DEPARTMENT OF POLITICAL SCIENCE

POLITICAL TRUST AND COVID-19 VACCINE HESITANCY

Comparing the effects of institutional vs. performance-based trust on vaccine hesitancy in Europe

Emma Törnblom

Master's Thesis:	30 higher education credits
Programme:	Master's Programme in Political Science
Date:	May 23rd, 2022
Supervisor:	Vanessa A. Boese
Words:	17 618 (excluding appendix)

Abstract

As vaccines against Covid-19 are being distributed globally the goal is to limit the impact of the disease by achieving herd immunity, and to accomplish this most people need to get vaccinated. Vaccine hesitancy is a challenge to this goal. This thesis investigates whether and how different forms of political trust can be linked to individuals' willingness to get the Covid-19 vaccine in the first half of 2021. Using data from the Eurobarometer surveys 94.3 from Feb/Mar 2021 (European Commission, 2021a) and 95.3 Jun/Jul 2021 (European Commission, 2021b) together with data from other sources, I perform multilevel regression analyses on the current 27 European Union member states to investigate the links between political trust and Covid-19 vaccine hesitancy. The results suggest that political trust is associated with less vaccine hesitancy, both in the form of institutional trust and trust based on the government's performance in response to the Covid-19 pandemic. The results suggest that countries with lower levels of political trust can expect vaccine hesitancy to be a bigger challenge to achieve high vaccination coverage.

Keywords: *political trust, vaccine hesitancy, Covid-19*, *EU*

Table of contents

1 Introduction ... 6
2 Theory and previous research ... 8
2.1 Political trust ... 8
2.1.1 What is political trust and why is it important? ... 8
2.1.2 What determines political trust? ... 9
2.1.3 Trust and COVID-19 ... 10
2.2 Vaccine hesitancy ... 12
2.2.1 What is vaccine hesitancy and why is it important? ... 12
2.2.2 What determines vaccine hesitancy? ... 13
2.2.3 Vaccine hesitancy, trust, and COVID-19 ... 14
2.3 Research gap and question ... 15
2.3.1 Research question ... 17
3 Materials and methods ... 18
3.1 Research model ... 18
3.2 Data ... 19
3.2.1 Operationalizations of concepts ... 19
3.2.2 Data overview ... 23
3.3 Sample selection ... 26
3.4 Statistical regression analysis ... 27
4 Results ... 29
4.1 Country-level analysis ... 29
4.1.1 Institutional trust – H_1 ... 29
4.1.2 Performance-based trust – H_2 ... 32
4.2 Multilevel analysis ... 34
4.2.1 Institutional trust – H_1 ... 34
4.2.2 Performance-based trust – H_2 ... 38
4.3 Robustness checks ... 40
5 Discussion and conclusion ... 43
5.1 Limitations and future research ... 44
6 References ... 46
Appendix I – Various ... 51
Appendix II – Regression outputs and figures ... 54
Appendix III – Robustness checks ... 65

List of figures

Figure 1. Model of the theoretical effects of political output on vaccine progress 15
Figure 2. The research model 18
Figure 3. Vaccine progress by country and region 24
Figure 4. Visualized relationship between vaccine progress and hesitancy 25
Figure 5. Illustration of vaccine hesitancy as a continuum. Source: SAGE Working Group on Vaccine Hesitancy (MacDonald, 2015, p. 4162) 52
Figure 6. Visualized relationship between vaccine progress and corruption 54
Figure 7. Visualized relationship between vaccine hesitancy and corruption 54
Figure 8. Vaccination progress and institutional trust (country averages of EB 94.3 & 95.3) 55
Figure 9. Vaccine hesitancy and institutional trust (country averages of EB 94.3 & 95.3) 55
Figure 10. Vaccination progress and the index on performance-based trust (averages of EB 94.3 & 95.3) 57
Figure 11. Vaccine hesitancy and performance-based trust (averages of EB 94.3 & 95.3) 57
Figure 12. Histogram of the residuals for the full model testing H_1 (EB 94.3) 69
Figure 13. Histogram of the residuals for the full model testing H_1 (EB 95.3) 69
Figure 14. Histogram of residuals for the full model testing H_2 (EB 94.3) 70
Figure 15. Histogram of residuals for the full model testing H_2 (EB 95.3) 70
Figure 16. The effect on vaccine hesitancy by performance-based trust as moderated by institutional trust (EB 94.3) 71
Figure 17. The effect on vaccine hesitancy by performance-based trust as moderated by institutional trust (EB 95.3) 71

List of tables

Table 1. Country-level summary statistics 25
Table 2. Regression output - H1 (using Eurobarometer 94.3 dataset, Feb/Mar 2021) 31
Table 3. Regression output - H_1 (using Eurobarometer 95.3 dataset, Jun/Jul 2021) 31
Table 4. Regression output – H_2 (using Eurobarometer 94.3, Feb/Mar 2021) 33
Table 5. Regression output - H_2 (using Eurobarometer 95.3, Jun/Jul 2021) 33
Table 6. Regression output - testing H_1 (based on Eurobarometer 94.3, Feb/Mar 2021) 34
Table 7. Regression output - H_1 (based on Eurobarometer 95.3, Jun/Jul 2021) 35
Table 8. Regression output – H_2 (survey data: Eurobarometer 94.3, Feb/Mar 2021) 38
Table 9. Regression output – H_2 (survey data: Eurobarometer 95.3, Jun/Jul 2021) 39
Table 10. List of included countries by geographical category 51
Table 11. Number of respondents by country and Eurobarometer survey 51
Table 12. Vaccine progress and hesitancy by country 52
Table 13. Individual-level variable summary statistics – EB 94.3 53
Table 14. Individual-level variable summary statistics – EB 95.3 53
Table 15. Country-level control variables summary statistics (same for all regressions) 53
Table 16. Full regression output - H_1 (Eurobarometer variables using EB 94.3 dataset, Feb/Mar 2021) 56
Table 17. Full country-level regression output - H_1 (Eurobarometer 95.3 dataset, Jun/Jul 2021) 56
Table 18. Full country-level regression output – H_2 (Eurobarometer 94.3 dataset, Feb/Mar 2021) 58
Table 19. Full country-level regression output – H_2 (Eurobarometer 95.3, Jun/Jul 2021) 58
Table 20. Full multi-level regression output – testing H_1 (Eurobarometer 94.3 Feb/Mar 2021) 59
Table 21. Full multi-level regression output – testing H_1 (Eurobarometer 95.3 dataset, Jun/Jul 2021) 60
Table 22. Full multi-level regression output – testing H_2 (Eurobarometer 94.3 dataset, Feb/Mar 2021) 61
Table 23. Full multi-level regression output – testing H_2 (Eurobarometer 95.3 dataset, Jun/Jul 2021) 62
Table 24. Likelihood-ratio tests 64
Table 25. Ordered logistic regression output - testing H_1 (EB 94.3 data, Feb/Mar 2021) 65

Table 26. Ordered logistic regression output - testing H_1 (EB 95.3 data, Jun/Jul 2021) 65
Table 27. Ordered logistic regression output - testing H_2 using EB 94.3 data 66
Table 28. Ordered logistic regression output - testing H_2 using EB 95.3 data 66
Table 29. Testing alternative operationalizations of institutional trust in the full model – H_1 (EB 94.3) 67
Table 30. Testing alternative operationalizations of institutional trust in the full model – H_1 (EB 95.3) 67
Table 31. Testing alternative operationalizations of institutional trust in the full model – H_2 (EB 94.3) 68
Table 32. Testing alternative operationalizations of institutional trust in the full model – H_2 (EB 95.3) 68

1 Introduction

In 2019, before the global outbreak of the coronavirus Covid-19, the World Health Organization (WHO) named vaccine hesitancy as one of ten major threats to global health (along for instance climate change and HIV). In that declaration, the WHO stated that vaccine hesitancy "threatens to reverse progress made in tackling vaccine-preventable diseases" and noted that measles had seen a 30% increase globally (WHO, 2019).

Shortly thereafter, people and governments globally were hit by the Covid-19 pandemic, causing a crisis that, in terms of its chocks on society, has been compared to the Second World War. In fact, in a press conference on March 5th, 2021, the Director-General of the WHO, Dr Tedros Adhanom Ghebreyesus, argued that the mass trauma caused by Covid-19 is even greater than that of the Second World War because it has affected "each and every individual on the surface of the world" (WHO, 2021).

Naturally, the Covid-19 crisis is a phenomenon that has interested researchers in different fields from the very onset, including political science. While the pool of political science research on the Covid-19 pandemic is growing fast, there are still many important questions left to answer. New data continues to become available, and we are now in a stage where most countries have experienced several 'waves' of disease spread, and the majority of the world's adult population has received at least one dose of a vaccine against Covid-19 (Our World in Data, 2022). This provides possibilities to seek answers to questions that were not possible to answer in the earlier stages. One such research gap, to which this paper intends to contribute, regards the relationship between political trust and vaccine willingness/hesitancy in the context of Covid-19.

Initial results suggest that higher levels of trust can be linked to lower levels of excess mortality during Covid-19 (Bosancianu, et al., 2021; Charron, et al., 2022), as well as higher levels of compliance with policies aimed at containing disease spread (Bayerlein, et al., 2021; Bargain & Aminjonov, 2020). While little research is out yet on Covid-19 vaccine hesitancy, the studies that were found when researching for this paper have mainly looked at other determinants of vaccine hesitancy, such as misinformation and socioeconomic factors (Wirsiy, et al., 2021; Loomba, et al., 2021; Fernandes, et al., 2021).

The main aim of this study is to explore if political trust can be linked to variation in hesitancy to get the Covid-19 vaccine in the European Union (EU). Additionally, the idea is to compare the effects of different forms of political trust. To do this, multi-level regression analysis is used, primarily utilizing data from two Eurobarometer surveys conducted in 2021 (European Commission, 2021a; European Commission, 2021b), looking at the 27 current member states of the EU. As such, this study makes the following contributions: the findings suggest that both institutional and performance-based political trust can be linked to willingness to get vaccinated, and policymakers should expect reaching herd immunity to be more challenging in places where political trust is low.

The structure of the thesis is such that it begins by providing the theoretical framework and review of previous research before specifying the research question and hypotheses. The data and methods used to approach the research question are then presented in the following section. Next, the results are presented, divided by how the data is utilized (country level or multi-level), before robustness checks are performed. Lastly, the findings are summed up and analyzed before the limitations of the findings are discussed together with suggestions for future research.

2 Theory and previous research

In this section, I am outlying underlying mechanisms of how political trust and vaccine hesitancy are thought to relate to each other. This overview is the backdrop of the identified research gap, which justifies the research question for this thesis. One of the main takeaways is that trust is central to both a functioning democracy and installing vaccine confidence.

2.1 Political trust

This section is structured to begin by defining political trust and separating this trust from generalized/social trust. Then, theoretical explanations on what generates or undermines political trust are reviewed before a section reviewing research on how political trust relates to the Covid-19 pandemic.

2.1.1 What is political trust and why is it important?

One of the most influential scholars on the topic of trust is Eric M. Uslaner. He defines political trust as "confidence in institutions such as the executive, the legislature, the judiciary, the bureaucracy, and the police" and argues that political trust is distinct from for example social (or generalized) trust, which he defines as "the belief that most people can be trusted" (Uslaner, 2018, p. 4). Additionally, political trust is sometimes thought of in terms of two overlapping dimensions: trust in the more neutral institutions (such as the justice system and civil service) on the one hand and the organizations of government (such as parliament and political parties) on the other (Newton, et al., 2018, pp. 40-41; Rothstein, 2017).

One of the most important aspects of political trust is that low levels of trust can make it very difficult for leaders to succeed (Hetherington, 1998). Insight into the mechanisms behind this can be gained by understanding that trust is an important component in successfully solving social dilemmas. Social dilemmas, such as collective action problems, occur "whenever individuals in interdependent situations face choices in which the maximization of short-term self-interest yields outcomes leaving all participants worse off than feasible alternatives" (Ostrom, 1998). Thus, there is an incentive to act out of self-interest but unless agents can collaborate the gain will be lost for everyone. Therefore "[it] makes no sense for the individual agent to contribute if she or he does not trust that (almost) everyone else will also contribute" (Rothstein, 2011, p. 148). This could also be the underlying mechanism explaining why empirical research has found political trust to be linked to "positive" outcomes such as "voting participation, willingness to pay taxes, and more support for an activist role in world affairs" (Uslaner, 2018, p. 6) as well as more generally the effective implementation of public services (Newton, et al., 2018, p. 38).

2.1.2 What determines political trust?

Why is trust in authorities and institutions higher in some societies than in others? What generates this trust? These are questions that have puzzled researchers interested in trust for decades. While associations have been found, the task of isolating distinct causes and effects has been described as the main problem in trust research (Newton, et al., 2018, p. 41). Reviewing the literature on the topic, Kenneth Newton and colleagues found that social and political trust are closely intertwined and mutually reinforcing, leading to the unsatisfying conclusion that "a combination of factors are involved with both the causes and the effects of social and political trust" (2018, p. 42). This suggests that political trust will be difficult to single out from social trust. Uslaner (2018) on the other hand argues that social (or generalized) trust is *fundamentally* different from political trust and that they are generated in different ways. He argues that political trust "is all about evaluations of performance", and thus responsive to short-term variations, while social trust has more so to do with one's upbringing (parental socialization) and is, therefore, more static and unaffected by good or bad life experiences (Uslaner, 2018, p. 4). Whether or not political trust can be separated from social trust is not a concern in this paper, but it should be noted that it is not unlikely that the political trust measures in this thesis do capture both some social as well.

Following Newton et al. (2018) theories on how social and political trust is generated can broadly be put in two categories: individual bottom-up and societal top-down theories. Bottom-up theories, such as those found in psychology and sociology, explain differences in trust as stemming from individual differences in personality characteristics or social situations. Top-down theories on the other hand study the characteristics of whole societies and find strong associations between trust and certain characteristics such as lack of corruption and income equality. Among those in favor of the top-down perspective, it is argued that "state institutions and government policies can help to create or undermine the circumstances in which social and political trust can grow or decay" (Newton, et al., 2018, p. 39). Bo Rothstein can be included in this category. He argues that neutral (or impartial) institutions play the most important role in generating trust, concluding that: "the major source of variations in social trust is to be found at the output side of the state machinery, namely in the quality of the legal and administrative branches of the state that are responsible for the implementation of public policies." (Rothstein, 2017, p. 32). The top-down perspective will also be the approach in this thesis.

Another aspect that has been found to affect political trust is political polarization. In the context of the United States, polarized political trust has been defined as occurring when "those who identify with the party opposite the president express much less trust in government than those who identify with the president's party" (Hetherington, 2015). Additionally, research from the US suggests that what is driving the polarization is not so much policy preferences as it is feelings about their political opponent (Hetherington & Rudolph, 2018, p. 581). Similar observations have been made in Europe, with the effect being especially apparent in Central Eastern and Southern Europe (Reiljan, 2020). The consequences of polarized trust are similar to generally low trust levels but there is an added challenge aspect that comes with the sharp contrast in trust which consensus and compromises harder to reach (Hetherington, 2015).

2.1.3 Trust and COVID-19

So far, most of the research on how trust relates to the Covid-19 pandemic has mainly been focused on two areas: explaining the variations in how countries have responded to the pandemic (policy choices) and variation in pandemic outcomes (adherence to policy, mortality rates, et cetera).

Studying variations in Covid-19 response, Toshkov et al. (2021) looked at variations in the speed at which governments initially responded to the pandemic. In doing so, they found that "societies with higher interpersonal trust, trust in government and general freedom scores reacted slower to the spread of the pandemic" (Toshkov, et al., 2021, pp. 16-17). Similarly, studying differences between regime types both Sebhatu et al. (2020) and Cheibub et al. (2020) found that democracies responded slower to Covid-19, a conclusion that was later reinforced by Engler et al. (2021) who conclude that more vertical and horizontal accountability made decision-makers more reluctant to "adopt public health interventions that encroach on civil liberties" (Engler, et al., 2021, p. 1096). Taken all together, these results could suggest that governments in more democratic countries generally have more trust among their citizens but also more accountability which restricted them from being able to act fast when faced with the Covid-19 pandemic.

Turning to research on how trust relates to pandemic outcomes, McMann & Tisch (2021) examined to what extent variation in Covid-19 deaths could be accounted for by differences in regime type and found that "democracy, compared to other regime types, lowers epidemic deaths in countries by approximately 70 percent, ceteris paribus" (p. 1). In line with the argument by Engler et al. (2021) that accountability slowed down democracies' response, McMann & Tisch (2021) similarly found that "constraints on executives" affected how governments acted. The difference is that instead of a slower government response McMann & Tisch argue that this feature of democracy could explain the relative success of democracies in reducing pandemic deaths (McMann & Tisch, 2021). In sum, how the performance of the average democratic government's response to the Covid-19 pandemic is evaluated in terms of efficiency and effectiveness could vary depending on what indicator is used.

Specifically studying the effects of trust, Bosancianu et al. (2021) found support suggesting that there is a "robust negative relationship between two types of trust – institutional and interpersonal – and Covid-19 mortalities" (Bosancianu, et al., 2021, p. 19). Similarly, one study aimed at explaining the substantial (within country) regional level differences in excess mortality across Europe found that, in the pandemic's first wave, regions characterized by low trust levels (social and institutional) had higher levels of excess mortality (Charron, et al., 2022). They also find evidence to support a negative effect of what has in previous parts of this paper been referred to as 'polarized trust': "When the divide in political trust between supporters and opponents of incumbent governments within societies is high, we observe consistently higher COVID-19-related excess mortality." (Charron, et al., 2022, p. 20).

Another possible explanation for the differences in pandemic outcomes can be found in the research that has looked at the relationship between trust and adherence to Covid-19 containment policies. Using data on human mobility on a regional European level, Bargain & Aminjonov (2020) found that "high-trust regions decrease their mobility related to non-necessary activities significantly more than low-trust regions" (p. 1). Focusing on the effects of populism, Bayerlein et al. (2021) found that countries run by populist governments were less successful in containing the pandemic, attributing this in part to their finding that populist governments also enacted less far-reaching policy measures to counter the pandemic. This can also be connected to the link between trust and polarization, as the authors point out that populism thrives in times of polarization (Bayerlein, et al., 2021, p. 394).

A concept closely related to trust is social capital. Robert D. Putnam, one of the most prominent names in the field of social capital theory defines social capital as referring to "connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them" (Putnam, 200, p. 19). Social capital has also been a topic of interest for several researchers in relation to the Covid-19 pandemic. Research from the United States has found that individuals in counties with high levels of social capital were faster to reduce mobility compared to individuals in counties with low levels of social capital (Borgonovi & Andrieu, 2020) and that counties with higher levels of social capital generally experienced fewer infections and deaths (Makridis & Wu, 2021). Similarly, independent analyses for a selection of European countries have found that higher social capital was related to fewer Covid-19 infections and deaths (Bartscher, et al., 2021). However, some studies have broken down social capital into different indicators and found that some indicators were positively while others were negatively associated with Covid-19 mortality (Elgar, et al., 2020; Imbulana Arachchi & Managi, 2021).

Going back to social dilemmas, Harring et al. (2021) argue that the Covid-19 pandemic shares many important characteristics of a large-scale collective action problem and that viewing the pandemic, as well as adherence to policy aimed at containing it, can bring valuable insights. When Harring et al. (2021) are talking about adherence to public policy as a large-scale collective action problem they were focusing on calls to reduce social contacts and mobility, stay home when you have symptoms, and so on. As mentioned, research conducted during the enforcement of such policies found a link between trust and adherence to policies aimed at containing the spread of Covid-19 (Bargain & Aminjonov, 2020), which could then be interpreted as high-trust countries being better at solving large scale collective action problems. Getting vaccinated can also be described in terms of a collective action problem requiring trust, which will be discussed more in a later section.

