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ABSTRACT

Risk Aversion and COVID-19 Vaccine Hesitancy

We here investigate the role of risk aversion in COVID-19 vaccine hesitancy. The theoretical effect is ambiguous, as both COVID-19 infection and vaccination side-effects involve probabilistic elements. In large-scale data covering five European countries, we find that vaccine hesitancy falls with risk aversion, so that COVID-19 infection is perceived as involving greater risk than is vaccination.

JEL Classification: I12, D81

Keywords: risk aversion, COVID-19, vaccine hesitancy

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1. Introduction

Despite the World Health Organization stating that vaccination is the most-effective way of eradicating disease, and millions of lives being saved every year by vaccines,[1] immunisation rates are often insufficient to reach herd immunity (Wiysonge *et al*., 2022). The first common explanation of incomplete vaccine coverage in the literature is material, underlining difficulties in vaccination access. The second is psychological. Theoretical models, such as Carpenter (2010) Zampetakis and Melas (2021), Courbage and Peter (2021) and Peter (2021), underline that the choice of vaccination reflects a trade-off between two risks: that from the disease itself and that from vaccination side-effects. Both risk aversion and the relative size of these two perceived risks therefore play key roles.

We here consider vaccine hesitancy in Europe during the COVID-19 crisis. This is a period of particular interest firstly because the scale of resources devoted by governments made vaccines almost universally-available (by the time that our data was collected). Any remaining non-vaccination may then be psychological in origin. Second, the sudden development of the pandemic and the lack of knowledge about any vaccine side-effects contributed to a climate of distrust in science and governments (as symbolised by the NoVax movement). In the extraordinary circumstances of the COVID-19 crisis it was not possible to state definitively *ex ante* whether individuals saw the pandemic itself or vaccine side-effects as the greatest health threat.

This uncertainty about relative risks is the main motivation for our research here. We use frequent panel data from five European countries (France, Germany, Italy, Spain and Sweden) to see how risk aversion is related to individual vaccination status in June 2021. The risk-aversion score is measured six months earlier than vaccination status in order to avoid any common-method variance issues. Risk aversion increases vaccine take-up, so that COVID-19 infection seems to be perceived as more risky than are any vaccine side-effects: a one standard-deviation rise in risk aversion predicts lower vaccine hesitancy of 1.4 percentage points (which is around 10% of the incidence of vaccine hesitancy). This figure does not change with the introduction of a large set of control variables in the regression, so that omitted variables may not be a major concern. Last, we analyse the vaccination status of our respondents in late October – early November 2021 and show

[1] See the website of the World Health Organization for more details: https://www.who.int/health-topics/vaccines-and-immunization#tab=tab_1.

that the predictive power of risk aversion is time-sensitive: the rise in the cost of vaccine hesitancy after the Summer of 2021 attenuates the vaccine hesitancy explained by risk aversion.

These results contribute to a number of different strands of the literature. They first provide a new perspective to the literature on psychological factors and vaccine hesitancy when the long-run effects of both disease and vaccines are far-better known, such as influenza (see, among others, Chapman and Coups, 1999; Mullahy, 1999; Shim *et al.*, 2012; Tsutsui *et al.*, 2012; Chen and Stevens, 2017; Kim *et al.*, 2017; Schmid *et al.*, 2017). Second, we add to the specific knowledge about COVID-19 vaccine hesitancy, most of which refers to *hypothetical vaccination preferences* in periods when vaccines were not yet available (Dror *et al.*, 2020; Edwards *et al.*, 2021; Machida *et al.*, 2021; McCabe *et al.*, 2021; Murphy *et al.*, 2021; Robertson *et al.*, 2021; Schwarzinger *et al.*, 2021; Soares *et al.*, 2021; Tsutsui *et al.*, 2021; Trueblood *et al.*, 2021; Guillon and Kergall, 2022). We on the contrary analyse *revealed vaccination behaviour*. Our results differ from those in Guillon and Kergall (2022) and Trueblood *et al.* (2021), both of which conclude that risk-aversion reduces vaccine acceptance. Although these papers use different definitions of vaccine hesitancy and time periods than those used here, the difference in results could also reflect that the determinants of hypothetical and real choices are not the same for all issues (Benjamin *et al.*, 2012).

