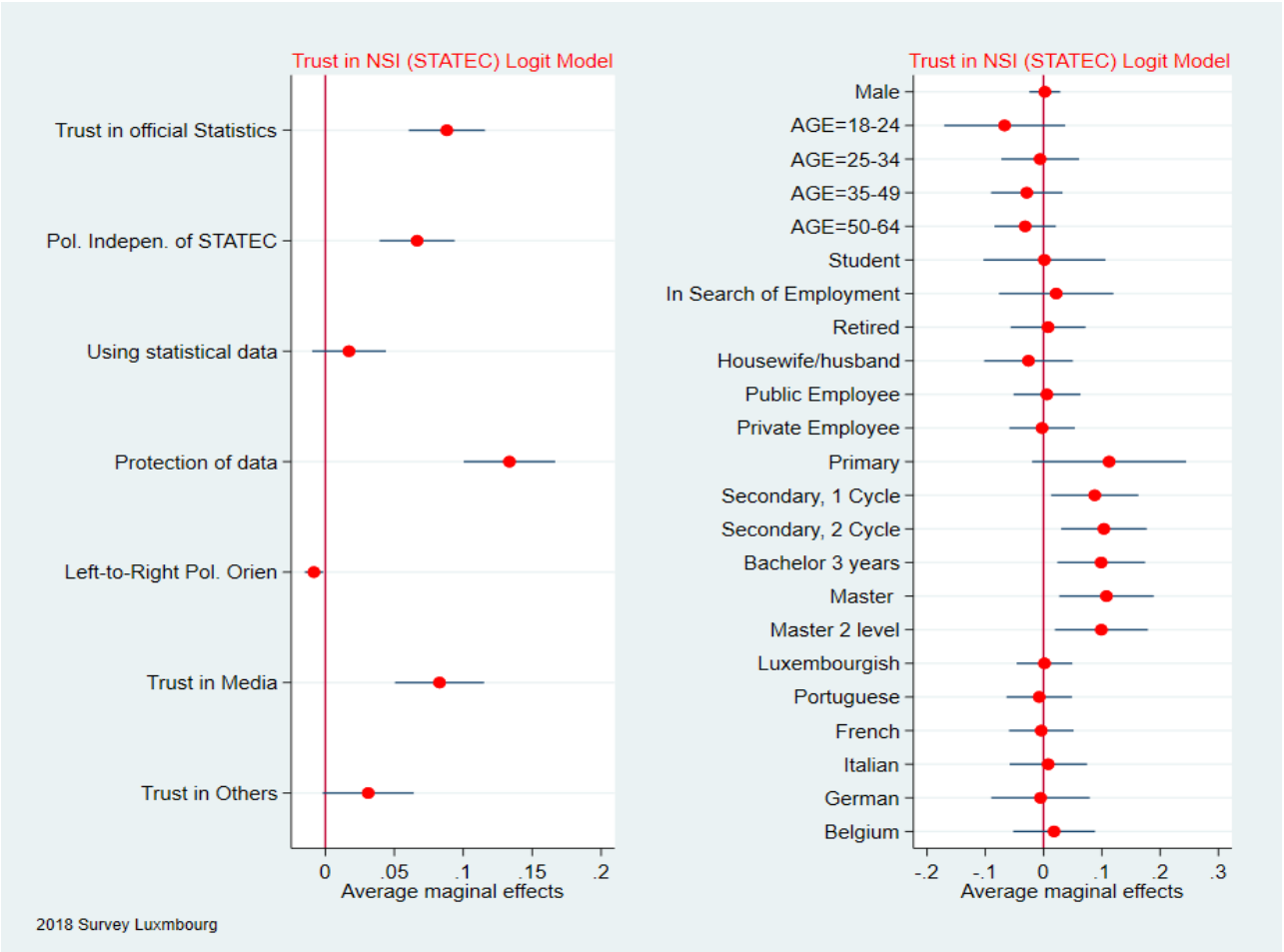

Figure 3: Average Marginal Effects for Trust in STATEC

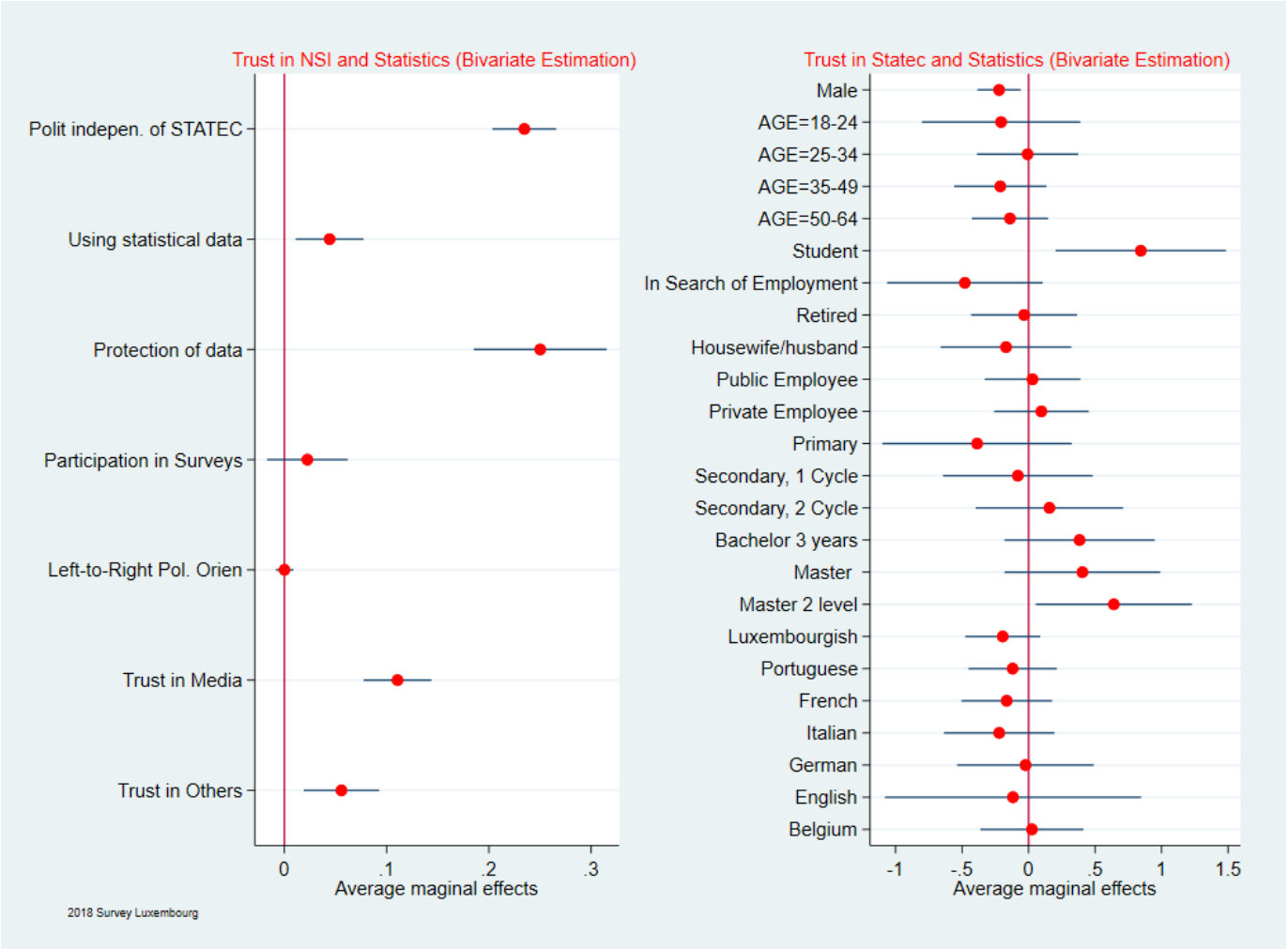

Figure 4: Average Marginal Effect for Bivariate Estimation (Trust in STATEC and Statistics)

Appendix B: Codification of some variables in dummy outcomes

a) Political orientation using a dummy variable

Table 7: Logit and Bivariate Logit Regressions for Trust in STATEC and trust in Statistics (Survey 2018)

VARIABLES	Logit Trust in Statistics	Logit Trust in Statistics	Logit Trust STATEC	Logit Trust STATEC	Bivariate Logit Trust STATEC and Statistics	Bivariate Logit Trust STATEC and Statistics
Trust Statec	0.844***	0.918***				
	(0.112)	(0.123)				
Trust Statistics			0.399***	0.432***		
			(0.112)	(0.129)		
Political Independence	0.933***	1.019***	0.869***	0.935***	0.616***	0.717***
	(0.0869)	(0.0974)	(0.121)	(0.141)	(0.0932)	(0.108)
Usage statistics	0.194***	0.0993	0.294***	0.253***	0.245***	0.158**
	(0.0538)	(0.0622)	(0.0809)	(0.0958)	(0.0572)	(0.0704)
Protection Data	0.00147	-0.0365	0.577***	0.582***	0.375***	0.333***
	(0.0562)	(0.0635)	(0.0644)	(0.0753)	(0.0498)	(0.0597)
Participation Survey	-0.158	-0.135	0.189	0.301	0.108	0.154