2.2 Vaccine hesitancy

This section is structured to begin by defining vaccine hesitancy and highlighting its relevance. Then, theoretical explanations on what determines vaccine hesitancy are reviewed before a section is dedicated to the initial research on Covid-19 vaccine hesitancy.

2.2.1 What is vaccine hesitancy and why is it important?

Attempting to capture 'vaccine hesitancy' as a concept, the World Health Organization's Strategic Advisory Group of Experts on Immunization (SAGE) agreed on the following definition: "Vaccine hesitancy refers to delay in acceptance or refusal of vaccination despite the availability of vaccination services. Vaccine hesitancy is complex and context specific, varying across time, place and vaccines. It is influenced by factors such as complacency, convenience and confidence." (MacDonald, 2015). Other definitions, such as that by professor and author Maya Goldenberg, instead view vaccine hesitancy as an attitude. Goldenberg specifically defines vaccine hesitancy as referring to "an attitude of ambivalence regarding vaccines" and differentiates such attitudes of uncertainty from *behaviors* such as vaccine refusal (2021, p. 3). These definitions have in common that they encompass more than simple vaccine refusal, but the former describes a degree of hesitancy in terms of time (delaying vaccination) while the other talks about attitudes (vaccine uncertainty).

Research shows that public trust in vaccines has declined in the last two decades (Larson, et al., 2018). Focusing on the EU, 2018 saw the highest number of people infected by measles within the EU in a decade (15 times higher than the record low of 2016), some of which caused deaths (WHO Europe, 2019). In short, addressing vaccine hesitancy is a necessary step towards achieving the herd immunity needed to limit disease spread and save lives. Its importance can hardly be understated.

2.2.2 What determines vaccine hesitancy?

Epidemiologists Heidi J. Larson et al. (2015) argue that "[p]ublic confidence in vaccines is, above all, a phenomenon of public trust". Following Larson et al. (2015) the trust aspects involved in vaccinations can be divided into three main parts: (1) the product (that is the vaccine itself), (2) the vaccinator, (3) and the policy-makers responsible for decisions about vaccine provision (Larson, et al., 2015). When it comes to trust in vaccines, the argument in this thesis is that because all respondents are in the respective Eurobarometer survey were asked around the same time about the same vaccine, this should eliminate most of the product dependent trust differences (although ideally this would have been controlled for at an individual level). When it comes to trust in vaccinators, several quantitative studies have found a positive association between trust in the healthcare system and vaccine uptake (Gilles, et al., 2011; Cooper, et al., 2017; Casiday, et al., 2006). However, one could assume that if the health care system is poor that would likely also be reflected in an individual's evaluation of the pandemic response. Future studies could look more into this possible connection. Nevertheless, the focus of this thesis will be on the third component of trust needed for vaccine confidence, which is related to the decision-makers.

Modern vaccine hesitancy is typically traced back to a – now widely discredited – 1998 article in a revered scientific journal that claimed that the measles, mumps, and rubella (MMR) vaccine could cause autism (Pearce, et al., 2008; Poland & Jacobson, 2011). In recent years, misinformation about the measles vaccine has been found to most notably spread through social media (Betsch, et al., 2012). This is particularly problematic considering that research has found that the speed and reach of misinformation spread tend to be greater than that of true or factual information (Vosoughi, et al., 2018) and that misinformed anti-vaccine thinking is difficult to change (Schmidt, et al., 2018).

The issue of the measles vaccine has also been framed as related to trust. Kawachi (2018) argues that trust deficit is at the core of the issue of sub-optimal child vaccination coverage for measles, and that "[v]accination against childhood infections is, at its core, a collective action problem." (Kawachi, 2018, p. 450). Kawachi argues that that herd immunity depends on peoples trust in others not to free-ride (that is to not get their child vaccinated) (2018, p. 451), meaning that people are less likely to accept risk or cost if they expect others to not accept that risk or cost. However, Kawachi also highlights how the combination between trust and misinformation can generate vaccine hesitancy: "[for] example, if a trusted contact is a source of misinformation – as in the case of rumors about childhood immunizations being a cause of autism – it can actually act as a detriment to public health" (Kawachi, 2018, p. 450). This example highlights the difficulty associated with determining cause and effects when concepts are intertwined, which explains the lack of clear-cut answers about either vaccine hesitancy or trust determinants.

Back to the topic of trust in decision-makers, researchers have increasingly been interested in the link between vaccine hesitancy and populism, concluding that populism is associated with a higher likelihood of vaccine hesitancy (Recio-Román, et al., 2022; Kennedy, 2019). Kennedy (2019) argues that insight into the link between populist (anti-establishment) politics and vaccine hesitancy can be gained through social theorists, such as Anthony Giddens. Kennedy specifically highlights Giddens' (1990) finding that in modern societies people must rely on 'expert systems', which are only understood by a small number of specialists. Thus, most people "must trust such systems without understanding how they function" (Kennedy, 2019, p. 513). Populist politics can lead to distrust in 'expert systems' as they are viewed as another expression of elitist establishment, effectively undermining vaccine confidence and increasing hesitancy (Recio-Román, et al., 2022).

2.2.3 Vaccine hesitancy, trust, and COVID-19

At the time of writing this paper, I did not discover a large pool of research on vaccine hesitancy as a factor in the progression of Covid-19 vaccinations. Among the research that has come out so far, there is for example a Portuguese study that used an online survey, finding that the psychological factor "general beliefs and attitudes" towards the Covid-19 vaccine (its safety and effectiveness) was the most important predictor of vaccine hesitancy (Fernandes, et al., 2021). Another study used experimental design to measure the impact of misinformation on COVID-19 vaccination intent in the UK and USA, finding that in both countries' misinformation (especially scientific-sounding misinformation) increased vaccine hesitancy (Loomba, et al., 2021). Research from Africa has also found a link between misinformation and hesitancy toward Covid-19 vaccinations (Wirsiy, et al., 2021).

Research attempting to explain variations in Covid-19 vaccination progress has also started to come out. One such study by Farzanegan & Hofman (2021) looked at the correlation between Covid-19 vaccination progress and corruption (which is linked to lower levels of trust, see for example Rothstein, 2011, and You, 2018). They found that higher levels of corruption were related to slower vaccination progress and that it had strong explanatory power: "Our analysis of more than 90 countries shows that cross-country variation in corruption levels in 2020 alone explains approximately 50% of the variation in vaccination progress by the summer of 2021." (Farzanegan & Hofmann, 2021). The channels through which the authors thought this effect might have occurred included the ineffective distribution of resources and a lack of political trust (ibid).

2.3 Research gap and question

How has political trust affected individuals' vaccine hesitancy during the Covid-19 pandemic? The literature outlined in the previous section suggests three main points: first, we know that there is serious concern about vaccine hesitancy as a growing threat to global health because it can slow down vaccine progress and increase disease spread (WHO, 2019) and that vaccine hesitancy has increased in Europe (WHO Europe, 2019). Second, research suggests that trust in policymakers is one of the determinants of vaccine hesitancy (Larson, et al., 2015; Recio-Román, et al., 2022). Third, top-down theories suggest that trust is predominantly generated from the output side of the political system (government effectiveness, level of corruption, quality of healthcare, and so on) (see for example Rothstein, 2011) and that political trust is largely dependent on evaluations of performance (See for example Uslaner, 2018). These findings and how they connect are illustrated in figure 1 below (note that this visualization is only intended to capture the *theoretical* ground relevant for the analysis in this paper and is thereby intentionally simplified and limited in its scope).

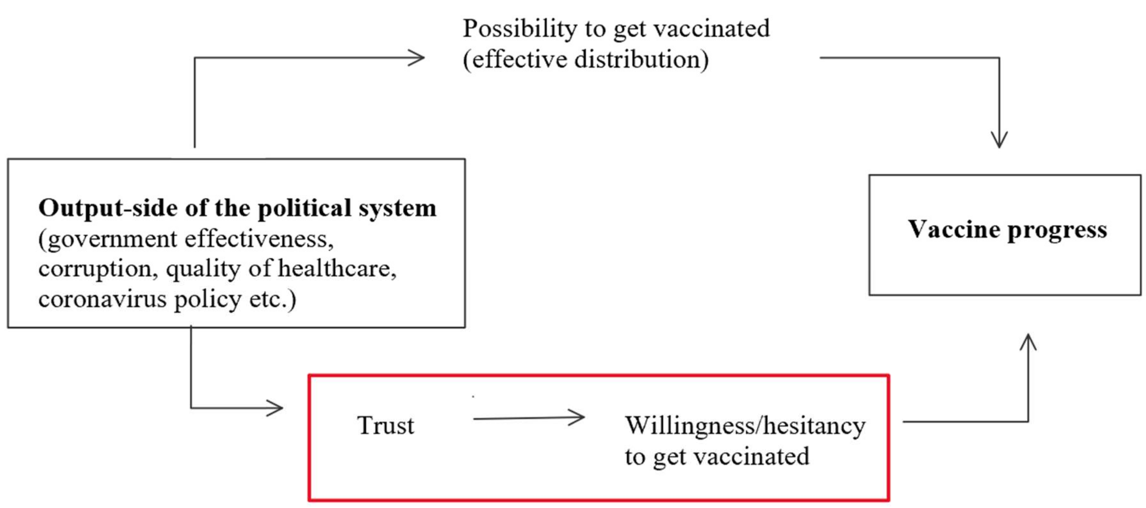

Figure 1. Model of the theoretical effects of political output on vaccine progress

This thesis aims to investigate and compare the links between vaccine hesitancy and two forms of political trust: trust in institutions (which are generated over a longer, undefined, period of time) and a short-term performance-based trust operationalized by evaluation of the government's response to the Covid-19 pandemic. The theoretical motivation for this stem, firstly, from the top-down explanation that what generates trust is qualitative, neutral, policy implementing institutions (such as the justice system and public administration) (Newton, et al., 2018; Rothstein, 2011). The interpretation is made that this dimension of political trust is generated over a longer period of time. Secondly, following

Uslaner (2018) political trust is determined by short-term performance evaluations. In the case of responses to the Covid-19 pandemic, the timeline for this evaluation cannot go back longer than to when the crisis began (in early 2020) and is therefore by nature more short-term.

In the theoretical model illustrated in figure 1, the ways in which the output of the political system could affect vaccine progress are divided into two pathways: an individual's possibility to get vaccinated and their willingness/hesitancy to get vaccinated. Without the possibility to get vaccinated no progress in vaccinations will be made regardless of how willing people are to get vaccinated. Conversely, without the willingness to get vaccinated no progress will be made in vaccinations[1] regardless of how effectively vaccinations are distributed. In this thesis, an important assumption is made: the possibility to get vaccinated does not directly affect vaccine willingness/hesitancy (explaining the lack of a link between "Possibility to get vaccinated" to "Vaccine willingness/hesitancy" in figure 1). Assuming such a direct effect would imply that people's attitudes towards vaccines depend on the *likelihood* that they would get vaccinated. The extent to which any indirect effects exist or could affect vaccine hesitancy is outside the scope of this paper.

There is already some research on the Covid-19 vaccinations that could be said to support the connections as illustrated in the theoretical model (figure 1). For instance, research shows that progress in vaccinations against Covid-19 has been slower in countries with higher levels of corruption (Farzanegan & Hofmann, 2021) and that countries with higher (pre-pandemic) levels of institutional trust have higher vaccine uptake (Recio-Román, et al., 2022). The study by Recio-Roman et al. (2022) used Eurobarometer data from 2019 to study the links between institutional trust, populism, and vaccine hesitancy, concluding that "institutional trust was a significant predictor of vaccine uptake" and that "political populism fully mediated the relationship" (p. 8). The approach of that study in terms of the research question and material it utilizes is the closest research I have found to what this thesis attempts to study. However, this thesis aims to investigate how the output of the political system (or the evaluation of it) affects vaccine willingness/hesitancy by affecting political trust. If how the concepts are thought to relate as visualized in figure 1 are accurate, a country that performs well in responding to the pandemic (an output of the political system) should instill trust in its citizens, making them more willing to get vaccinated when their government encourages them to. I have not found any research that has investigated the short-term effects of government performance on vaccine hesitancy.

[1] Assuming that vaccinations are not made compulsory, which is a vaccination strategy that has both been linked to higher risk of vaccine hesitancy (Salmon, et al., 2015) and questioned ethically (Colgrove, 2006).

2.3.1 Research question

Q: Can political trust be linked to variation in hesitancy to get the Covid-19 vaccine in the EU? Can trust based on the government's performance in response to the pandemic be singled out?

Two hypotheses are constructed to operationalize the research question. The first is meant to test the idea that higher levels of institutional trust are associated with lower levels of vaccine hesitancy:

$\boldsymbol{H_1}$: In the EU in 2021, individuals who had institutional trust were relatively less likely to be hesitant to get the Covid-19 vaccine.

The second hypothesis aims to uncover a possible independent short-term effect on vaccine hesitancy by individuals' evaluation of their governments' performance in response to Covid-19. The idea is that the government will gain trust and people will be more willing to get vaccinated if they evaluate their government's performance in responding to the Covid-19 pandemic positively compared to people who evaluate the response more negatively.

$\boldsymbol{H_2}$: In the EU in 2021, individuals who were relatively more satisfied with their government's response to the Covid-19 pandemic were relatively less hesitant to get the Covid-19 vaccine, even when controlling for institutional trust.

3 Materials and methods

This section outlines how the research question will be approached and hypotheses tested. First, the research model is presented and motivated. Then, the data used for the analysis is presented and operationalizations of concepts are motivated before a note on the sample selection. Finally, the methods used in the statistical regression analysis are presented.

3.1 Research model

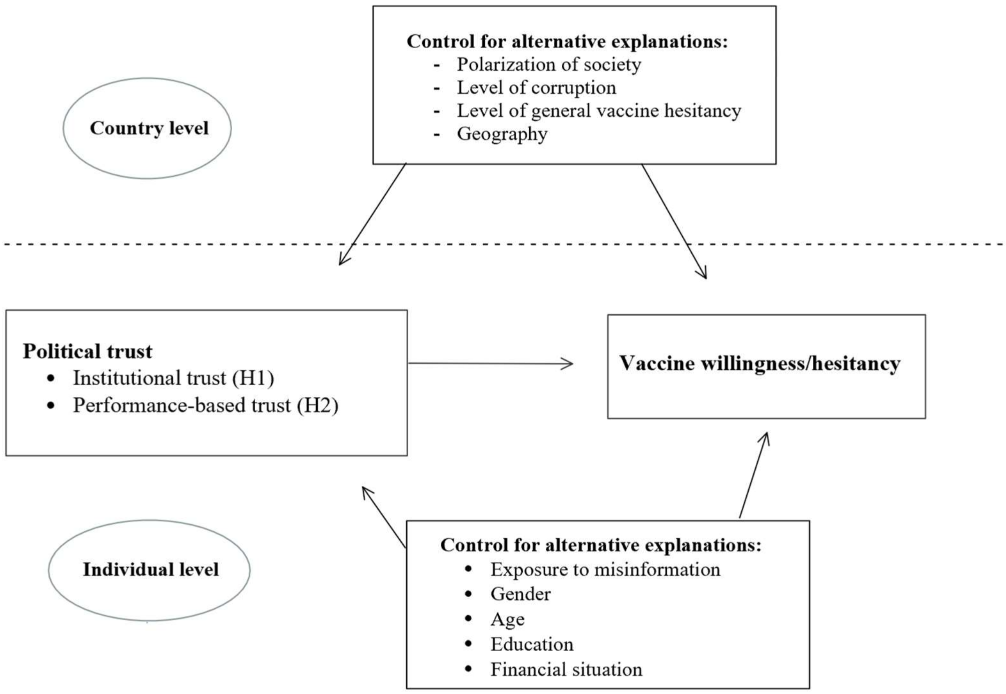

Figure 2. The research model

Figure 2 illustrated the research approach to answering the research question. In it, the independent variable political trust is divided into two forms of political trust: institutional trust and trust based on governments' response to the Covid-19 pandemic. While both are under the umbrella of political trust, the assumption is made in this thesis that performance-based trust is substantially separate from institutional trust, meaning that the two are not measuring the same concept. While there is good reason to assume that the same factors that likely affect institutional trust (including government effectiveness and level of corruption) will also affect a governments response when faced with the Covid-19 pandemic, this does not necessarily determine how governments respond or (even more importantly) how that response is perceived. This leads to the conclusion that the two (meaning institutional trust and performance-based trust) are different concepts that, while not unrelated, are meaningfully measuring different things. It is then possible to compare the effects of these variables, both capturing political trust but one more general and the other directly time-restricted and policy area specific.

In order to test whether we can see an effect of political trust on vaccine willingness/hesitancy, it is necessary to include control for variables that could affect both trust and vaccine willingness/hesitancy. While the foundation for the theoretical relationships illustrated in figure 1 will also be tested, the main intention of this paper is to test the focal relationship as illustrated in the research model in figure 2.

3.2 Data

The main source of data for this thesis stemmed from the EUROBAROMETER (EB) surveys 94.3 (European Commission, 2021a) (sometimes referred to with the abbreviation EB 94.3 in this thesis) and EUROBAROMETER 95.3 (European Commission, 2021b) (sometimes referred to using the abbreviation EB 95.3 in this thesis). For EB 94.3, the data was collected between February 12th and March 18th, 2021, and for EB 95.3 the was data collected between June 14th and July 15th, 2021. For both surveys, the data was collected by the company Kantar Public at the request of the European Commission and both datasets were accessed through GESIS (Leibniz-Institute für Sozialwissenschaften, 2022). Both the focal independent and dependent variables as well as all individual-level control variables are based on data from these Eurobarometer surveys. Additionally, some variables are included which utilize data from other sources; several indicators from the V-Dem dataset (Coppedge, et al., 2022), immunization data from the World Health Organization (WHO, 2022), and data on Covid-19 vaccine progress from Our World in Data (Ritchie, et al., 2022). For every variable based on Eurobarometer data answers coded as “Don’t know” were coded as missing and subsequently excluded from the analysis. Summary statistics for all individual and country-level variables are in appendix I.

3.2.1 Operationalizations of concepts

Vaccine hesitancy

In Eurobarometer 94.3, respondents were asked the question “If a vaccine against COVID-19 (coronavirus) is authorised by public authorities and available for you, when would you like to get vaccinated?” (the variable is called *qa19* in the dataset). Similarly, in Eurobarometer 95.3 respondents were asked “When would you like to get vaccinated against COVID-19 (coronavirus)?” (the variable is called *qa21* in the dataset). In both surveys answers were recoded as follows: 0 (“I have already been vaccinated”), 1 (“As soon as possible”), 2 (“Some time in 2021”), 3 (“Later”), or 4 (“Never”).

Operationalized like this, vaccine hesitancy on average decreased in EB 95.3 compared to 94, mainly because the category of people who had gotten vaccinated increased (see summary statistics in appendix II). This does mean that the variable is more skewed in the EB 95.3, but the argument behind including already vaccinated people that excluding them was thought to risk overestimating the level of vaccine hesitancy.

The argument for keeping the scale and not recoding it to a dichotomous variable is that such coding would undermine the ability to accurately capture the concept of vaccine hesitancy. For example, the SAGE Working Group on Vaccine Hesitancy (MacDonald, 2015) illustrates vaccine hesitancy as the area between total vaccine acceptance and total vaccine refusal (see figure 5 in appendix I) and the concept is inherently a spectrum. The consequences of these choices will be discussed, and tests performed, in the robustness check.

As vaccine hesitancy will be measured in terms of when a person would want to get vaccinated and there is no way of following up for example whether or when a person who stated "Later" actually got vaccinated, the measure arguably most closely captures vaccine hesitancy as an attitude of uncertainty, in line with the definition by Goldenberg (2021). This measure is not perfect, but the assessment is made that it does say something about the prevalence of vaccine hesitancy.