The remainder of the paper is organised as follows. Section 2 introduces our dataset, and the empirical model and analysis sample then appear in Section 3. Section 4 presents and discusses the results. Last, Section 5 concludes.

2. Data and Vaccination Policies during the Data Collection

The COME-HERE (COVID-19, MEntal Health, Resilience and Self-regulation) survey is a longitudinal study designed by researchers at the University of Luxembourg (for details see Vögele *et al.*, 2020). The survey is carried out by Qualtrics on nationally-representative samples of adults (aged 18 or over) in France, Germany, Italy, Spain and Sweden. Stratification ensured that the data was representative in terms of gender, region, and age. Ethics approval was granted by the Ethics Review Panel of the University of Luxembourg. The survey currently includes ten waves of data collected over the period from April 2020 to December 2022.

In Wave 6 of the COME-HERE survey (June 2021), when vaccine rollouts were at their peak, respondents were asked about their vaccination status: *"Have you been vaccinated against Covid-*

19?", with the three response categories of *"Yes", "No, but I plan to. I am waiting for my turn to come"*, and *"No, and I do not plan to"*. In the remainder of the paper, we will refer to the participants who replied "No, and I do not plan to" as the vaccine-hesitant.

Risk-aversion was assessed in Waves 2, 4, 6, and 8 via the self-reported willingness-to-take-risks on an 11-point scale: *"How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please tick a box on the scale, where the value 0 means: 'unwilling to take risks' and the value 10 means: 'fully prepared to take risk'*. We reverse this scale in our empirical analysis so that higher numbers indicate greater risk-aversion.

The survey further collects detailed information on individuals' living conditions and mental health during the pandemic, as well as recent changes and events in their lives. There is also information on standard sociodemographic characteristics such as age, gender, education, labour-force status, and country and region of residence.

Most of the COME-HERE Wave 6 interviews took place in the first week of June 2021. Vaccination was already universal in France at this time. In Germany and Italy, access to vaccination for all was introduced on June 7th and 19th respectively. Last, universal vaccination in Spain and Sweden was implemented after the data collection for Wave 6 of COME-HERE (https://ourworldindata.org/covid-vaccination-policy). Prior to universal access, vaccine access mainly depended on age, occupation and the existence of a comorbidity. We will also use the data from the COME-HERE Wave 7 interviews (collected between October 14th and November 9th 2021) in the last part of our analysis to assess the extent to which the rise in the cost of vaccine-hesitancy (for example, from the introduction of the EU Digital COVID Certificate required to gain access to many public spaces) moderated the relationship between vaccination status and risk aversion.

3. Empirical Strategy

Faced with uncertainty about health outcomes, the choice to be vaccinated against COVID-19, when the vaccine is widely-available, will depend on individual risk attitudes. We estimate the following linear probability model:[2]

[2] We have also estimated the full model via probit and logit regressions. The results from these in the first two columns of Online Appendix Table A1 are similar to those from the linear-probability model.

$$VH_{ij} = \beta_1 RA_i + \beta_2 D_i + \beta_3 E_i + \beta_4 H_i + \beta_5 I_i + \beta_6 COVID_{jd} + \lambda_d + \mu_j + \epsilon_{ijd}. \quad (1)$$

In Equation (1), VH_{ijt} is a dummy variable for individual i in country j interviewed at time d reporting that they had not been vaccinated and did not plan to do so; VH_{ij} is hence zero for those who have either already been vaccinated or are planning to do so in the near future.[3] RA_i is our risk-aversion measure, on a scale of 0 to 10 with higher values indicating greater risk aversion.[4] We address potential concerns about common-method variance and reverse causality by taking a measure of risk aversion from Wave 4 of COME-HERE, which was fielded six months prior to the wave with the vaccine question.