	(0.141)	(0.157)	(0.231)	(0.263)	(0.158)	(0.184)
Political Orientation(0-1)	0.00247	-0.0139	-0.0896	0.0844	-0.498***	-0.296*
	(0.125)	(0.143)	(0.185)	(0.214)	(0.143)	(0.168)
Trust in Media	0.339***	0.426***	0.868***	0.988***	0.269***	0.283***
	(0.0821)	(0.0925)	(0.120)	(0.135)	(0.0887)	(0.103)
Trust Others	0.488***	0.456***	0.641***	0.761***	0.716***	0.560***
	(0.136)	(0.154)	(0.233)	(0.263)	(0.142)	(0.165)
Male		-0.435***		-0.0980		0.339**
		(0.133)		(0.200)		(0.147)
Age Dummies		YES		YES		Yes
Employment Dummies		YES		YES		Yes
Income Dummies		YES		YES		Yes
Nationality Dummies		YES		YES		Yes
Regional Dummies		YES		YES		Yes
Constant	6.417***	5.201***	8.668***	8.539***	5.107***	3.480***
	(0.367)	-1.217	(0.587)	-1.587	(0.368)	-1.132
Observations	2,369	2,212	2,369	1,935	2,173	1,794

Note: We include a 0-10 scale when measuring political orientation (left-to-right). We provide an alternative estimation cutting the variable of political orientation in 0-1. The significance level of the variable disappears for logistics estimation. It is still significant for bivariate even though the coefficient of the marginal effect is quite low.