Institutional trust

In the Eurobarometer surveys, respondents were asked about their trust in different institutions. Out of those, trust in the justice system was selected as an indicator of institutional trust following among others Rothstein's (2017) argument that politically neutral state institutions in charge of implementing public policy (such as the justice system) are the main generators of trust. Based on answers to whether respondents tend to trust the justice/legal system in their countries a dummy variable was created (0 = "Tend not to trust", 1 = "Tend to trust")[2].

"The choice of an indicator may lead to different conclusions as to whether (and why) trust leads to cooperative behavior or whether social and political trust are related or distinct." (Uslaner, 2018, p. 6). This quote highlights the importance of the chosen operationalization of trust. However, within trust research, there are several debates regarding how to best measure trust. One such debate regards scale length: if dichotomous or long answer scales are more suitable (Bauer & Freitag, 2018). Even though

[2] The variable is called qa6b_2 in the Eurobarometer 94.3 dataset (European Commission, 2021a) and qa6a_2 in the Eurobarometer 95.3 dataset (European Commission, 2021b). The phrasing of the question is "How much trust do you have in certain institutions? For each of the following institutions, do you tend to trust it or tend not to trust it?" and the option I chose is "Justice, the (NATIONALITY) legal system".

there is newer evidence to suggest the advantages of using longer scales (Bauer & Freitag, 2018, p. 22) scholars such as Uslaner favor dichotomous scales, arguing that longer scales can lead people to "choose the middle options […] even if they are really trusters or mistrusters" (Uslaner, 2018, p. 8). The Eurobarometer surveys give respondents dichotomous options when measuring trust in certain institutions (tend to trust vs. tend to not trust). Depending on where one lands in the debate on scale length this measure of trust could be viewed as sub-optimal and a limitation to the findings in this thesis.

Performance-based trust

Performance-based trust that captures how citizens view their government's policy response to the pandemic is operationalized by an index combining answers to two Eurobarometer questions. In the first question of the index, respondents are asked to rate how satisfied they are with the measures taken by the national government to fight the Covid-19 pandemic on a four-point scale from "Very satisfied" to "Not at all satisfied"[3]. In the second question, respondents are asked to what extent they perceive the measures taken to have been justified on a four-point scale from "Absolutely justified" to "Not at all justified"[4]. The value on the created index (Cronbach's alpha = 0.66 for EB 94.3 data and 0.71 for EB 95.3) can range from 0 (lowest evaluation) to 6 (highest evaluation). The mean score for EB 94.3 was about 3.3 and 3.5 in EB 95.3 (see appendix I for summary statistics).

Misinformation

Both misinformation and distrust have been found to decrease the likelihood of vaccine willingness (Vinck, et al., 2019). To control for this effect, indicators meant to capture the risk of *exposure* to misinformation are included. Both the EB 94.3 and 95 datasets include an index based that gives a score on their level of internet use (called *netuse* in both datasets) and the former also includes a question on social media use (qd3_6). The idea is that a person who spends more time on the internet (particularly social media) will have a higher probability of being exposed to misinformation about vaccines which could then influence their vaccine willingness. It is uncertain to what extent this operationalization can capture actual misinformation exposure. Furthermore, while initial results suggest that exposure to misinformation about COVID-19 is associated with misinformation belief (Lee, et al., 2020) the causality is not clear. In sum, even if this measure does capture exposure to misinformation this does

[3] (a) Q: "In general, how satisfied are you with the measures taken to fight the coronavirus pandemic by ….? - The (NATIONALITY) government." Response options and their value in the index: "Very satisfied" =3, "Fairly satisfied" =2, "Rather not satisfied" =1, and "Not at all satisfied" =0. (qa10_1 in Eurobarometer 94.3 and qa13_1 in the Eurobarometer 95.3 dataset)

[4] (b) Q: "Thinking about the restriction measures taken by the public authorities in (OUR COUNTRY) to fight the coronavirus and its effects, would you say that they were justified"- Response options and their value in the index: "Absolutely justified" =3, "Somewhat justified" =2, "Not very justified" =1, and "Not at all justified" =0. (qa16 in Eurobarometer 94.3 and qa19 in the Eurobarometer 95.3 dataset)

not equal holding misinformed beliefs and the inability to better control for either misinformation exposure or belief is a limitation in the models.

Polarization

As mentioned in the research overview political polarization has been linked to lower levels of political trust (see for example Hetherington & Rudolph, 2018) and higher levels of vaccine hesitancy (Recio-Román, et al., 2022; Kennedy, 2019). Ideally, political polarization would somehow have been controlled for at the individual level, but due to data restrictions and this being outside the main research focus country-level political polarization is used.

In the V-Dem data section *Civic and Academic Space* there is an indicator called "Political polarization" (v2cacamps), which gives a score of 0-4. The question the indicator is intended to respond to is "Is society polarized into antagonistic, political camps?" where a high score indicates high levels of polarization (Coppedge, et al., 2022, p. 227). This variable is included to see if the effect of trust on vaccine hesitancy is affected by the level of polarization in society, with the idea in mind that there could be a negative effect of polarization on vaccine willingness.

General vaccine hesitancy

Measles vaccine coverage is used as a proxy for pre-pandemic levels of general vaccine hesitancy. The idea is to make sure that between-country variation in Covid-19 vaccine hesitancy was not determined by pre-existing differences in vaccine hesitancy.

WHO/UNICEF estimates from 2019 (WHO, 2022) on the share of the population that is covered by measles vaccines are therefore used as a proxy. Coverage of the 2^{nd} dose of measles vaccine is used for all countries except Ireland, which did not have a value for the second dose and instead data for the 1^{st} dose is used. This proxy is not perfect, but it should give some indication at least as to the level of vaccine refusal in a country.

Corruption

Research has found that trust is negatively associated with corruption (Rothstein, 2011; You, 2018) as well as Covid-19 vaccination progress (Farzanegan & Hofmann, 2021). Control for corruption is therefore included to make sure that corruption is not the hidden explanation of any found association.

For this purpose, 2020 values on Transparency International's *Corruption Perception Index* (CPI) are used. The variable is taken from the V-Dem dataset where it is coded "e_ti_cpi" (Coppedge, et al., 2022). The index gives countries a score on a 0-100 scale which goes from highly corrupt to highly clean. Initially, the idea was to also control for government effectiveness using the World Bank's

Government Effectiveness Estimate (WBGEE) indicator available in the same dataset. However, the 2020 values on CPI and WBGEE for the EU countries were found to correlate to 92%. The assumption is made that these values likely capture the same root concept (quality of government) that is of interest for this paper, so the government effectiveness index is not included to reduce multicollinearity in the models.

Other control variables

A variable for the geographical region of a country is included from the V-Dem dataset (called "e_regiongeo") (Coppedge, et al., 2022). It puts countries in groups according to their geographical region (Cyprus was recoded into the group Southern Europe, see appendix I for a table of the countries in each geographical category). This variable is included to control for regional differences in the focal relationship (for example the typically high-trust countries in Northern Europe might tend to have less vaccine hesitancy).

A selection of typical individual-level control variables from the Eurobarometer surveys are included: gender (recoded to (0) "Man", (1) "Woman"), age (five categories: (1) "15-24" (2) "25-39", (3) "40-54", and (5) "55-98"), the age when an individual finished their education (five categories: (1) "Up to 15", (2) "16-19", (3) "20+", (4) "Still studying", (5) No full-time education"), and self-rated financial situation in the household (the scale was reversed and recoded to (1) "Very bad", (2) "Rather bad", (3) "Rather good", or (4) "Very good").

The variable measuring coronavirus vaccination progress uses data from the *Our World in Data* COVID-19 dataset called 'Vaccination progress' (Ritchie, et al., 2022). The percentage of people vaccinated (with at least one dose) by the end of 2021 is used as a country-level variable in some of the regressions.

3.2.2 Data overview

This section provides an overview of the data that will be used in the analyses before diving into the regression outputs. There are three main points I will make in this section: (1) within the EU there is substantial between-country variation in both the dependent and independent variables, (2) vaccination progress appears to have a relationship with vaccine hesitancy, and (3) there appears to be a relationship between the quality of output-side of the political system and both vaccination progress and vaccine hesitancy (which is in line with the theoretical model in figure 1).

The graphs in figure 3 illustrate the progress of vaccinations against Covid-19 in each EU country during 2021 as grouped by geographical region. From these graphs, we can see that the Western European countries progressed at a very similar pace and ultimately ended at similar levels of vaccination coverage by the end of 2021. Compared to Western Europe, it appears that countries in Northern and Southern Europe had a greater variation among them as to both how vaccinations progressed and what percentage of the population had received vaccinations by the end of 2021 (note that these graphs do not portray the percentage of fully vaccinated people, only the percentage of the population that has received at least one dose of vaccine). Lastly, Eastern Europe was the region with the comparatively lowest levels of vaccination progress with Bulgaria coming in last place. The main takeaway from these graphs is that even though the sample of countries is restricted to the EU member-states there is clear variation in vaccination progress within the union. The same conclusion can be drawn from the country-level summary statistics in table 1 (see appendix I for statistics by country).

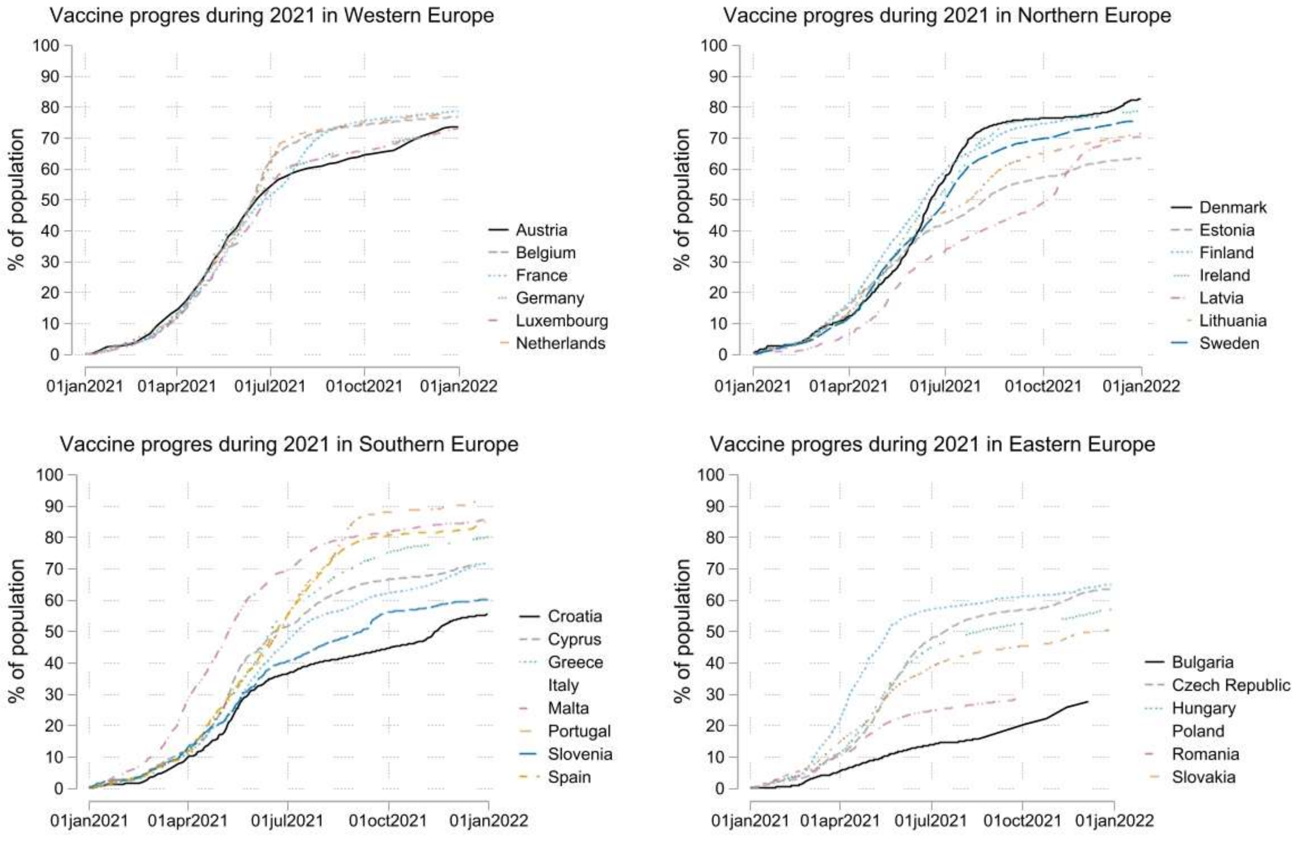

Figure 3. Vaccine progress by country and region

Table 1. Country-level summary statistics

	N	Mean	SD	Min	Max
Dependent variables					
Covid-19 vaccination progress (by 31 Dec 2021)	27	69.16	15.24	27.61	91.71
Vaccine hesitancy	27	1.53	0.46	0.87	2.43
Independent variables					
Institutional trust	27	0.54	0.19	0.22	0.89
Performance-based trust	27	3.43	0.56	2.35	4.52
Political polarization	27	63.67	14.21	44	88
Corruption	27	-0.39	1.72	-3.11	3.08
Measles vaccine coverage	27	90.85	5.31	76	99

Comment: for all variables except vaccination progress the values are country-level averages of the Eurobarometer surveys 94.3 (Feb-Mar 2021) & 95.3 (Jun-Jul 2021).

When it comes to vaccine hesitancy, the numbers are a bit less intuitive. In table 1, the scores for vaccine hesitancy and the two trust variables are averages of the data from EB 94.3 (Feb-Mar 2021 (European Commission, 2021a)) and EB 95.3 (Jun-Jun 2021 (European Commission, 2021b). As discussed in the previous section, the vaccine hesitancy score is based on a question that gives respondents a score on a five-point scale where higher scores indicate more hesitancy. This means that the lowest score of 0.87 can be understood as the highest level of willingness to get vaccinated, which was recorded for Ireland. The country with the highest level of vaccine hesitancy (a score of 2.43) was recorded in Bulgaria, which was also the country with the lowest level of vaccination progress by the end of 2021. In other words, there seems to also be variation in vaccine hesitancy within the EU. Figure 4 is a scatterplot between vaccination progress and vaccine hesitancy with a fitted line, which indicates that vaccination progress was lower in countries with higher levels of vaccine hesitancy.

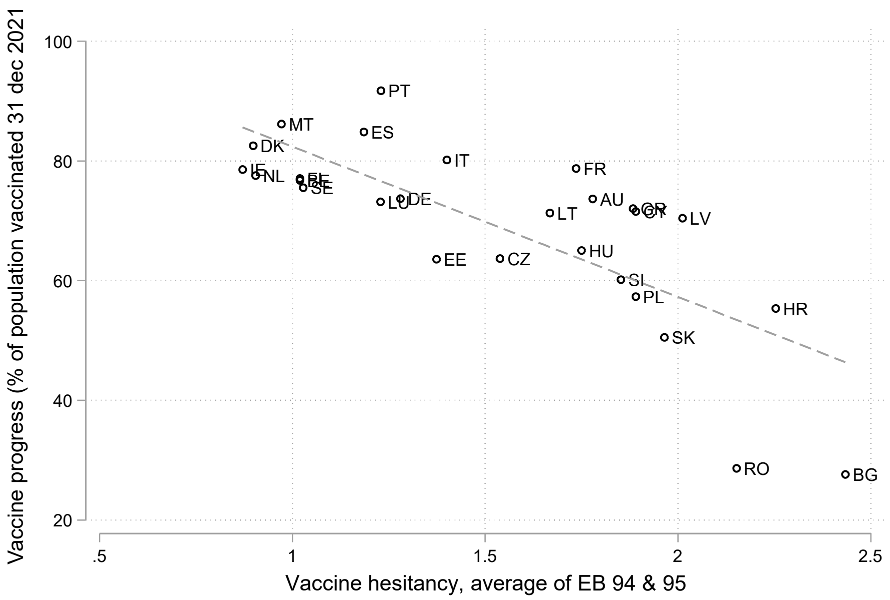

Figure 4. Visualized relationship between vaccine progress and hesitancy

The numbers in table 1 also indicate that there is a variation in both institutional trust and performance-based trust. The scores could indicate that about 54% of people in the EU tend to institutional trust, with Croatia scoring the lowest trust level (22%) and Denmark the highest (89%). The numbers for the index on performance-based trust are a bit trickier to interpret, but what we can say is that the EU average indicates that people were on average slightly more satisfied than not with their government's pandemic measures (3.4 on a scale of 0-6) with the lowest level of satisfaction recorded in Latvia and the highest level of satisfaction recorded in Denmark. As with vaccine hesitancy, there seems to be significant variation in the two forms of political trust within the EU.

The theoretical model (see figure 1) assumes the output-side of the political system will affect vaccination progress as well as vaccine hesitancy, supported by previous findings that the absence of corruption was associated with higher levels of vaccination progress (Farzanegan & Hofmann, 2021). To test this idea with the data for this thesis, we can plot the relationship between a variable intended to capture the quality of the output side of the political system (level of corruption) against vaccination progress and the focal dependent variable vaccine hesitancy. However, to understand the graphs it is important to remember that the Corruption Perception index used to measure corruption is coded such that a low score indicates more corruption, and a high score indicated the absence of corruption. Looking at the plotted relationships, it does appear that the absence of corruption is associated with higher levels of vaccination progress (see figure 6 in appendix II) as well as lower levels of vaccine hesitancy (see figure 7 in appendix II). In other words, countries with less corruption appear on average also have faster vaccination progress and higher vaccine willingness.

3.3 Sample selection

The countries included in the scope of this thesis are limited to the 27 current EU member states (see appendix I for a list of countries). This sample selection arguably strengthens some aspects of this thesis and undermines others. The sample selection reduces the probability that the findings are generalizable and the extent to which the results be said to indicate something universal about the relationships between the variables. On the other hand, the limited scope also reduces some of the risks of the models being underspecified due to omitted variables. Early into the pandemic, way before vaccines against Covid-19 were certified, the European Commission presented an EU vaccine strategy with goals such as securing "swift access to vaccines for all Member States and their populations" (European Commission, 2020). While not without criticism, this strategy has been praised for its efficiency and solidarity (Karsikas & Fasianos, 2021). The fact (or least perception) that the EU was very active in this policy area paired with the member states' relatively higher levels of shared history, culture, geography, and so on, should add to the validity of the findings in this thesis.

3.4 Statistical regression analysis

The initial statistical analysis in this paper will be multiple linear ordinary least square (OLS) regressions. These models will be treating the data at a country level only to see if the relationships between vaccine hesitancy and the two forms of political trust (institutional and performance-based) appear statistically significant when keeping the alternative country-level explanations constant (see research model in figure 2).

The main part of the analysis will then be done using multilevel mixed-effects modelling, which is also a linear regression but more fitting for the individual-level survey data. Multilevel (or hierarchical) modelling can be appropriate when observations at the lower level (individuals in this case) are nested in a second level (in this case countries). This is because such data tend to breach the assumption that is made in OLS regressions that units are independent, which multilevel models solve by allowing the second level (in this case countries) to have random intercepts (Mehmetoglu & Jakobsen, 2017, p. 194). This means that if vaccine hesitancy on average is higher in Bulgaria, for instance, then Bulgaria's intercept will be higher. Further, if there is evidence that the model is improved by allowing countries to have random slopes (as in not the same slope for every country) then this should also be done (Mehmetoglu & Jakobsen, 2017, pp. 210-211).

Additionally, the theoretical reason for using multilevel modelling for this thesis is that it allows for the investigation of individuals' vaccine hesitancy to be explained by both individual characteristics and country characteristics (see figure 2 for illustration of the research model and include variables). This method can also be seen as a defense against the criticism that survey research often fails to consider respondents' context, as the inclusion of country-level factors does just that; it allows for the context of an individual to be accounted for (Mehmetoglu & Jakobsen, 2017, p. 195).