Risk aversion differs by age, gender and other socio-demographic variables (Barsky *et al.*, 1997; Donkers *et al.*, 2001; Dohmen *et al.*, 2011), and so does access to vaccines and vaccine hesitancy in the COME-HERE data (Borga *et al.*, 2022). Given the substantial difficulty in finding exogenous variations in risk aversion, we introduce a variety of control variables to address the issue of confounding. In this respect, D_i is a vector of demographic characteristics (age and dummies for female, being partnered, post-Secondary education and having children living in the household), E_i contains economic variables (log equivalised net monthly household income in PPP, equivalised using the square root of the number of household members, labour-force status and homeownership, which is a proxy for wealth), health-related variables appear in H_i (dummies for at least one diagnosed physical health condition and having tested positive for COVID-19 at least once since the beginning of the pandemic), and last I_i covers attitudes (via dummies for supporting a Right-wing party, a Left-wing party, and the respondent's degree of confidence in the government's ability to handle the COVID-19 crisis measured on a Likert scale from 1 to 7). This last confidence evaluation comes from Wave 5 of the COME-HERE data, again to address

[3] There are three response categories for the vaccine question, and it could be argued that respondents who reported "No, but I plan to. I am waiting for my turn to come" are also vaccine hesitant. To see whether this group are indeed different from those who are already vaccinated, at least in terms of their risk aversion, we estimate a multinomial-logit model to see how risk aversion predicts the separate probabilities of answering "Yes", "No, but I plan to. I am waiting for my turn to come" and "No, and I do not plan to". The resulting marginal effects appear in Appendix Table A2. The six models in this table are the same as those in Table 2. In most cases, the risk-aversion coefficient is not statistically different for the "Yes" and "No, but I plan to. I am waiting for my turn to come" categories. The only exception is in model 1, where risk aversion predicts a lower probability of belonging to the "No, but I plan to. I am waiting for my turn to come" category. However, the coefficients here are confounded by age: older people are more risk-averse, and at the time of the COME-HERE Wave 6 data collection were more likely to have had the vaccine made available to them (and so less likely to be waiting their turn).

[4] We here assume that the risk-aversion scale can be interpreted cardinally. In column (3) of Appendix Table A1, we show that qualitatively-similar results are obtained if we replace the continuous measure of risk aversion by a dummy variable for individuals with a risk-aversion score that is above the median value.

common-method variance concerns. Last, $COVID_{jd}$ is a vector reflecting the evolution of the pandemic itself and the resulting policy responses in each country: the 4-week average number of daily COVID-19 deaths per 100,000 inhabitants and the 2-week average Stringency Index (the latter supplied by the Blavatnik School of Governance at the University of Oxford).[5] λ_d and μ_j are respectively day-of-interview and country fixed effects.[6] All of the continuous variables have been standardised.

We estimate Equation (1) on the sample of respondents who have non-missing information for both the dependent and independent variables. The descriptive statistics for the resulting estimation sample of 3906 respondents appear in Table 1.[7] Around 13% of these respondents are not vaccinated and do not wish to be so. Average risk aversion is 6.15 on the zero to ten scale, with a standard deviation of 2.71. The distribution of risk aversion is plotted in Figure 1. The sample is split equally by sex, and average age is around 52.

4. Results

The estimated coefficients on risk aversion from the linear-probability estimation of vaccine hesitancy appear in Table 2. The first column includes no other control variables (apart from the fixed effects for the day of the interview and country of residence). We then introduce in turn a number of control variables to finally produce the full model corresponding to Equation (1) in the last column. The estimated coefficients on all of the control variables appear in Appendix Table A3.

[5] The Stringency Index is composed of the nine following sub-indices, measuring various aspects of containment policies: "school closing", "workplace closing", "cancellation of public events", "restriction on gathering", "public transport closing", "stay-at-home requirements", "restriction on internal movement", "restriction on international travel" and "public information campaign". It ranges from 0 to 100, and a higher value of the index corresponds to a more-stringent country lockdown-style policy response to COVID-19.

[6] Time preferences may also matter for vaccination decisions, and may be correlated with risk aversion. The Wave-2 questionnaire of our survey included a series of hypothetical choices of over monetary payments occurring at different points in time (similar to the staircase method in Falk *et al*., 2016). We use these individual choices to construct a patience score ranging from 1 to 16, where higher scores correspond to more patience. This is included in our list of controls in column (6) of Appendix Table A1. The results change only very little, perhaps because patience and risk aversion are almost uncorrelated in our data (with a correlation coefficient of 0.02).

[7] 4899 respondents participated in Wave 6 of COME-HERE. Our sample selection drops 993 observations either due to missing retrospective risk aversion in 87% of cases or missing control variables in the other 13%. The respondents we dropped are more likely to be young and to be men. We apply an inverse probability weighting procedure to account for this selection in our robustness checks: the results in column (4) of Appendix Table A1 are similar to our benchmark estimates.

The predicted effect of risk aversion on vaccination is ambiguous, in the context of uncertainty about any side-effects of COVID-19 vaccines. In column (1) of Table 2, risk-averse individuals are more likely to accept vaccination, which is consistent with the perceived risk posed by COVID-19 infection being greater than that from vaccination.

It is important to be careful about confounding variables: for example, women are often considered to be more risk-averse than men, and could perhaps be more open to vaccination as they are more often in contact with young children. Columns (2) through (6) of Table 2 add the various control variables in Equation (1) in turn. The estimated risk-aversion coefficient is remarkably stable across the different specifications: as such, the relationship between risk aversion and vaccine hesitancy is not confounded by the wide variety of control variables introduced.[8,9] The estimated relationship is non-negligible in size: a one standard-deviation rise in risk aversion is associated with a 1.4 percentage-point fall in vaccine hesitancy, which from Table 1 is about 10% of the mean incidence of vaccine hesitancy in our analysis sample.

To what extent does this result depend on vaccination policies? In the summer of 2021, the cost of non-vaccination rose dramatically with the introduction of the EU Digital COVID Certificate. For example, the Italian government even made vaccination mandatory for workers on October 15th 2021. We take advantage of the fact that we also have information on vaccination status in COME-HERE Wave 7 (collected between the 14th of October and the 9th of November 2021). We therefore re-estimate the specifications in Table 2, but this time using reported vaccine hesitancy in Wave 7 as the dependent variable. The results appear in Appendix Table A5. Although the estimated coefficients remain negative, they no longer play a significant role in vaccination decisions. Putting the results from Table 2 and Appendix Table A5 together suggests that the cost of vaccine hesitancy moderates the effect of risk aversion.[10]

[8] In addition to this lack of confounding, Appendix Table A4 shows that there is no significant moderation in this relationship by age, gender or education.

[9] It could be argued that the level of risk aversion depends on the pandemic, or even the economic and health environment. As such, even though we control for day-of-interview fixed effects, country fixed effects, the Stringency Index and 4-week average COVID-19 deaths, our estimates could still reflect the influence of some unobserved time-varying confounder. We can attenuate this concern by using the risk-aversion score from June 2020 (which is one year before the risk-aversion score we use in our main specification). The results in column (5) of Appendix Table A1 are the same as those in the main specification: greater risk aversion predicts less vaccine hesitancy.

[10] In Appendix Table A6, we replace the measure of vaccine hesitancy with a dummy for individuals who reported in both Waves 6 and 7 that they do not plan to be vaccinated: this dummy variable captures what we call vaccine reluctance. The results are like those in Appendix Table A5.

5. Conclusion

The uptake of vaccines is related to both their availability and individual preferences. Given the widespread vaccine roll-out in EU countries at the time of our survey data, preferences likely play a large role in any observed vaccine hesitancy. In data covering around four thousand individuals in five European countries, and accounting for a substantial number of potential confounding variables, we show that vaccine acceptance rises with risk aversion.

These results are important from a policy and health perspective. The sign of the correlation between risk aversion and vaccination is *a priori* ambiguous. Finding this to be positive indicates that the risk from COVID-19 infection was on average perceived to be greater than that of any potential vaccine side-effects at the time of our survey. This relationship seems to vanish when the cost of vaccine hesitancy increases. It may also change in size or even in sign as new information becomes available about any longer-term vaccine side-effects and the dangers from new COVID-19 variants.