Weights are appropriate to use in survey data when each unit (country) does not have the same number of respondents (Mehmetoglu & Jakobsen, 2017, p. 221), which is the case for the data here. For this reason, sample weights are estimated after the sample of respondents is limited to those with values on each of the included variables and included in all multilevel regressions so that each country has the same weight in the results.

The analysis is conducted in STATA 17.0 and the null hypotheses that the estimated slope coefficients are equal to zero are rejected at the standard significance level of 0.05. In Stata, the command used for the multilevel mixed-effects modelling will be *xtmixed* (Stata, 2022).

4 Results

This section is structured to begin by assessing the hypotheses using country-level data to perform initial linear ordinary least square (OLS) regressions. These tests are intended to investigate if there appears to be between-country variation in measures of vaccination progress and vaccine hesitancy that can be accounted for by between-country variation in trust variables that align with the hypotheses and its underlying theoretical assumptions. The subsequent parts of the analysis utilize individual-level data as nested in countries using multilevel modelling. As mentioned, multi-level modeling allows for the analysis of variation in the dependent variable as explained by both individual and country-level variables (Mehmetoglu & Jakobsen, 2017). The advantage of this method is that it allows for the analysis to simultaneously account for both within-country (between-individuals) and between-country variation. Once the regressions models are presented, a section is dedicated to robustness checks.

4.1 Country-level analysis

These country-level tests use the data from the Eurobarometer surveys as country averages. The aim is twofold: (1) to assess if countries where people on average had higher institutional trust also had lower levels of vaccine hesitancy in the first half of 2021, and (2) to see if countries where people on average had high levels of performance-based trust also had lower levels of vaccine hesitancy in the same period. Additionally, regressions using vaccination progress as the dependent variable are included with the assumption that vaccination progress is closely related to vaccine hesitancy. Vaccine progress will not be used in the multilevel regressions in section 5.2 as it is a country-level and not individual-level dependent variable.

4.1.1 Institutional trust – H_1

The first hypothesis (H_1) predicts that people will be relatively more willing to get vaccinated against Covid-19 if they have relatively higher levels of institutional trust. To test this, we can begin by comparing the vaccination progress at the end of 2021 and the levels of institutional trust in the first half of 2021. Plotting when the relationship (see figure 8 in appendix II), there does seem to be a positive association between vaccine progress and institutional trust. While there are some outliers, the scatterplot and the fitted line between the values seem to indicate that countries with higher scores on institutional trust had on average gotten further with their Covid-19 vaccination coverage by the end of 2021.

In a second step, we can look at the relationship between vaccine hesitancy and institutional trust as averages of the values from EB 94.3 (Feb-Mar 2021) & 95.3 (Jun-Jul 2021). In the event this indicated either a positive or no correlation between vaccine hesitancy and institutional trust, there might be reason to reject H_1 (since that would suggest more institutional trust was associated with either more vaccine hesitancy or that the variables are not associated at all). However, plotting the relationship and fitting a line between observations there does seem to be a negative relationship between vaccine hesitancy and institutional trust (see figure 9 in appendix II), as was predicted in H_1. Next, the strength of these visualized associations is tested in multiple OLS regressions, which introduces controls for other explanations for the variation in vaccine hesitancy and vaccination progress.

Tables 2 & 3 below present the results of regressions to test H_1. The difference between them consists of which Eurobarometer survey the data for the institutional trust and vaccine hesitancy variables are based on, with the models in table 2 using the Eurobarometer 94.3 dataset (European Commission, 2021a) (hereafter referred to as EB 94.3) and those in table 3 using the Eurobarometer 95.3 dataset (European Commission, 2021b) (hereafter referred to as EB 95.3). Models 1 and 3 in each table are simple bivariate OLS regressions to see if institutional trust is associated with vaccine progress (model 1) and vaccine hesitancy (model 3). In all the bivariate regressions, the association is significant (the threshold for significance in this paper is $p<0.05$) and the direction of the association is as hypothesized. To elaborate, for institutional trust to increase vaccine willingness we would see a positive association between institutional trust and vaccine progress and a negative association with vaccine hesitancy, which is exactly what the results suggest.

Models 2 & 4 in tables 2 & 3 are multiple OLS regression models, which control variables meant to control for alternate explanations and spuriousness (see full regression output in tables 16 and 17 in appendix II). Based on the theoretical model (see figure 1) the following control variables were selected and included: level of corruption, political polarization, measles vaccine coverage (as a proxy for pre-pandemic levels of vaccine hesitancy), and categorical variables for geographical region. When including these control variables, the coefficient for institutional trust is reduced and the association is for the most part no longer significant. The one exception is the association with vaccine hesitancy in using EB 94.3 data (table 2), but since the results are not consistent between surveys the association cannot be said to hold under control. Further, neither of the control variables showed significant association with the dependent variables. In other words, in these regression outputs, there does not appear to be a significant effect of institutional trust on either vaccination progress or vaccine hesitancy. However, the adjusted R-squared values, which are included at the bottom of the tables, imply that vaccine hesitancy is explained by the level of institutional trust more so than vaccination progress (which is not surprising considering that the theoretical model in figure 1 predicts that trust will only affect the willingness and not the possibility to get vaccinated). Further, the inclusion of control variables increased the adjusted R-squared in all cases, suggesting that the control variables do account for some of the variation.

Table 2. Regression output - H1 (using Eurobarometer 94.3 dataset, Feb/Mar 2021)

	Model 1 Vaccination progress by 31 Dec 2021	**Model 2** Vaccination progress by 31 Dec 2021	**Model 3** Vaccine hesitancy	**Model 4** Vaccine hesitancy
Institutional trust	32.744**	39.885	-1.69***	-1.606**
	(13.854)	(23.292)	(0.317)	(0.633)
Control variables	No	Yes	No	Yes
Intercept	51.515***	-17.902	2.437***	5.115***
	(7.938)	(41.041)	(0.181)	(1.116)
Observations	27	27	27	27
Adjusted R-squared	0.150	0.550	0.514	0.636

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*
Comment: full regression output in table 16 in appendix II.

Table 3. Regression output - H_1 (using Eurobarometer 95.3 dataset, Jun/Jul 2021)

	Model 1 Vaccination progress by 31 Dec 2021	**Model 2** Vaccination progress by 31 Dec 2021	**Model 3** Vaccine hesitancy	**Model 4** Vaccine hesitancy
Institutional trust	39.997**	42.386*	-1.888***	-1.360*
	(15.441)	(23.118)	(0.366)	(0.665)
Control variables	No	Yes	No	Yes
Intercept	47.183***	-23.628	2.564***	5.175***
	(8.889)	(41.29)	(.211)	(1.187)
Observations	27	27	27	27
Adjusted R-squared	0.180	0.559	0.497	0.601

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*
Comment: full regression output in table 17 in appendix II.

4.1.2 Performance-based trust – H_2

The second hypothesis (H_2) predicts that there is an independent link between individual vaccine hesitancy and evaluation of the government's response to the Covid-19 pandemic, with the theoretical mechanism being that a response that is perceived well earns the government trust among its citizens, making them more willing follow recommendations to get vaccinated. This effect is labeled performance-based trust.

As a first step to test H_2 we can again look at vaccination progress by the end of 2021 but this time instead of levels of institutional trust we can plot vaccination progress against performance-based trust at the beginning of 2021 (see figure 10 in appendix II). The plotted relationship and fitted line suggest that there does appear to have been a positive correlation. In other words, it seems that in general vaccine progress was faster in countries where people were more satisfied with their government's response. To be clear, this association does not prove H_2, since a positive relationship could have many possible explanations, but it is in line with the hypothesis.

Plotting the relationship between vaccine hesitancy and performance-based trust (see figure 11 in appendix II) it once again does appear to be an association in line with H_2. In countries where people were on average more satisfied with the government's response to the pandemic during the first half of 2021 people were also on average less hesitant to get vaccinated. This is arguably a stronger test of the hypothesis as it is based on the response people gave about when they would *want* to get vaccinated. Therefore, as opposed to vaccine progress there is no reason to believe that this measure was (at least directly) influenced by factors such as the availability of vaccines or how effectively vaccines were distributed in a specific country.

Tables 4 & 5 show country-level regression output testing the H_2 (see full regression outputs in appendix II). The regression output indicates that vaccination progress seemed associated with performance-based trust in the bivariate regression (models 1 in each table) but the non-significant when including control variables (models 2 in each table). As for vaccine hesitancy, the output indicates that there was a significant negative association with performance-based trust in the bivariate regressions (see model 3 in each table) which remained when introducing control variables for EB 95.3 (model 4 in table 5) but disappeared for EB 94.3 (model 4 in table 4). The control variables were once again corruption, political polarization, measles vaccine coverage (as a proxy for general pre-pandemic levels of vaccine hesitancy), and categorical dummy variables for geographical region. None of the control variables had a consistently significant association with the focal dependent variable.

Finally, model 5 in each table is intended to test if the association between performance-based trust and vaccine hesitancy remains when controlling for institutional trust. The output in table 5 shows that the association with performance-based trust is no longer significant when controlling for institutional trust,

At this stage, the results from the country-level tests of H_1 and H_2 do not support the claim that vaccine hesitancy is related to political trust either in the form of institutional trust or performance-based trust related to the government's response to the Covid-19 pandemic. To investigate the relationship further, and with more accuracy, the following sections treat the survey data as individual-level data and nested in countries

Table 4. Regression output – H_2 (using Eurobarometer 94.3, Feb/Mar 2021)

	Model 1 Vaccination progress by 31 Dec 2021	**Model 2** Vaccination progress by 31 Dec 2021	**Model 3** Vaccine hesitancy	**Model 4** Vaccine hesitancy	**Model 5** Vaccine hesitancy
Performance-based trust	10.389**	-0.149	-0.562***	-0.231	-0.090
	(4.865)	(5.301)	(0.114)	(0.146)	(0.155)
Control variables	No	Yes	No	Yes	Yes
Institutional trust					-1.403*
					(.732)
Intercept	34.732**	-2.707	3.388***	4.567***	5.063***
	(16.351)	(43.079)	(.383)	(1.185)	(1.139)
Observations	27	27	27	27	27
Adjusted R-squared	0.121	0.481	0.473	0.570	0.623

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*
Comment: full regression output in table 18 in appendix II.

Table 5. Regression output - H_2 (using Eurobarometer 95.3, Jun/Jul 2021)

	Model 1 Vaccination progress by 31 Dec 2021	**Model 2** Vaccination progress by 31 Dec 2021	**Model 3** Vaccine hesitancy	**Model 4** Vaccine hesitancy	**Model 5** Vaccine hesitancy
Performance-based trust	13.158***	4.465	-0.637***	-0.366**	-0.294*
	(4.707)	(5.487)	(0.102)	(0.140)	(0.149)
Control variables	No	Yes	No	Yes	Yes
Institutional trust					-0.857
					(0.670)
Intercept	22.387	-3.139	3.792***	4.537***	4.953***
	(16.935)	(42.328)	(0.366)	(1.081)	(1.112)
Observations	27	27	27	27	27
Adjusted R-squared	0.208	0.498	0.596	0.642	0.654

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*
Comment: full regression output in table 19 in appendix II.

4.2 Multilevel analysis

In total there were 38 718 respondents in EB 94.3 and 37 214 in EB 95.3. However, after limiting the scope to the 27 current EU member states and excluding observations with missing values on any of the variables included in the models in this section, there remained 24 192 respondents for EB 94.3 and 23 822 respondents for EB 95.3 (see appendix I for the distribution of observations per country).

4.2.1 Institutional trust – H_1

As a reminder, the first hypothesis, H_1, predicts that individuals will be more willing to get vaccinated against Covid-19 if they have relatively more institutional trust. Tables 6 & 7 below display regressions to test H_1 divided by which dataset the regressions are based on. The regressions in table 6 utilize EB 94.3 data from Feb-Mar 2021 (European Commission, 2021a) and in table 7 they utilize EB 95.3 data from Jun-Jul 2021 (European Commission, 2021b). The full output of the regressions, including the regression output for each individual-level and country-level control variable, is in appendix II.

Table 6. Regression output - testing H_1 (based on Eurobarometer 94.3, Feb/Mar 2021)

	Model_1	**Model_2**	**Model_3**	**Model_4**	**Model_5**
Institutional trust	-0.554***		-0.386***	-0.334***	-0.332***
	(0.015)		(0.032)	(0.031)	(0.031)
Individual-level controls	No	No	No	Yes	Yes
Country-level controls	No	No	No	No	Yes
Intercept	2.274***	1.973***	2.187***	3.193***	5.706***
Variance components					
Country.(υ_j)		-0.889***	-1.961***	-2.019***	-2.023***
		(0.089)	(.164)	(.162)	(0.162)
Individual (ϵ_i)		0.042*	0.026	-0.006	-0.006
		(0.025)	(0.024)	(0.022)	(0.022)
ICC		0.134	0.118	0.098	0.049
Obs. (country = 27)	24 192	24 192	24 192	24 192	24 192
R-squared	0.064				
Level 1 R-squared			0.055	0.138	0.177
Level 2 R-squared			0.226	0.448	0.739
Random intercept	No	Yes	Yes	Yes	Yes
Random slope	No	No	Yes	Yes	Yes

Standard errors are in parentheses

**** p<.01, ** p<.05, * p<.1*

Comment: R-squared for the multilevel models are Snijders/Bosker estimations (Snijders & Bosker, 1994).

Table 7. Regression output - H_1 (based on Eurobarometer 95.3, Jun/Jul 2021)

	Model 1	Model 2	Model 3	Model 4	Model 5
Institutional trust	-0.605***		-0.406***	-0.363***	-0.362***
	(0.02)		(0.046)	(0.041)	(0.041)
Individual-level controls	No	No	No	Yes	Yes
Country-level controls	No	No	No	No	Yes
Intercept	1.399***	1.063***	1.296***	2.738***	5.305***
	(0.016)	(0.103)	(.102)	(.178)	(1.06)
Variance components					
Country. (υ_j)		-0.65***	-1.579***	-1.618***	-1.624***
		(0.113)	(.13)	(.16)	(0.163)
Individual (ϵ_i)		0.308***	.296***	.246***	0.246***
		(0.037)	(.037)	(.039)	(0.039)
ICC		0.128	0.124	0.103	0.065
Obs. (country = 27)	23 822	23 822	23 822	23 822	23 822
R-squared	0.064				
Level 1 R-squared			0.038	0.151	0.183
Level 2 R-squared			0.165	0.421	0.668
Random intercept	No	Yes	Yes	Yes	Yes
Random slope	No	No	Yes	Yes	Yes

Standard errors are in parentheses
**** $p<.01$, ** $p<.05$, * $p<.1$*
Comment: R-squared for the multilevel models are Snijders/Bosker estimations (Snijders & Bosker, 1994).

For both datasets, model 1 displays the estimates of the bivariate pooled OLS regression. For both datasets, this surface-level output indicates that people who stated that they tend to trust the justice system (having institutional trust) were less likely to be vaccine hesitant. Since institutional trust is a dichotomous independent variable, the coefficients tell us that people who had institutional trust were on average about 0.55 points lower on the 0-4 scale of vaccine hesitancy in EB 94.3 and 0.61 points lower in EB 95.3 compared to people how did not have institutional trust. In both datasets, the effect of institutional trust is highly significant ($p<0.01$), but it only explains about 6% of the variation in vaccine hesitancy in both datasets (see R-squared in both tables).

While we could assume that there is a county effect on the likelihood that a person would be vaccine hesitant it is good to test this assumption before treating the data as hierarchical. Therefore, the empty multi-level models, also called intercept-only models (Mehmetoglu & Jakobsen, 2017, p. 199), were produced for both datasets and are displayed in model 2. The purpose of doing this is to test if there does appear to be variation in the dependent variable (vaccine hesitancy in this case) that is accounted for at the country level. For this purpose, the *intraclass correlation coefficient* (ICC) was estimated for each empty multi-level model, which represents the variability in the regression outcome that can be attributed to the second level (Mehmetoglu & Jakobsen, 2017, p. 203). To be clear, in this thesis level

1 represent the individual respondents and level 2 represents the countries individual respondents are nested in.

The output of model 2 suggests that where you live is associated with the likelihood that you are vaccine hesitant. For both Eurobarometer datasets, the empty multi-level model of vaccine hesitancy showed that about 13% of the individual-level variance in vaccine hesitancy was accounted for at the country level (see model 2 in tables 6 & 7. In both cases, the tests show that there is enough variability accounted for at the second (country) level that it should not be ignored (the "rule of thumb" is that an ICC>0.05 should not be ignored (Mehmetoglu & Jakobsen, 2017)). This provides reason to attempt to explain individual-level variation in vaccine hesitancy using not only individual-level variables but also country-level variables.

As a next step, individual respondents are nested by country, and the bivariate relationship is estimated again but this time with random country intercepts and random slopes for institutional trust[5] (see outputs as models 3 in tables 6 & 7). Comparing the output of the pooled OLS model and model 3 the standard errors are as expected greater in the latter and the coefficient for institutional trust is also reduced, both indicating that the pooled OLS was overestimating the strength of the relationship. The estimation of to what extent institutional trust explains variation in vaccine hesitancy has also decreased compared to the bivariate pooled OLS output (comparing the R-squared value for model 1 with the Snijders/Bosker R-squared level 1 value of model 3 in the tables). However, the relationship between vaccine hesitancy and institutional trust remains highly significant in both datasets. Next, individual-level control variables are added to see if the effect of institutional trust remains when these are held constant.

The strength of the focal relationship was slightly reduced but remained significant when controlling for alternative explanations at the individual level. Models 4 in tables 6 & 7 display the output of the random intercept model when individual-level variables are controlled for (see full regression output in appendix II). Remember, there was an important difference in the ability to control for misinformation between the survey datasets in that while both EB 94.3 and 95.3 included an index on internet use but only the former asked respondents about how much they use social media. Social media use was thought to be a more accurate indication of the risk of being exposed to vaccine misinformation than overall internet use. Because only EB 94.3 included the social media use question, the EB 95.3 models include the internet use index instead. When reviewing the regression output, it appears that respondents' self-

[5] An LR-test was conducted in Stata comparing the fixed-slope and random-slope models I both datasets, which showed that the random slope model was a significant improvement. I will therefore continue with the random slope model. See table 24 in appendix II for full LR-test output.

reported level of social media use was negatively associated with variation in vaccine hesitancy and that this association was stronger than with general internet use (this was also tested by including both variables in EB 94.3 and the effect of internet use was significant at the level of $p<0.05$ while social media use was significant at the $p<0.01$ level). These results contradict how the variables were thought to relate to each other and could indicate that the operationalizations did not accurately capture the concept of exposure to misinformation (since the results as they appear otherwise suggest that more exposure to misinformation increase vaccine willingness).

Models 5 in tables 6 and 7 represent the output when introducing three country-level control variables meant to test alternative explanations and account for some of the country level variance: corruption, political polarization, coverage of measles vaccine (as a proxy for general pre-pandemic levels of vaccine hesitancy), and categories for geographical region. Selected based on the theoretical model (figure 1), these variables are intended to capture variance in the output side of the political system. Out of the country-level control variables, corruption and being included in the regional category Southern Europe were the only variables with consistent significant association with vaccine hesitancy between the datasets (see appendix I for countries by regional categories). The results suggest that people in countries with relatively higher levels of corruption were relatively more hesitant to get vaccinated against Covid-19, and that compared to other European regions people in southern Europe were relatively less hesitant towards the same vaccine.

The ICC shows that after adding the country-level control variables the models now explain more of the second (country) level variance. For EB 94.3, the empty model variance was about 13% but in model 5 it is down to about 5%. For EB 95.3 the empty model showed about 13% variability at the country level but in model 5 it is down to about 6,5%. This suggests that the country-level control variables did cut into some of the initial variability at the country level.

Snijders/Bosker R-squared is a postestimation for two-level hierarchical mixed-effects models of how much of the variability in the dependent variable is explained by the independent variables per level (Snijders & Bosker, 1994). In other words, the level 1 estimation of about 0.18 for model 5 in both datasets suggests that each model accounts for about 18% of the individual-level variance and there is about 80 % individual-level variance in vaccine hesitancy which the models do not explain. However, the Snijders/Bosker R-squared level 2 estimations that only about 26-33% of the country-level variance in vaccine hesitancy is not accounted for in the model.

In conclusion, the multi-level regressions could not reject H_1 and there does appear to be an association between higher institutional trust and lower vaccine hesitancy.

4.2.2 Performance-based trust – H_2

As a reminder, the second hypothesis (H_2) predicts that there is an independent link between individual vaccine hesitancy and performance-based trust. The regression models in tables 8 & 9 are constructed to test this hypothesis both between individuals and countries (see full regression output in appendix II).

Table 8. Regression output – H_2 (survey data: Eurobarometer 94.3, Feb/Mar 2021)

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Performance-based trust	-0.281***	-0.247***	-0.221***	-0.221***	-0.208***
	(0.005)	(0.016)	(0.016)	(0.015)	(0.015)
Individual-level controls	No	No	No	Yes	Yes
Country-level controls	No	No	No	No	Yes
Institutional trust					-0.163***
					(0.028)
Intercept	2.905***	2.782***	3.389***	6.473***	6.522***
	(0.018)	(0.103)	(0.127)	(0.872)	(0.898)
Variance components					
Country. (υ_j)		-2.568***	-2.609***	-2.608***	-2.621***
		(0.144)	(0.147)	(0.143)	(0.147)
Individual (ϵ_i)		-0.69***	-0.787***	-1.106***	-1.108***
Country. (υ_j)		(0.113)	(0.123)	(0.228)	(0.226)
ICC		0.211	0.187	0.108	0.109
Obs. (country = 27)	24 192	24 192	24 192	24 192	24 192
R-squared	0.163				
Level 1 R-squared		0.152	0.208	0.236	0.242
Level 2 R-squared		0.339	0.514	0.721	0.729
Random intercept	No	Yes	Yes	Yes	Yes
Random slope	No	Yes	Yes	Yes	Yes

Standard errors are in parentheses
*** $p<.01$, ** $p<.05$, * $p<.1$
Comment: R-squared for the multilevel models are Snijders/Bosker estimations (Snijders & Bosker, 1994).

Table 9. Regression output – H_2 (survey data: Eurobarometer 95.3, Jun/Jul 2021)

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Performance-based trust	-0.377***	-0.312***	-0.273***	-0.273***	-0.262***
	(0.006)	(0.024)	(0.023)	(0.023)	(0.022)
Individual-level controls	No	No	No	Yes	Yes
Country-level controls	No	No	No	No	Yes
Institutional trust					-0.133***
					(0.026)
Intercept	2.409***	2.153***	3.062***	7.071***	7.114***
	(0.026)	(0.139)	(0.182)	(1.434)	(1.454)
Variance components					
Country.(υ_j)		-2.182***	-2.22***	-2.215***	-2.225***
		(0.15)	(0.137)	(0.134)	(0.137)
Individual (ϵ_i)		-.391***	-0.452***	-0.817***	-0.817***
		(0.122)	(0.124)	(0.162)	(0.159)
ICC		0.223	0.214	0.116	0.116
Obs. (country = 27)	23 822	23 822	23 822	23 822	23 822
R-squared	0.163				
Level 1 R-squared		0.162	0.233	0.254	0.257
Level 2 R-squared		0.423	0.558	0.725	0.732
Random intercept	No	Yes	Yes	Yes	Yes
Random slope	No	Yes	Yes	Yes	Yes

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*
Comment: R-squared for the multilevel models are Snijders/Bosker estimations (Snijders & Bosker, 1994).

The first step was once again to run bivariate pooled OLS models, the results of which are represented as model 1 in table 8 (using the EB 94.3 dataset) and table 9 (using the EB 95.3 dataset). From the output, we can see that the index on performance-based trust showed a significant negative association with vaccine hesitancy in both datasets, in line with the hypothesis. As for the next step, there is no reason to run the empty/intercept-only model again for H_2 since the dependent variable (vaccine hesitancy) remains the same as for H_1. Instead, the next model is the bivariate mixed-level model.

Model 2 displays the multi-level bivariate model with random country intercept and random slope for performance-based trust.[6] Once again, as expected, the standard errors for the focal independent variable increase with random intercepts and slopes for both surveys, indicating that the pooled OLS model overestimated the strength of the relationship. Furthermore, both tables show that the coefficient for performance-based trust also declined but the association remained strongly significant (p<0.01) in the multilevel model.

[6] An LR-test was conducted in Stata comparing the fixed-slope and random-slope models in both datasets, which showed that the random slope model was a significant improvement. I will therefore continue with the random slope model. See table 24 in appendix II for full LR-test output.

The strength of the focal relationship was again slightly reduced but remained strongly significant when keeping the individual-level control variables constant in model 3 in tables 8 & 9 (see full regression output in appendix II). The main takeaway is the same as for H_1; social media and internet use which were included to control for exposure to misinformation did not act as the theory predicted. The interpretation is made that the variables were not able to capture the impact of misinformation rather than that the theoretical framework should be questioned.

Following the projection of the previous tests for H_1, the next set of models (models 4 in tables 8 & 9 respectively) adds country-level variables intended to control for alternative explanations and cut to the country-level variance. The results mirror those for H_1; people in countries with relatively less corruption were on average less vaccine hesitant, and people in Sothern Europe were also less vaccine hesitant compared to other regions in the EU. Still, the relationship remained strongly significant in both datasets when controlling for both individual and country-level alternative explanations.

To test if there is an independent association between performance-based trust and institutional trust, model 5 adds control for institutional trust to the full model with both individual and country-level controls. Both the measure of institutional and performance-based trust are thought to capture political trust, but the idea is that they capture substantially different forms of political trust. The output of model 5 indicates that the effect of performance-based trust on vaccine hesitancy is somewhat reduced but remains significant even when controlling for institutional trust, which also has a significant association.[7] In other words, there does appear to be an independent association between higher performance-based trust and lower vaccine hesitancy, meaning that H_2 cannot be rejected.

4.3 Robustness checks

One of the assumptions in regression modelling is that the dependent variable is quantitative, continuous, and unbound (Berry, 1993). The dependent variable in the main regressions in this thesis (vaccine hesitancy) is based on a survey question with answers coded as one of five options, which means it is debatable if any of the before mentioned assumptions are met. Yet, treating limited answer survey questions about attitudes, values, or other non-numeric concepts as continuous to perform linear

[7] Note that compared to model 2, the bivariate random slope model, the country level Snijders/Bosker R-squared postestimation has gone from approximately 0.34 to 0.73 in model 5 for the EB 94.3 data (table 8) and from 0.42 to 0.73 in model 5 for the EB 95.3 data (table 9). This is an indication that the added controls have been effective in cutting into the unexplained country-level variance. However, while the Snijders/Bosker R-squared postestimation for the individual level variance shows that the added control variables have cut into some of that variability as well, the model still only accounts for about 24-26 % of the individual level variance in vaccine hesitancy.

regression analyses is not uncommon in social sciences. While a disputed and controversial subject in social science methodology, many social science studies have treated de facto ordinal variables as continuous in previous research often based on assumptions of the kind "an unobservable normally distributed continuous variable underlies each observed ordinal variable" (Lee, et al., 2012, p. 315). This (not unproblematic) assumption is also made in this thesis. Suggestions for how to solve this type of problem in social science include increasing the number of measurement points to closer capture the underlying distribution (Wu & Leung, 2017), but this solution is at the data collection level and therefore does not apply. Another solution is to approach the statistical analysis using models specifically designed for ordinal dependent variables (see for example McCullagh (1980)). One such modelling for hierarchical data available in Stat is *meologit* which "fits mixed-effects logistic models for ordered responses" (Stata, 2022). The data from using both the Eurobarometer 94.3 and 95.3 as baseline surveys was analyzed using this method for the multilevel models from section 5.2 (see the output in tables 25-28 in appendix III). One easy way of interpreting the output of any probability model (which a logistic model is) is to look at the statistical significance and the sign of parameter estimates (Futing Liao, 1994, p. 7). In terms of whether the independent variables showed a statistically significant association with vaccine hesitancy and the sign of the estimation of the independent variables, the outputs of the mixed-effect ordered logistic regressions were the same as the multilevel mixed-effects linear regression output under section 5.2 (with the reservation that any specific assumptions of mixed-effects logistic models were not investigated).

Another assumption is that the errors are normally distributed (Berry, 1993). While possible skewness is less important in this case because of the large number of observations (Mehmetoglu & Jakobsen, 2017, p. 153) histograms of the distribution of residual of the main models were produced (see figures 12-15 in appendix III). The histograms indicate that there is significant skewness, which is attributed to the skewness in the dependent variable. However, since the fixed-effects logistic models for ordered responses only assume that responses are ordered, not normally distributed, the interpretation is made that if the results hold in under that testing then the skewness of the residuals are not a problem for the validity of the findings in this thesis.

The results also depend on the operationalizations of political trust. In this thesis, the decision was made to use trust in the justice system as an indicator of institutional trust following the argument that the more politically neutral institutions in charge of implementing public policy capture institutional trust best (Rothstein, 2011). However, one could argue that trust in the more political institutions could be more relevant in form of institutional trust to use in the models, or that other more neutral institutions could capture institutional trust better. Therefore, to test the robustness of the results of the full models in section 5.2, tests were performed using a selection of institutions about which trust was also asked in the Eurobarometer surveys. The alternative institutions tested were public administration, the national government, the national parliament, and political parties. The output is presented in tables 29-32 in appendix III. For the full model testing H_1, the sign of the coefficient and the statistical significance of the tested alternative operationalizations of trust were the same as the original operationalization. For the full model testing H_2 with control for institutional trust, there are some differences in the statistical significance of institutional trust, but the performance-based trust remains strongly significant with all operationalizations.

One idea could be that the degree to which performance-based trust affects vaccine hesitancy depends on the level of institutional trust. Initial tests suggest that so is the case (see graphs in figures 16 & 17 in appendix III). While not the aim of this paper, future research could look closer at this possible moderation.

5 Discussion and conclusion

Based on the theoretical framework and previous research that was reviewed in this thesis, two hypotheses were formed. The first hypothesis predicted that higher levels of institutional trust would be associated with relatively less hesitancy to get the Covid-19 vaccine, and the second hypothesis predicted that there would be an independent link between more positive evaluations of the government's response to the Covid-19 pandemic and less hesitancy to get the Covid-19 vaccine. Utilizing data from two Eurobarometer surveys conducted in 2021 (European Commission, 2021a; European Commission, 2021b) the hypotheses were tested using multilevel mixed-effects linear regression. The tests were not able to reject either of the hypotheses, leading to the conclusion that this thesis did find support for higher levels of both forms of political trust being associated with lower levels of vaccine hesitancy.

To the extent that these findings are generalizable, they imply that governments will have a higher likelihood of public cooperation with vaccine recommendations if people evaluate that government's performance in dealing with the disease in a positive light. This might sound intuitive, and it is in line with previous findings on the connection between higher levels of trust and higher levels of compliance with Covid-19 containment policies (Bargain & Aminjonov, 2020), but from what I have found no previous research has not looked at this effect when it comes to vaccine willingness. While research has come out that links political trust to vaccine hesitancy through populism (Kennedy, 2019; Recio-Román, et al., 2022) these studies have not focused primarily on political trust. Further, this thesis also presents a theoretical model explaining how the relationship between political trust and vaccine hesitancy connects to the output side of the political system and top-down theory on how political trust is generated (see section 2.3 Research gap and question).

As a note of caution, it should be mentioned that generally speaking both vaccine hesitancy and political distrust can be logical and an expression of critical thinking, and neither are inherently wrong. The problem arises when the hesitancy is towards an issue where the science is clear, such as the debunking of any increase in autism from measles vaccines, and the hesitancy becomes an obstacle to public health. Furthermore, there is evidence to suggest that vaccine hesitancy can be promoted by populist parties as an anti-establishment idea (Recio-Román, et al., 2022), which shifts vaccine hesitancy from critical thinking about science toward the expression of resistance against what is viewed as political (or elitist) oppression.

In conclusion, the findings in this thesis indicate that for successful, wide-reaching, voluntary, vaccinations against a pandemic to take place in society, there needs to be political trust. Further, this trust will be difficult to generate only in the short term, as institutional trust was found to have a significant association, but can also be affected by short-term performance evaluations, as performance-based trust was also found to have a significant association. Therefore, one policy implication of this thesis is that in societies where political trust is generally low, policymakers can expect vaccine hesitancy to be a bigger obstacle compared to societies where political trust is high. This said, the results also indicate that governments cannot “bank on” high levels of institutional trust as short-term performance-based trust also appear to have an impact on vaccine hesitancy.

5.1 Limitations and future research

This thesis should be evaluated with its limitations. For one, the Eurobarometer indicators are restricted by the surveys’ predefined items. However, the survey’s large scale and the quality of the data it can collect through standardized sampling procedures are deemed to outweigh its downsides. Second, there is a limit to the generalizability of the results of this thesis. Arguably, this thesis can only suggest something about the links between political trust and vaccine hesitancy in the European (or even only the EU) context, and future research would be needed with another/wider geographical scope to investigate the generalizability of these findings.

Third, it should be mentioned that the choices made about design and methods for this thesis were based on the theoretical framework and the ability to effectively operationalize the concepts within it. For instance, the results suggested that the operationalization of exposure to misinformation *decreased* vaccine hesitancy. The interpretation is made that this is due to a poor operationalization and not at the fault of the theoretical model, but this leaves the question of what the results would be with a more accurate operationalization of the impact of misinformation. Future research could test other operationalizations and different study designs to see if the theoretical framework appears to function in the same way when subjecting its implications to different tests.

Fourth, the analysis presented in this thesis can only point to association, not causality. In theory, the direction is that political trust affects vaccine hesitancy. However, there are probably other ways in which these variables interact and other variables than those included in the analysis that could affect how the relationship appears. For instance, a person that is initially vaccine hesitant might not be satisfied with a strategy centered around vaccinations and not the other way around. Different approaches would be needed to analyze the relationship and the possibility to uncover causality.

Finally, in a recent paper on the relationship between Covid-19 mortality and trust the authors argue that “in societies where there is a wide gap in institutional trust between those who support the government and those who support the opposition, it will be more difficult to implement measures and recommendations against COVID-19" (Charron, et al., 2022, p. 4). Additionally, research focused on EU regions has found that in some cases the within-country regional differences (for instance between the northern and southern regions of a country) in institutional trust outweigh national differences (Rothstein & Charron, 2018). Unfortunately, the political trust measures used in this thesis are not able to capture the polarization of trust within a country or look into subnational differences in trust. Future research would be needed to investigate if/how these characteristics of trust can be linked to variation in vaccine hesitancy.

6 References

Bargain, O. & Aminjonov, U., 2020. Trust and compliance to public health policies in times of COVID-19. *Journal of public economics,* Volume 192, p. 104316.

Bartscher, A. K. et al., 2021. Social capital and the spread of covid-19: Insights from european countries. *Journal of health economics,* Volume 80, pp. 102531-102531.

Bauer, P. C. & Freitag, M., 2018. Measuring Trust. In: E. M. Uslaner, ed. *The Oxford Handbook of Social and Political Trust.* s.l.:Oxford University Press, pp. 15-36.

Bayerlein, M. et al., 2021. Populism and COVID-19: How Populist Governments (Mis)Handle the Pandemic. *Journal Of Political Institutions And Political Economy,,* 2(3), pp. 389-.428.

Berry, W. D., 1993. *Understanding Regression Assumptions.* Los Angeles: SAGE Publications.

Betsch, C. et al., 2012. Opportunities and challenges of Web 2.0 for vaccination decisions. *Vaccine,* 30(25), pp. 3727-3733.

Borgonovi, F. & Andrieu, E., 2020. Bowling together by bowling alone: Social capital and COVID-19. *Social science & medicine ,* Volume 265, pp. 113501-113501.

Bosancianu, C. M. et al., 2021. *Political and Social Correlates of Covid-19 Mortality.* [Online]
Available at: doi:10.31235/osf.io/ub3zd.

Casiday, R., Cresswell, T., Wilson, D. & Panter-Brick, C., 2006. A survey of UK parental attitudes to the MMR vaccine and trust in medical authority. *Vaccine,* 24(2), pp. 177-184.

Charron, N., Lapuente, V. & Rodriguez-Pose, A., 2022. Uncooperative society, uncooperative politics or both? Trust, polarization, populism and COVID-19 deaths across European regions. *European journal of political research,* Issue Online version before publishing.

Cheibub, J. A., Hong, Y. J. & Preworski, A., 2020. *Rights and Deaths: Government Reactions to the Pandemic.* [Online]
Available at: http://dx.doi.org/10.2139/ssrn.3645410
[Accessed 02 06 2021].

Colgrove, J., 2006. The Ethics and Politics of Compulsory HPV Vaccination. *The New England journal of medicine,* 355(23), pp. 2389-2391.

Cooper, D. L. et al., 2017. HPV vaccine awareness and the association of trust in cancer information from physicians among males. *Vaccine,* 35(20), pp. 2661-2667.

Coppedge, M. et al., 2022. V-Dem Codebook v12. *Varieties of Democracy (V-Dem) Project.*

Elgar, F. J., Stefaniak, A. & Wohl, M. J., 2020. The trouble with trust: Time-series analysis of social capital, income inequality, and COVID-19 deaths in 84 countries. *Social science & medicine,* Volume 263, pp. 113365-113365.

Engler, S. et al., 2021. Democracy in times of the pandemic: explaining the variation of COVID-19 policies across European democracies. *West European politics,* 44(5-6), pp. 1077-1102.

European Commission, 2020. *Coronavirus: Commission unveils EU vaccines strategy.* [Online]
Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1103
[Accessed 11 05 2022].

European Commission, 2021a. *Eurobarometer 94.3. GESIS Data Archive, Cologne. ZA7780 Data file Version 1.0.0.* [Online]
Available at: https://doi.org/10.4232/1.13793
[Accessed 27 04 2022].

European Commission, 2021b. *Eurobarometer 95.3. GESIS, Cologne. ZA7783 Data file Version 1.0.0.* [Online]
Available at: https://doi.org/10.4232/1.13826
[Accessed 27 04 2022].

Farzanegan, M. R. & Hofmann, H. P., 2021. Effect of public corruption on the COVID-19 immunization progress. *Scientific reports,* 11(1), pp. 23423-23423.

Fernandes, N. et al., 2021. Predicting covid-19 vaccination intention: The determinants of vaccine hesitancy. *Vaccines (Basel),* 9(10), p. 1161.

Futing Liao, T., 1994. *Interpreting Probability Models: Logit, Probit, and Other Generalized Linear Models.* Online edition (published online in 2011) ed. Los Angeles: SAGE Publications Inc.

Giddens, A., 1990. *The consequences of modernity.* Cambridge: s.n.

Gilles, I. et al., 2011. Trust in medical organizations predicts pandemic (H1N1) 2009 vaccination behavior and perceived efficacy of protection measures in the Swiss public. *European journal of epidemiology,* 26(3), pp. 203-210.

Goldenberg, M. J., 2021. *Vaccine hesitancy: public trust, expertise, and the war on science.* Pittsburgh: University of Pittsburgh Press.

Harring, N., Jagers, S. C. & Löfgren, Å., 2021. COVID-19: Large-scale collective action, government intervention, and the importance of trust. *World development,* Volume 138, p. 105236.

Hetherington, M., 2015. Why Polarized Trust Matters. *The forum: a journal of applied research in contemporary politics,* 13(3), pp. 445-458.

Hetherington, M. J., 1998. The Political Relevance of Political Trust. *The American political science review,* 92(4), pp. 791-808.

Hetherington, M. J. & Rudolph, T. J., 2018. Political Trust and Polarization. In: E. M. Uslaner, ed. *The Oxford Handbook of Social and Political Trust.* s.l.:Oxford University Press, pp. 579-597.

Imbulana Arachchi, J. & Managi, S., 2021. *The role of social capital in COVID-19,* BMC public health, Vol. 21:434 : https://doi.org/10.1186/s12889-021-10475-8,

Karsikas, D. & Fasianos, A., 2021. *In Defense of EU's COVID-19 Vaccine Strategy.* [Online]
Available at: https://www.globalpolicyjournal.com/blog/16/04/2021/defense-eus-covid-19-vaccine-strategy
[Accessed 12 05 2022].

Kawachi, I., 2018. Trust and Population Health. In: E. M. Uslaner, ed. *Oxford Handbook of Social and Political Trust.* s.l.:Oxford University Press, pp. 447-470.

Kennedy, J., 2019. Populist politics and vaccine hesitancy in Western Europe: an analysis of national-level data. *European journal of public health,* 29(3), pp. 512-516.

Larson, H. J. et al., 2018. Measuring trust in vaccination: A systematic review. *Human vaccines & immunotherapeutics,* 14(7), pp. 1599-1609.

Larson, H. J., Schulz, W. S., Tucker, J. D. & Smith, D. M. D., 2015. Measuring vaccine confidence: Introducing a global Vaccine Confidence Index. *United States: Public Library of Science (PLoS currents),* Volume 7.

Lee, C.-T., Zhang, G. & Edwards, M. C., 2012. Ordinary Least Squares Estimation of Parameters in Exploratory Factor Analysis With Ordinal Data. *Multivariate behavioral research,* 47(2), pp. 314-339.

Lee, J. J. et al., 2020. Associations between COVID-19 misinformation exposure and belief with COVID-19 knowledge and preventive behaviors: cross-sectional online study. *Journal of medical Internet research,* 22(11), pp. e22205-e22205.

Leibniz-Institute für Sozialwissenschaften, 2022. *GESIS.* [Online]
Available at: https://www.gesis.org/
[Accessed 11 May 2022].

Loomba, S. et al., 2021. Measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA. *Nature human behaviour,* 5(3), p. 337–348.

MacDonald, N. E., 2015. Vaccine hesitancy: Definition, scope and determinants. *Vaccine,* 33(34), pp. 4161-4164.

Makridis, C. A. & Wu, C., 2021. *How social capital helps communities weather the COVID-19 pandemic,* PLoS ONE, Vol. 16,: https://doi.org/10.1371/journal.pone.0245135.

McCullagh, P., 1980. Regression Models for Ordinal Data. *Journal of the Royal Statistical Society. Series B, Methodological,* 42(2), pp. 109-142.

McMann, K. M. & Tisch, D., 2021. *Democratic Regimes and Pandemic Deaths,* University of Gothenburg: V-Dem Institute Working Papers 2021:126.

Mehmetoglu, M. & Jakobsen, T. G., 2017. *Applied Statistics Using Stata. A Guide.* 1 ed. London: Sage Publictions Ltd.

Newton, K., Stolle, D. & Zmerli, S., 2018. Social and Political Trust. In: E. M. Uslaner, ed. *The Oxford Handbook of Social and Political Trust.* s.l.:Oxford University Press, pp. 37-56.

Ostrom, E., 1998. A Behavioral Approach to the Rational Choice Theory of Collective Action: Presidential Address, American Political Science Association, 1997. *The American political science review,,* 92(1), pp. 1-22.

Our World in Data, 2022. *Coronavirus (COVID-19) Vaccinations.* [Online]
Available at: https://ourworldindata.org/covid-vaccinations
[Accessed 16 05 2022].

Pearce, A. et al., 2008. Factors Associated with Uptake of Measles, Mumps, and Rubella Vaccine (MMR) and Use of Single Antigen Vaccines in a Contemporary UK Cohort: Prospective Cohort Study. *British Medical Association (online),* Volume 336, pp. 754-757.

Poland, G. A. & Jacobson, R. M., 2011. The Age-Old Struggle against the Antivaccinationists. *The New England journal of medicine,* 364(2), pp. 97-99.

Putnam, R. D., 200. *Bowling alone : the collapse and revival of American community.* New York: Simon & Schuster.

Recio-Román, A., Recio-Menéndez, M. & Román-González, M. V., 2022. Political Populism, Institutional Distrust and Vaccination Uptake: A Mediation Analysis. *International journal of environmental research and public health,* Volume 19.6, p. 3265.

Reiljan, A., 2020. 'Fear and loathing across party lines' (also) in Europe: Affective polarisation in European party systems. *European journal of political research,* 59(2), pp. 376-396.

Ritchie, H. et al., 2022. *"Coronavirus Pandemic (COVID-19)".* [Online]
Available at: https://ourworldindata.org/covid-vaccinations?country=OWID_WRL
[Accessed 7 March 2022].

Rothstein, B., 2011. *The quality of government : corruption, social trust, and inequality in international perspective.* 1st ed. London: The University of Chicago Press.

Rothstein, B., 2017. The relevance of comparative politics. In: D. Caramani, ed. *Comparative politics 4th ed.* s.l.:Oxford University Press, pp. 21-34.

Rothstein, B. & Charron, N., 2018. Regions of Trust and Distrust: How Good Institutions Can Foster Social Cohesion. In: U. Bernitz, M. Mårtensson, L. Oxelheim & T. Persson, eds. *Bridging The Prosperity Gap In The EU: The Social Challenge Ahead.* Cheltenham, UK: Edward Elgar Publishing, pp. 236-250.

Salmon, D. A., Dudley, M. Z., Glanz, J. M. & Omer, S. B., 2015. Vaccine Hesitancy: Causes, Consequences, and a Call to Action. *American journal of preventive medicine,* 49(6), pp. S391-S398.

Schmidt, A. L. et al., 2018. Polarization of the vaccination debate on Facebook. *Vaccine,* 36(25), pp. 3606-3612.

Sebhatu, A., Wennberg, K., Arora-Jonsson, S. & Lindberg, S. I., 2020. Explaining the homogeneous diffusion of COVID-19 nonpharmaceutical interventions across heterogeneous countries. *Proceedings of the National Academy of Science of the United States of America,* 117(35), pp. 21201-21208.

Snijders, T. A. & Bosker, R. J., 1994. Modeled Variance in Two-Level Models. *Sociological methods & research,* 22(3), pp. 342-363.

Stata, 2022. *meologit - Multilevel mixed-effects ordered logistic regression.* [Online]
Available at: https://www.stata.com/manuals/memeologit.pdf#memeologit
[Accessed 16 05 2022].

Stata, 2022. *xtmixed — Multilevel mixed-effects linear regression.* [Online]
Available at: https://www.stata.com/bookstore/pdf/xt_xtmixed.pdf
[Accessed 16 05 2022].

Toshkov, D., Carroll, B. & Yesilkagit, K., 2021. Government capacity, societal trust or party preferences: what accounts for the variety of national policy responses to the COVID-19 pandemic in Europe?. *Journal of European public policy,* pp. 1-20.

Uslaner, E. M., 2018. The Study of Trust. In: E. M. Uslaner, ed. *The Oxford Handbook of Social and Political Trust.* s.l.:Oxford University Press, pp. 3-13.

Vinck, P. et al., 2019. Institutional trust and misinformation in the response to the 2018–19 Ebola outbreak in North Kivu, DR Congo: a population-based survey. *The Lancet infectious diseases,* 19(5), pp. 529-536.

Vosoughi, S., Roy, D. & Aral, S., 2018. The spread of true and false news online. *Science,* 359(6380), pp. 1146-1151.

WHO Europe, 2019. *Measles in Europe: record number of both sick and immunized.* [Online]
Available at: https://www.euro.who.int/en/media-centre/sections/press-releases/2019/measles-in-europe-record-number-of-both-sick-and-immunized
[Accessed 10 05 2022].

WHO, 2019. *Ten threats to global health in 2019.* [Online]
Available at: https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019
[Accessed 10 05 2022].

WHO, 2021. *COVID-19 Virtual Press conference transcript - 5 March 2021.* [Online]
Available at: https://www.who.int/publications/m/item/covid-19-virtual-press-conference-transcript---5-march-2021
[Accessed 16 05 2022].

WHO, 2022. *Immuniztion data.* [Online]
Available at:
https://immunizationdata.who.int/pages/coverage/mcv.html?GROUP=Countries&ANTIGEN=&YEAR=&CODE=
[Accessed 07 03 2022].

Wirsiy, F. S. et al., 2021. Acceptability of COVID-19 Vaccine in Africa. *International Journal Of Maternal And Child Health And Health,* 10(1), pp. 134-138.

Wu, H. & Leung, S.-O., 2017. Can Likert Scales be Treated as Interval Scales?—A Simulation Study. *Journal of Social Service Research,* 43(3), pp. 527-532.

You, J.-s., 2018. Trust and Corruption. In: E. M. Uslaner, ed. *The Oxford Handbook of Social and Political Trust.* s.l.:Oxford University Press, pp. 473-496.

Appendix I – Various

Table 10. List of included countries by geographical category

Western Europe	Northern Europe	Southern Europe	Eastern Europe
Austria (AU)	Denmark (DK)	Croatia (HR)	Bulgaria (BG)
Belgium (BE)	Estonia (EE)	Greece (GR)	Czech Republic (CZ)
France (FR)	Finland (FI)	Italy (IT)	Hungary (HU)
Germany (DE)	Ireland (IE)	Malta (MT)	Poland (PO)
Luxembourg (LU)	Latvia (LV)	Portugal (PT)	Romania (RO)
Netherlands (NL)	Lithuania (LT)	Slovenia (SI)	Slovakia (SK)
	Sweden (SE)	Spain (ES)	
		*Cyprus (CY)	

*Cyprus was not originally included in this category (it was in the category Western Asia) but is recoded to Southern Europe to avoid having a region with only one observation.

Table 11. Number of respondents by country and Eurobarometer survey

Observations per country (dataset: Eurobarometer 94.3)		Observations per country (Eurobarometer 95.3)	
Austria	851	Austria	865
Belgium	1 005	Belgium	942
Bulgaria	717	Bulgaria	760
Croatia	954	Croatia	948
Cyprus	427	Cyprus	468
Czech Republic	1 017	Czech Republic	989
Denmark	938	Denmark	934
Estonia	938	Estonia	931
Finland	916	Finland	853
France	869	France	899
Germany	1 409	Germany	1 404
Greece	992	Greece	964
Hungary	962	Hungary	9450
Ireland	1 035	Ireland	972
Italy	845	Italy	935
Latvia	906	Latvia	905
Lithuania	898	Lithuania	854
Luxembourg	558	Luxembourg	446
Malta	381	Malta	417
Netherlands	975	Netherlands	977
Poland	838	Poland	877
Portugal	1 007	Portugal	907
Romania	944	Romania	885
Slovakia	1 029	Slovakia	904
Slovenia	885	Slovenia	959
Spain	884	Spain	926
Sweden	1 002	Sweden	951
Total	24 192	Total	23 822

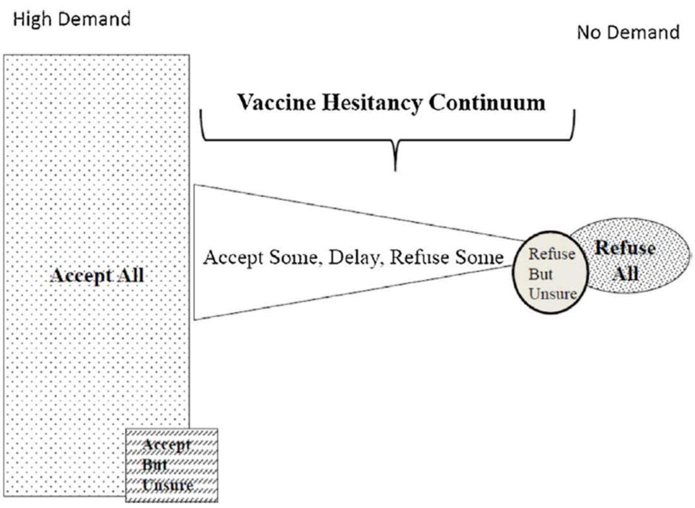

Figure 5. Illustration of vaccine hesitancy as a continuum. Source: SAGE Working Group on Vaccine Hesitancy (MacDonald, 2015, p. 4162)

Table 12. Vaccine progress and hesitancy by country

	Vaccine progress as of Dec. 31st, 2021	Vaccine hesitancy, EB 94.3	Vaccine hesitancy, EB 95.3
Austria	73.65	2.25	1.31
Belgium	76.76	1.58	0.46
Bulgaria	27.61	2.60	2.27
Croatia	55.35	2.59	1.92
Cyprus	71.53	2.59	1.20
Czech Republic	63.67	1.96	1.12
Denmark	82.54	1.26	0.53
Estonia	63.55	1.85	0.89
Finland	77.05	1.50	0.54
France	78.74	2.34	1.13
Germany	73.69	1.74	0.82
Greece	72.02	2.27	1.50
Hungary	65.04	2.39	1.11
Ireland	78.54	1.31	0.43
Italy	80.16	1.89	0.91
Latvia	70.42	2.30	1.73
Lithuania	71.30	2.16	1.18
Luxembourg	73.16	1.82	0.64
Malta	86.15	1.60	0.35
Netherlands	77.55	1.44	0.37
Poland	57.34	2.36	1.42
Portugal	91.71	1.75	0.72
Romania	28.62	2.43	1.88
Slovakia	50.50	2.20	1.74
Slovenia	60.16	2.17	1.53
Spain	84.85	1.70	0.67
Sweden	75.53	1.38	0.68

Note: The vaccine hesitancy scores in this table are country averages of respondents' scores on a 0-4 scale.

Table 13. Individual-level variable summary statistics – EB 94.3

	N	SD	Mean	Min	Max
Woman	24192	0.499	0.525	0	1
Age	24192	16.878	49.206	15	95
Education (years when ended)	21840	5.746	21.207	2	75
Financial situation	24192	0.752	2.822	1	4
Social media use	24192	1.954	2.341	1	6
Vaccine hesitancy	24192	1.116	1.952	0	4
Institutional trust	24192	0.497	0.554	0	1
Performance-based trust	24192	1.562	3.315	0	6

Table 14. Individual-level variable summary statistics – EB 95.3

	N	SD	Mean	Min	Max
Woman	23822	0.499	0.528	0	1
Age	23822	17.309	50.399	15	98
Education (years when ended)	21852	5.453	20.387	2	79
Financial situation	23822	0.71	2.872	1	4
Internet use index	23822	1.548	1.58	1	7
Vaccine hesitancy	23822	1.456	1.068	0	4
Institutional trust	23822	0.496	0.56	0	1
Performance-based trust	23822	1.565	3.542	0	6

Table 15. Country-level control variables summary statistics (same for all regressions)

	N	SD	Mean	Min	Max
Corruption	27	14.207	63.667	44	88
Political polarization	27	1.72	-0.389	-3.108	3.082
Measles vaccine coverage	27	5.311	90.852	76	99

Appendix II – Regression outputs and figures

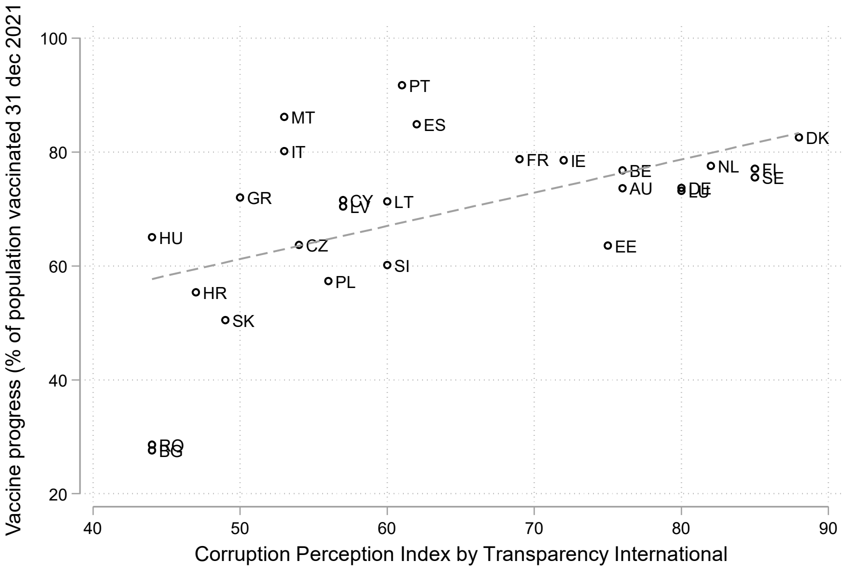

Figure 6. Visualized relationship between vaccine progress and corruption

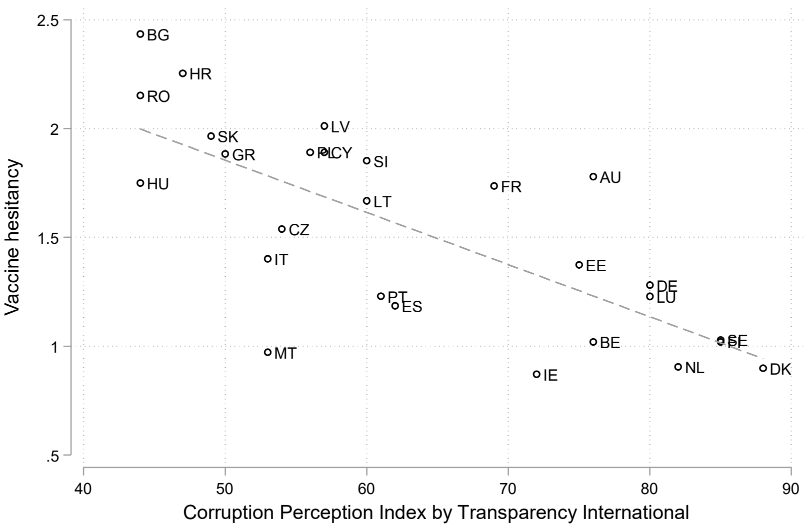

Figure 7. Visualized relationship between vaccine hesitancy and corruption

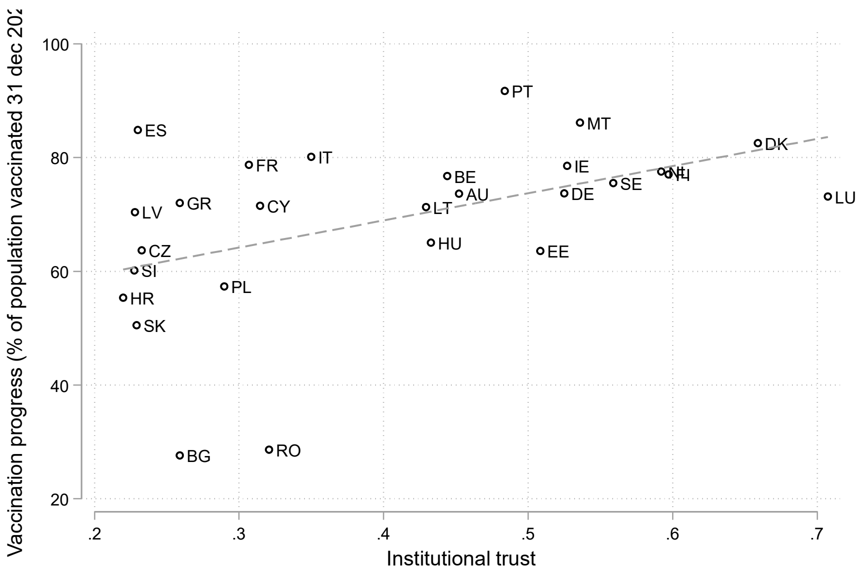

Figure 8. Vaccination progress and institutional trust (country averages of EB 94.3 & 95.3)

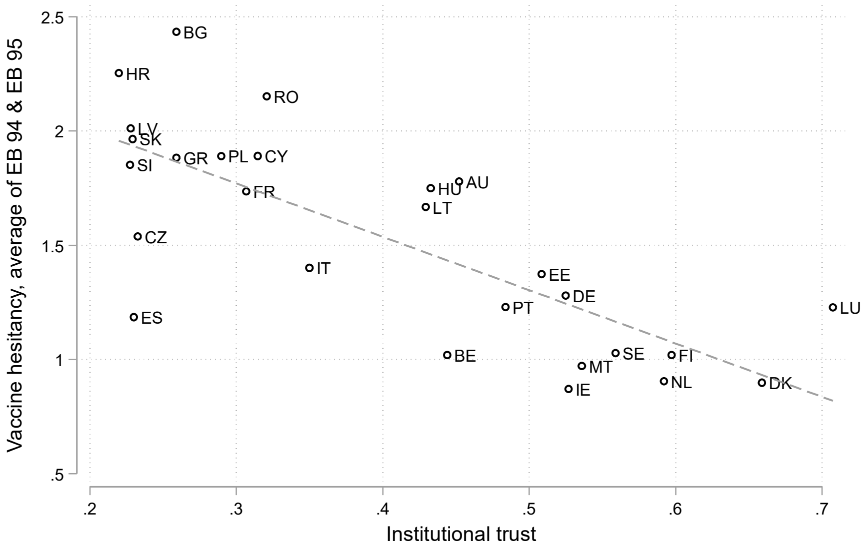

Figure 9. Vaccine hesitancy and institutional trust (country averages of EB 94.3 & 95.3)

Table 16. Full regression output - H_1 (Eurobarometer variables using EB 94.3 dataset, Feb/Mar 2021)

	Model 1 Vaccination progress by 31 Dec 2021	**Model 2** Vaccination progress by 31 Dec 2021	**Model 3** Vaccine hesitancy	**Model 4** Vaccine hesitancy
Institutional trust	32.744**	39.885	-1.69***	-1.606**
	(13.854)	(23.292)	(0.317)	(0.633)
Corruption		-0.06		-0.011
		(0.417)		(0.011)
Political polarization		-0.711		0.034
		(1.702)		(0.046)
Measles vaccine coverage		0.798*		-0.02
		(0.451)		(0.012)
Geographical region (control: Western Europe)				
Northern Europe		-6.097		0.039
		(6.552)		(0.178)
Southern Europe		8.102		-0.443*
		(8.782)		(0.239)
Eastern Europe		-19.102		-0.133
		(11.117)		(0.302)
Intercept	51.515***	-17.902	2.437***	5.115***
	(7.938)	(41.041)	(0.181)	(1.116)
Observations	27	27	27	27
Adjusted R-squared	0.150	0.550	0.514	0.636

Standard errors are in parentheses
****p<.01, **p<.05, *p<.1*

Table 17. Full country-level regression output - H_1 (Eurobarometer 95.3 dataset, Jun/Jul 2021)

	Model 1 Vaccination progress by 31 Dec 2021	**Model 2** Vaccination progress by 31 Dec 2021	**Model 3** Vaccine hesitancy	**Model 4** Vaccine hesitancy
Institutional trust	39.997**	42.386*	-1.888***	-1.360*
	(15.441)	(23.118)	(0.366)	(0.665)
Corruption		-0.034		-0.017
		(0.390)		(0.011)
Political polarization		-0.661		0.037
		(1.688)		(0.049)
Measles vaccine coverage		0.835*		-0.019
		(0.450)		(0.013)
Geographical region (control: Western Europe)				
Northern Europe		-7.046		0.052
		(6.590)		(0.189)
Southern Europe		5.888		-0.387
		(8.908)		(0.256)
Eastern Europe		-19.856*		-0.162
		(11.078)		(0.319)
Intercept	47.183***	-23.628	2.564***	5.175***
	(8.889)	(41.29)	(.211)	(1.187)
Observations	27	27	27	27
Adjusted R-squared	0.180	0.559	0.497	0.601

Standard errors are in parentheses
****p<.01, **p<.05, *p<.1*

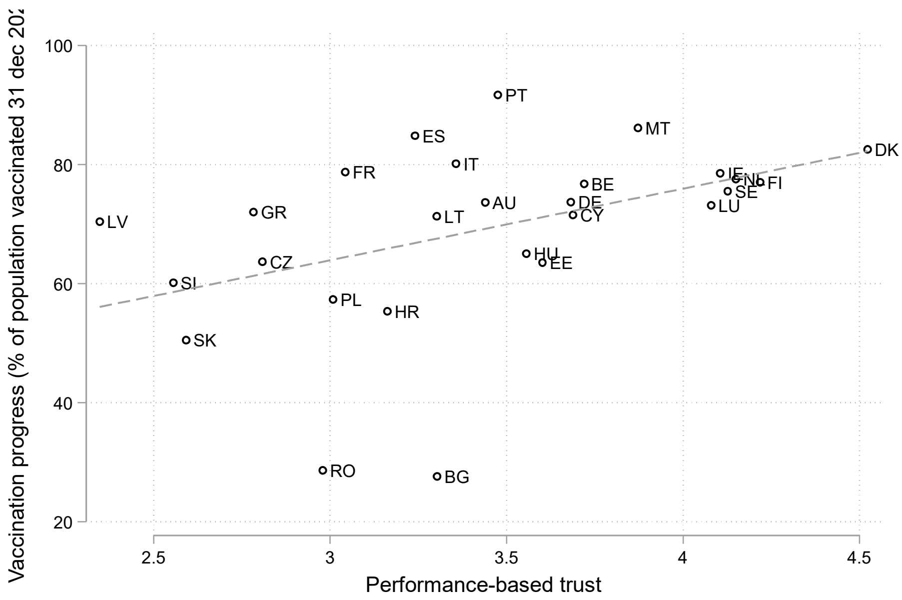

Figure 10. Vaccination progress and the index on performance-based trust (averages of EB 94.3 & 95.3)

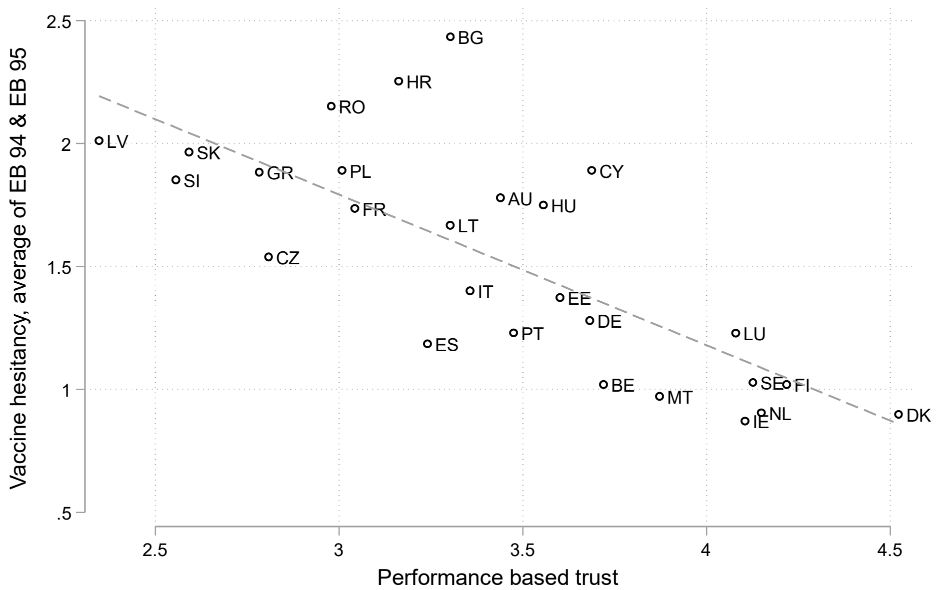

Figure 11. Vaccine hesitancy and performance-based trust (averages of EB 94.3 & 95.3)

Table 18. Full country-level regression output – H_2 (Eurobarometer 94.3 dataset, Feb/Mar 2021)

	Model 1	Model 2	Model 3	Model 4	Model 5
Performance-based trust	10.389**	-0.149	-0.562***	-0.231	-0.09
	(4.865)	(5.301)	(0.114)	(0.146)	(0.155)
Corruption		0.482		-0.025**	-0.011
		(0.353)		(0.01)	(0.012)
Political polarization		-1.187		0.039	0.031
		(1.837)		(0.051)	(0.047)
Measles vaccine coverage		0.463		-0.006	-0.018
		(0.436)		(0.012)	(0.013)
Geographical region (control: Western Europe)					
Northern Europe		-3.895		-0.021	0.039
		(6.933)		(0.191)	(0.181)
Southern Europe		9.977		-0.404	-0.408
		(9.707)		(0.267)	(0.25)
Northern Europe		-12.529		-0.271	-0.118
		(11.58)		(0.319)	(0.309)
Institutional trust					-1.403*
					(0.732)
Intercept	34.732**	-2.707	3.388***	4.567***	5.063***
	(16.351)	(43.079)	(0.383)	(1.185)	(1.139)
Observations	27	27	27	27	27
Adjusted R-squared	0.121	0.481	0.473	0.570	0.623

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 19. Full country-level regression output – H_2 (Eurobarometer 95.3, Jun/Jul 2021)

	Model 1	Model 2	Model 3	Model 4	Model 5
Performance-based trust	13.158***	4.465	-0.637***	-0.366**	-0.294*
	(4.707)	(5.487)	(0.102)	(0.14)	(0.149)
Corruption		0.301		-0.019*	-0.011
		(0.362)		(0.009)	(0.011)
Political polarization		-1.094		0.046	0.037
		(1.778)		(0.045)	(0.045)
Measles vaccine coverage		0.426		-0.004	-0.012
		(0.431)		(0.011)	(0.013)
Geographical region (control: Western Europe)					
Northern Europe		-4.094		-0.034	0.026
		(6.791)		(0.173)	(0.177)
Southern Europe		8.099		-0.367	-0.315
		(9.472)		(0.242)	(0.241)
Northern Europe		-14.648		-0.227	-0.114
		(11.318)		(0.289)	(0.298)
Institutional trust					-0.857
					(0.67)
Intercept	22.387	-3.139	3.792***	4.537***	4.953***
	(16.935)	(42.328)	(0.366)	(1.081)	(1.112)
Observations	27	27	27	27	27
Adjusted R-squared	0.208	0.498	0.596	0.642	0.654

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 20. Full multi-level regression output – testing H_1 (Eurobarometer 94.3 Feb/Mar 2021)

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Institutional trust	-0.554***		-0.386***	-0.334***	-0.332***
	(0.015)		(0.032)	(0.031)	(0.031)
Woman				0.079***	0.079***
				(0.027)	(0.027)
Age (control group: 15-24)					
25-39				-0.045*	-0.044*
				(0.027)	(0.027)
40-54				-0.204***	-0.203***
				(0.029)	(0.028)
55-98				-0.49***	-0.489***
				(0.044)	(0.044)
Social media use				-0.047***	-0.047***
				(0.015)	(0.014)
Education age (control: up to 15)					
16-19				-0.089*	-0.09*
				(0.05)	(0.05)
20+				-0.279***	-0.278***
				(0.053)	(0.053)
Still studying				-0.299***	-0.298***
				(0.055)	(0.055)
No full-time education				-0.121	-0.119
				(0.087)	(0.086)
Financial situation				-0.197***	-0.197***
				(0.023)	(0.023)
Corruption					-0.021***
					(0.003)
Polarization of society					0.086***
					(0.027)
Measles vaccine coverage					-0.009
					(0.007)
Geographical region Control: Western Europe					
Northern Europe					-0.115
					(0.103)
Southern Europe					-0.654***
					(0.146)
Eastern Europe					-0.532***
					(0.139)
Intercept	2.274***	1.973***	2.187***	3.193***	5.706***
	(0.012)	(0.081)	(0.076)	(0.128)	(0.597)
Variance components					
Country. (υ_j)		-0.889***	-1.961***	-2.019***	-2.023***
		(0.089)	(.164)	(.162)	(0.162)
Individual (ϵ_i)		0.042*	0.026	-0.006	-0.006
		(0.025)	(0.024)	(0.022)	(0.022)
ICC		0.134	0.118	0.098	0.049
Obs. (country = 27)	24 192	24 192	24 192	24 192	24 192

R-squared	0.064				
Level 1 R-squared			0.055	0.138	0.177
Level 2 R-squared			0.226	0.448	0.739
Random intercept	No	Yes	Yes	Yes	Yes
Random slope	No	No	Yes	Yes	Yes

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*
Comment: R-squared for the multilevel models are Snijders/Bosker estimations (Snijders & Bosker, 1994).

Table 21. Full multi-level regression output – testing H_1 (Eurobarometer 95.3 dataset, Jun/Jul 2021)

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Institutional trust	-0.605***		-0.406***	-0.363***	-0.362***
	(0.02)		(0.046)	(0.041)	(0.041)
Woman				-0.017	-0.017
				(0.024)	(0.025)
Age (control group: 15-24)					
25-39				-0.203***	-0.203***
				(0.046)	(0.046)
40-54				-0.61***	-0.61***
				(0.072)	(0.072)
55-98				-1.038***	-1.038***
				(0.074)	(0.074)
Social media use				-0.01	-0.01
				(0.009)	(0.009)
Education age (control: up to 15)					
16-19				0.063	0.062
				(0.054)	(0.054)
20+				-0.126**	-0.127**
				(0.058)	(0.057)
Still studying				-0.044	-0.045
				(0.089)	(0.089)
No full-time education				0.051	0.053
				(0.092)	(0.092)
Financial situation				-0.262***	-0.262***
				(0.03)	(0.03)
Corruption					-0.025***
					(0.007)
Polarization of society					0.057
					(0.055)
Measles vaccine coverage					-0.009
					(0.013)
Geographical region Control: Western Europe					
Northern Europe					0.142
					(0.142)
Southern Europe					-0.573***

					(0.219)
Eastern Europe					-0.291
					(0.244)
Intercept	1.399***	1.063***	1.296***	2.738***	5.305***
	(0.016)	(0.103)	(.102)	(.178)	(1.06)
Variance components					
Country. (υ_j)		-0.65***	-1.579***	-1.618***	-1.624***
		(0.113)	(.13)	(.16)	(0.163)
Individual (ϵ_i)		0.308***	.296***	.246***	0.246***
		(0.037)	(.037)	(.039)	(0.039)
ICC		0.128	0.124	0.103	0.065
Obs. (country = 27)	23 822	23 822	23 822	23 822	23 822
R-squared	0.064				
Level 1 R-squared			0.038	0.151	0.183
Level 2 R-squared			0.165	0.421	0.668
Random intercept	No	Yes	Yes	Yes	Yes
Random slope	No	No	Yes	Yes	Yes

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*
Comment: R-squared for the multilevel models are Snijders/Bosker estimations (Snijders & Bosker, 1994).

Table 22. Full multi-level regression output – testing H2 (Eurobarometer 94.3 dataset, Feb/Mar 2021)

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Performance-based trust	-0.281***	-0.247***	-0.221***	-0.221***	-0.208***
	(0.005)	(0.016)	(0.016)	(0.015)	(0.015)
Woman			0.095***	0.094***	0.094***
			(0.025)	(0.025)	(0.025)
Age (control: 15-24)					
25-39			-0.044*	-0.043*	-0.046*
			(0.026)	(0.026)	(0.025)
40-54			-0.164***	-0.164***	-0.166***
			(0.027)	(0.027)	(0.026)
55-98			-0.41***	-0.409***	-0.418***
			(0.042)	(0.042)	(0.041)
Social media use			-0.017***	-0.017***	-0.017***
			(0.006)	(0.006)	(0.007)
Education age (control: up to 15)					
16-19			-0.047	-0.047	-0.047
			(0.041)	(0.041)	(0.041)
20+			-0.215***	-0.215***	-0.208***
			(0.047)	(0.047)	(0.047)
Still studying			-0.246***	-0.246***	-0.236***
			(0.051)	(0.051)	(0.049)
No full-time education			-0.056	-0.055	-0.051
			(0.101)	(0.102)	(0.099)
Financial situation			-0.121***	-0.121***	-0.111***
			(0.017)	(0.017)	(0.017)
Corruption				-0.033***	-0.031***

				(0.005)	(0.005)
Political polarization				0.053	0.051
				(0.039)	(0.039)
Measles vaccine coverage				-0.003	-0.005
				(0.011)	(0.011)
Geographical region Control: Western Europe					
Northern Europe				-0.4***	-0.386***
				(0.142)	(0.146)
Southern Europe				-1.057***	-1.028***
				(0.216)	(0.215)
Eastern Europe				-0.962***	-0.92***
				(0.235)	(0.229)
Institutional trust					-0.163***
					(0.028)
Intercept	2.905***	2.782***	3.389***	6.473***	6.522***
	(0.018)	(0.103)	(0.127)	(0.872)	(0.898)
Variance components					
Country. (υ_j)		-2.568***	-2.609***	-2.608***	-2.621***
		(0.144)	(0.147)	(0.143)	(0.147)
Individual (ϵ_i)		-0.69***	-0.787***	-1.106***	-1.108***
Country. (υ_j)		(0.113)	(0.123)	(0.228)	(0.226)
ICC		0.211	0.187	0.108	0.109
Obs. (country = 27)	24 192	24 192	24 192	24 192	24 192
R-squared	0.163				
Level 1 R-squared		0.152	0.208	0.236	0.242
Level 2 R-squared		0.339	0.514	0.721	0.729
Random intercept	No	Yes	Yes	Yes	Yes
Random slope	No	Yes	Yes	Yes	Yes

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*
Comment: R-squared for the multilevel models are Snijders/Bosker estimations (Snijders & Bosker, 1994).

Table 23. Full multi-level regression output – testing H_2 (Eurobarometer 95.3 dataset, Jun/Jul 2021)

	Model 1	Model 2	Model 3	Model 4	Model 5
Performance-based trust	-0.377***	-0.312***	-0.273***	-0.273***	-0.262***
	(0.006)	(0.024)	(0.023)	(0.023)	(0.022)
Woman			-0.004	-0.004	-0.002
			(0.023)	(0.023)	(0.023)
Age (control: 15-24)					
25-39			-0.182***	-0.182***	-0.186***
			(0.049)	(0.049)	(0.049)
40-54			-0.557***	-0.558***	-.0564***
			(0.068)	(0.068)	(0.068)
55-98			-0.9***	-0.901***	-0.912***
			(0.072)	(0.071)	(0.071)
Social media use			-0.001	-0.002	-0.001
			(0.008)	(0.008)	(0.008)

Education age (control: up to 15)					
16-19			0.085*	0.084*	0.081
			(0.05)	(0.05)	(0.05)
20+			-0.1*	-0.1*	-0.098*
			(0.055)	(0.055)	(0.054)
Still studying			0.011	0.011	0.016
			(0.087)	(0.087)	(0.086)
No full-time education			0.016	0.019	0.012
			(0.089)	(0.089)	(0.085)
Financial situation			-0.159***	-0.159***	-0.148***
			(0.024)	(0.024)	(0.024)
Corruption				-0.047***	-0.045***
				(0.006)	(0.006)
Political polarization				0.114	0.111
				(0.072)	(0.073)
Measles vaccine coverage				-0.003	-0.004
				(0.017)	(0.017)
Geographical region Control: Western Europe					
Northern Europe				-0.128	-0.12
				(0.203)	(0.208)
Southern Europe				-1.479***	-1.456***
				(0.288)	(0.289)
Eastern Europe				-1.096***	-1.068***
				(0.302)	(0.303)
Institutional trust					-0.133***
					(0.026)
Intercept	2.409***	2.153***	3.062***	7.071***	7.114***
	(0.026)	(0.139)	(0.182)	(1.434)	(1.454)
Variance components					
Country. (υ_j)		-2.182***	-2.22***	-2.215***	-2.225***
		(0.15)	(0.137)	(0.134)	(0.137)
Individual (ϵ_i)		-.391***	-0.452***	-0.817***	-0.817***
		(0.122)	(0.124)	(0.162)	(0.159)
ICC		0.223	0.214	0.116	0.116
Obs. (country = 27)	23 822	23 822	23 822	23 822	23 822
R-squared	0.163				
Level 1 R-squared		0.162	0.233	0.254	0.257
Level 2 R-squared		0.423	0.558	0.725	0.732
Random intercept	No	Yes	Yes	Yes	Yes
Random slope	No	Yes	Yes	Yes	Yes

Standard errors are in parentheses
**** $p<.01$, ** $p<.05$, * $p<.1$*
Comment: R-squared for the multilevel models are Snijders/Bosker estimations (Snijders & Bosker, 1994).

Table 24. Likelihood-ratio tests

Comparing the fixed-slope and random slope of model 3 in table 6 (EB 94.3)	LR chi2 (1) = 60.98
	Prob > chi2 = 0.0000
Comparing the fixed-slope and random slope of model 3 in table 7 (EB 95.3)	LR chi2 (1) = 75.88
	Prob > chi2 = 0.0000
Comparing the fixed-slope and random slope of model 2 in table 8 (EB 94.3)	LR chi2 (1) = 239.12
	Prob > chi2 = 0.0000
Comparing the fixed-slope and random slope of model 2 in table 9 (EB 94.3)	LR chi2 (1) = 247.76
	Prob > chi2 = 0.0000

Appendix III – Robustness checks

Table 25. Ordered logistic regression output - testing H_1 (EB 94.3 data, Feb/Mar 2021)

	Model 1 Pooled, bivariate logistic regression	**Model 2** Multilevel fixed-effects ordered logistic regression	**Model 3** Same as model 2 but including ind.-level controls	**Model 4** Same as model 3 but including country-level controls
Institutional trust	-.903***	-.636***	-.575***	-.573***
	(.025)	(.054)	(.053)	(.052)
Individual-level controls	No	No	Yes	Yes
Country-level controls	No	No	No	Yes
Estimated cutpoint 1	-4.194***	-4.26***	-6.169***	-10.397***
	(.048)	(.141)	(.193)	(.962)
Estimated cutpoint 2	-.668***	-.542***	-2.334***	-6.562***
	(.021)	(.138)	(.204)	(.972)
Estimated cutpoint 3	.225***	.445***	-1.297***	-5.524***
	(.02)	(.147)	(.218)	(.979)
Estimated cutpoint 4	1.49***	1.789***	.103	-4.125***
	(.024)	(.147)	(.222)	(.985)
Variance component		.431***	.311***	.143**
(country)		(.089)	(.068)	(.057)
Observations	24192	24192	24192	24192
Pseudo R^2	.021	.z	.z	.z

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 26. Ordered logistic regression output - testing H_1 (EB 95.3 data, Jun/Jul 2021)

	Model 1 Pooled, bivariate logistic regression	**Model 2** Multilevel fixed-effects ordered logistic regression	**Model 3** Same as model 2 but including ind.-level controls	**Model 4** Same as model 3 but including country-level controls
Institutional trust	-.7***	-.484***	-.488***	-.486***
	(.026)	(.061)	(.058)	(.058)
Individual-level controls	No	No	Yes	Yes
Country-level controls	No	No	No	Yes
Estimated cutpoint 1	-.074***	.073	-2.07***	-4.826***
	(.021)	(.134)	(.167)	(1.306)
Estimated cutpoint 2	.434***	.636***	-1.431***	-4.187***
	(.022)	(.165)	(.204)	(1.31)
Estimated cutpoint 3	.88***	1.129***	-.894***	-3.65***
	(.022)	(.167)	(.214)	(1.305)
Estimated cutpoint 4	1.687***	1.986***	.009	-2.747**
	(.026)	(.157)	(.223)	(1.317)
Variance component		.459***	.36***	.237***
(country)		(.126)	(.108)	(.083)
Observations	23 822	23 822	23 822	23 822
Pseudo R^2	.013	.z	.z	.z

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 27. Ordered logistic regression output - testing H_2 using EB 94.3 data

	Model 1 Pooled, bivariate logistic regression	**Model 2** Multilevel fixed-effects ordered logistic regression	**Model 3** Same as model 2 but including ind.-level controls	**Model 4** Same as model 3 but including country-level controls	**Model 5** Same as model 4 but adding control for institutional trust
Performance-based trust	-.503***	-.47***	-.431***	-.43***	-.407***
	(.009)	(.032)	(.031)	(.031)	(.032)
Individual-level controls	No	No	Yes	Yes	Yes
Country-level controls	No	No	No	Yes	Yes
Institutional trust					-.304***
					(.056)
Estimated cutpoint 1	-5.542***	-5.647***	-6.978***	-10.387***	-10.511***
	(.061)	(.204)	(.221)	(.908)	(.91)
Estimated cutpoint 2	-1.89***	-1.798***	-3.04***	-6.447***	-6.566***
	(.036)	(.199)	(.231)	(.937)	(.938)
Estimated cutpoint 3	-.929***	-.742***	-1.946***	-5.353***	-5.468***
	(.034)	(.195)	(.235)	(.942)	(.945)
Estimated cutpoint 4	.443***	.713***	-.452**	-3.86***	-3.968***
	(.034)	(.174)	(.226)	(.94)	(.943)
Variance component (country)		.398***	.301***	.164**	.16**
		(.094)	(.08)	(.066)	(.065)
Observations	24 192	24 192	24 192	24 192	24 192
Pseudo R^2	0.058				

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 28. Ordered logistic regression output - testing H_2 using EB 95.3 data

	Model 1 Pooled, bivariate logistic regression	**Model 2** Multilevel fixed-effects ordered logistic regression	**Model 3** Same as model 2 but including ind.-level controls	**Model 4** Same as model 3 but including country-level controls	**Model 5** Same as model 4 but adding control for institutional trust
Performance-based trust	-.523***	-.474***	-.435***	-.434***	-.418***
	(.01)	(.027)	(.028)	(.028)	(.027)
Individual-level controls	No	No	Yes	Yes	Yes
Country-level controls	No	No	No	Yes	Yes
Institutional trust					-.199***
					(.048)
Estimated cutpoint 1	-1.561***	-1.361***	-2.852***	-4.56***	-4.64***
	(.039)	(.142)	(.142)	(1.075)	(1.082)
Estimated cutpoint 2	-1.007***	-.761***	-2.184***	-3.892***	-3.972***
	(.038)	(.18)	(.19)	(1.073)	(1.08)
Estimated cutpoint 3	-.511***	-.224	-1.612***	-3.32***	-3.398***
	(.038)	(.184)	(.198)	(1.064)	(1.07)
Estimated cutpoint 4	.391***	.718***	-.637***	-2.345**	-2.421**
	(.038)	(.173)	(.2)	(1.075)	(1.079)
Variance component (country)		.352***	.294***	.208***	.205***
		(.114)	(.102)	(.066)	(.065)
Observations	23 822	23 822	23 822	23 822	23 822
Pseudo R^2	0.061				

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 29. Testing alternative operationalizations of institutional trust in the full model – H_1 (EB 94.3)

Trust in public administration	-0.282*** (0.034)			
Trust in national government		-0.401*** (0.042)		
Trust in the national parliament			-0.342*** (0.031)	
Trust in political parties				-0.288*** (0.027)
Individual-level control variables	Yes	Yes	Yes	Yes
Country-level control variables	Yes	Yes	Yes	Yes
Intercept	5.127*** (0.554)	5.114*** (0.495)	5.067*** (0.489)	5.156*** (0.54)
lns1_1_1:_cons	-1.567*** (0.190)	-1.59*** (0.196)	-1.594*** (0.189)	-1.558*** (0.197)
lnsig_e:_cons	-0.002 (0.022)	-0.010 (0.022)	-0.005 (0.022)	0.002 (0.023)
Observations	23 801	23 825	23 723	23 845

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 30. Testing alternative operationalizations of institutional trust in the full model – H_1 (EB 95.3)

Trust in public administration	-0.313*** (0.040)			
Trust in national government		-0.373*** (0.054)		
Trust in the national parliament			-0.314*** (0.046)	
Trust in political parties				-0.193*** (0.042)
Individual-level control variables	Yes	Yes	Yes	Yes
Country-level control variables	Yes	Yes	Yes	Yes
Intercept	4.471*** (.838)	4.577*** (.811)	4.58*** (.822)	4.715*** (.862)
lns1_1_1:_cons	-1.198*** (.134)	-1.201*** (.135)	-1.194*** (.132)	-1.164*** (.136)
lnsig_e:_cons	.247*** (.039)	.248*** (.039)	.251*** (.039)	.257*** (.039)
Observations	23 290	23 341	23 130	23 419

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 31. Testing alternative operationalizations of institutional trust in the full model – H_2 (EB 94.3)

Performance-based trust	-.216*** (.016)	-.209*** (.015)	-.213*** (.015)	-.217*** (.016)
Trust in public administration	-.083*** (.031)			
Trust in national government		-.087*** (.03)		
Trust in the national parliament			-.098*** (.019)	
Trust in political parties				-.086*** (.018)
Individual-level control variables	Yes	Yes	Yes	Yes
Country-level control variables	Yes	Yes	Yes	Yes
Intercept	5.149*** (.518)	5.175*** (.5)	5.131*** (.487)	5.159*** (.509)
lns1_1_1:_cons	-1.534*** (.2)	-1.546*** (.202)	-1.552*** (.196)	-1.536*** (.202)
lnsig_e:_cons	-.046** (.022)	-.046** (.022)	-.046** (.022)	-.044** (.022)
Observations	23801	23825	23723	23845
Pseudo R^2				

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 32. Testing alternative operationalizations of institutional trust in the full model – H_2 (EB 95.3)

Performance-based trust	-0.277*** (0.020)	-0.282*** (0.019)	-0.283*** (0.021)	-0.287*** (0.021)
Trust in public administration	-0.068*** (0.022)			
Trust in national government		-0.008 (0.036)		
Trust in the national parliament			-0.025 (0.027)	
Trust in political parties				0.038 (0.036)
Individual-level control variables	Yes	Yes	Yes	Yes
Country-level control variables	Yes	Yes	Yes	Yes
Intercept	4.424*** (0.674)	4.547*** (0.684)	4.557*** (0.671)	4.569*** (0.679)
lns1_1_1:_cons	-1.305*** (0.143)	-1.289*** (0.145)	-1.298*** (0.146)	-1.297*** (0.142)
lnsig_e:_cons	0.203*** (0.037)	0.206*** (0.037)	0.206*** (0.037)	0.207*** (0.037)
Observations	23 290	23 341	23 130	23 419
Pseudo R^2				

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Distribution of residuals in the full models

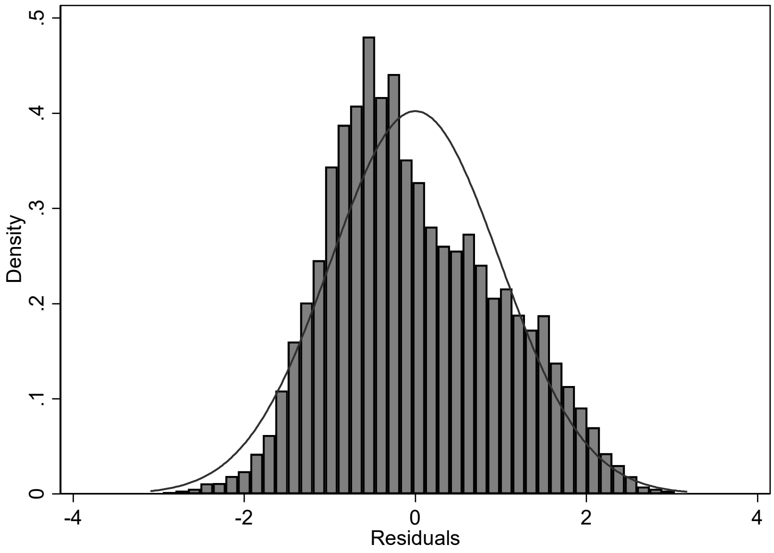

Figure 12. Histogram of the residuals for the full model testing H_1 (EB 94.3)

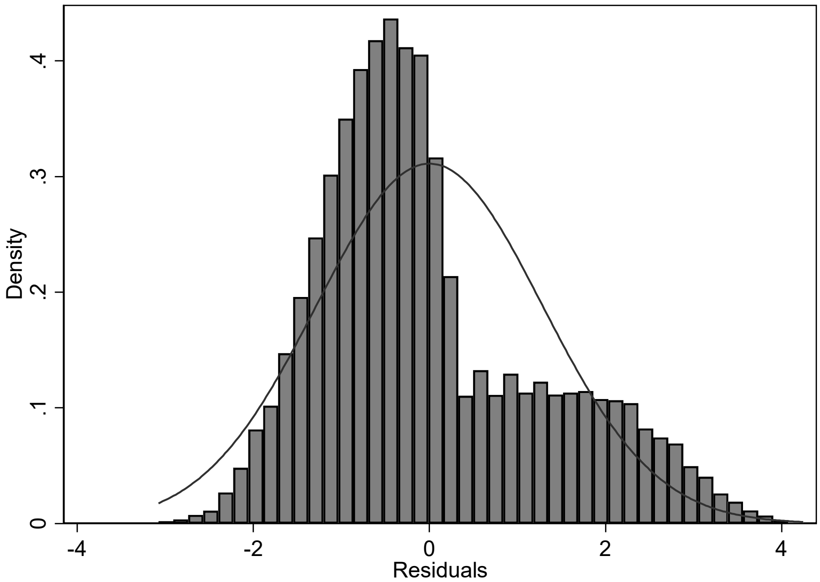

Figure 13. Histogram of the residuals for the full model testing H_1 (EB 95.3)

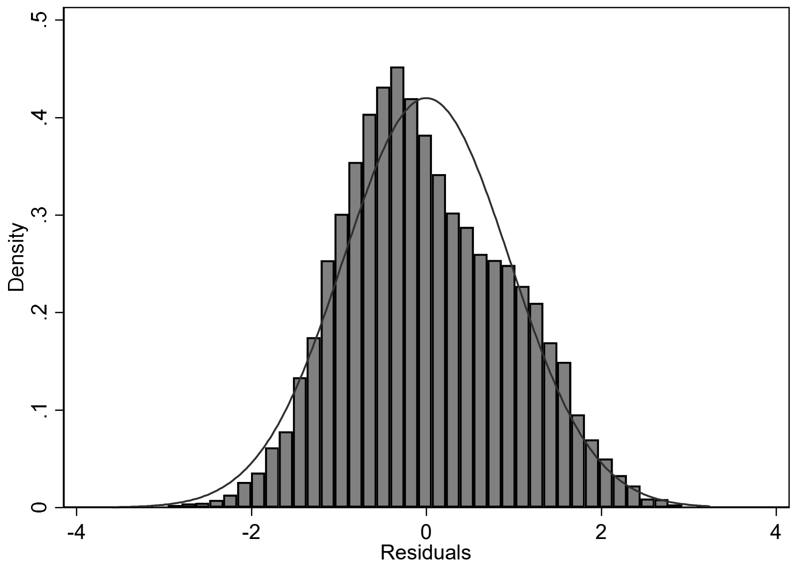

Figure 14. Histogram of residuals for the full model testing H_2 (EB 94.3)

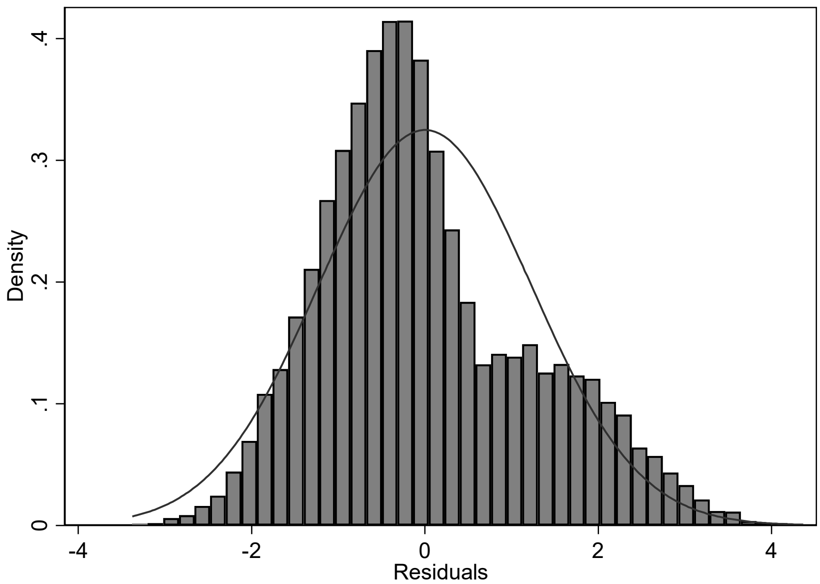

Figure 15. Histogram of residuals for the full model testing H_2 (EB 95.3)

Visualizing interaction effects

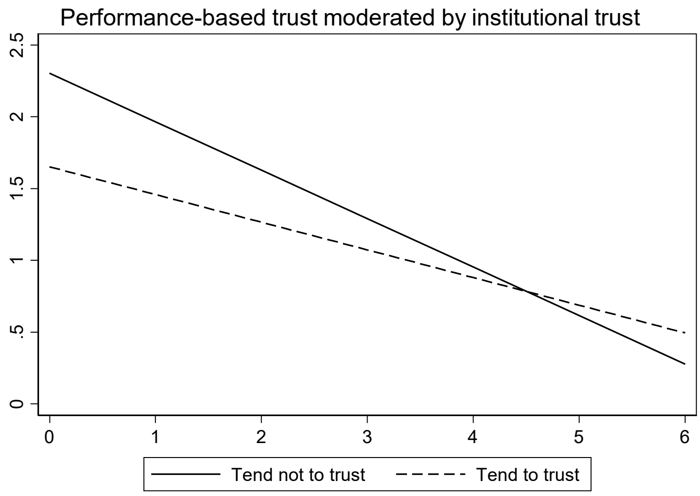

Figure 16. The effect on vaccine hesitancy by performance-based trust as moderated by institutional trust (EB 94.3)

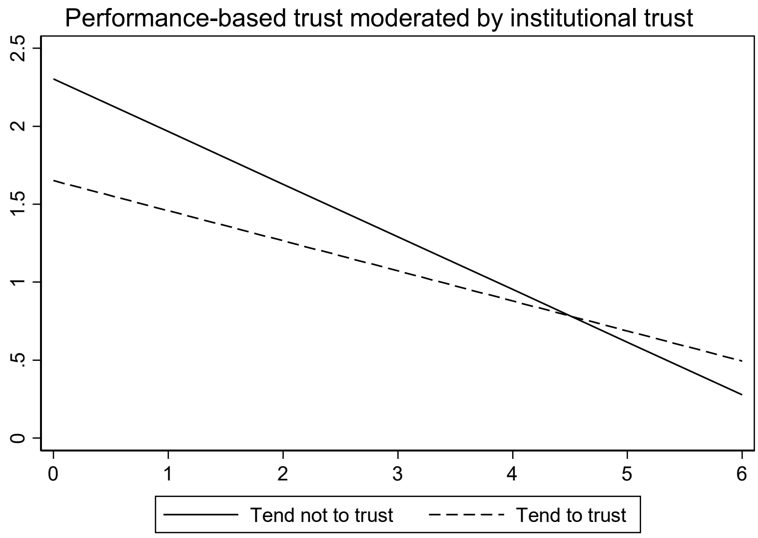

Figure 17. The effect on vaccine hesitancy by performance-based trust as moderated by institutional trust (EB 95.3)