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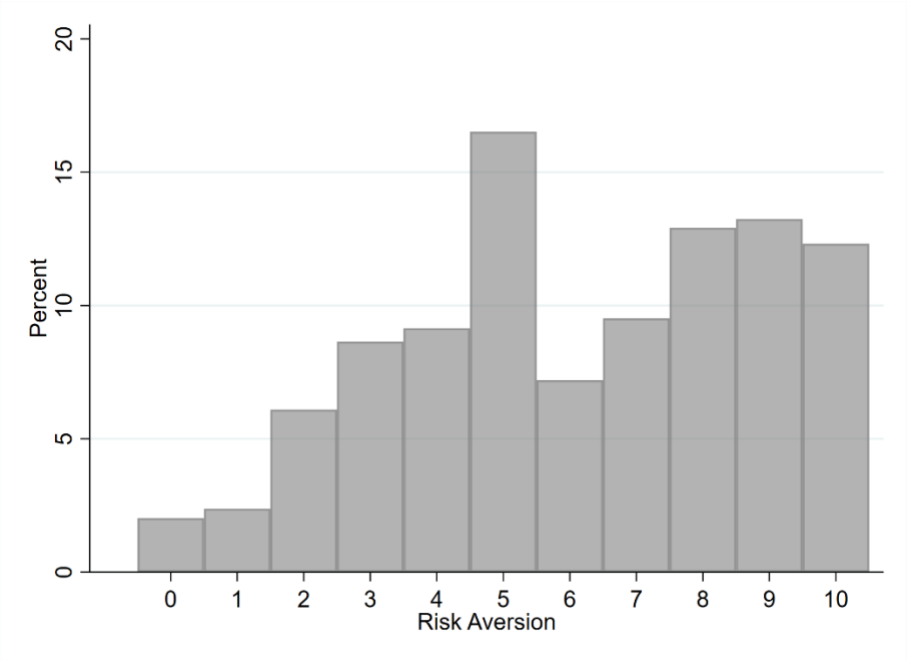
Figures and Tables:

Figure 1: The Distribution of Risk Aversion in the Estimation Sample



Note: These figures refer to our estimation sample.

Table 1: Descriptive Statistics of the Estimation Sample

	Mean	SD	Min	Max
Vaccine Hesitant	0.13		0	1
Risk Aversion	6.15	2.71	0	10
Female	0.49		0	1
Age	51.78	15.32	18	88
Living with a Partner	0.64		0	1
Post-Secondary Education	0.43		0	1
Children in the Household	0.27		0	1
Patience Score	9.58	4.65	1	16
Log Equivalised Monthly Net HH Income	7.41	0.62	5.33	9.36
Homeowner	0.69		0	1
Employed	0.55		0	1
Unemployed	0.05		0	1
Out of the Labour Force (Working Age)	0.10		0	1
Retired	0.30		0	1
Underlying Health Condition	0.30		0	1
Ever Tested Positive for Covid-19	0.10		0	1
Confidence in the Government	4.09	1.83	1	7
Right-Wing Supporter	0.25		0	1
Centre Supporter	0.47		0	1
Left-Wing Supporter	0.28		0	1
Number of daily deaths/100,000 inhabitants (4-week average)	0.18	0.06	0.05	0.28
Stringency Index (2-week average)	64.4	7.14	47.7	74.3
France	0.23		0	1
Germany	0.16		0	1
Italy	0.23		0	1
Spain	0.24		0	1
Sweden	0.13		0	1

Notes: These figures refer to our estimation sample from Wave 6 of COME-HERE. N=3906.

Table 2: Risk Aversion and Vaccine Hesitancy – LPM Results

	Vaccine Hesitancy (0-1)					
	(1)	(2)	(3)	(4)	(5)	(6)
Risk Aversion (std)	-0.018***	-0.012**	-0.013**	-0.013**	-0.014***	-0.014***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Observations	3906	3906	3906	3906	3906	3906
Demographic controls	.	✓	✓	✓	✓	✓
Economic controls	.	.	✓	✓	✓	✓
Health controls	.	.	.	✓	✓	✓
Attitudes controls	.	.	.	.	✓	✓
COVID-19 controls	.	.	.	.	.	✓

Notes: These are estimates from linear regressions. Standard errors are in parentheses. Risk aversion is a continuous score (from 0 to 10) measured between November and December 2020. Vaccine hesitancy is measured in June 2021. All of the regressions include day-of-interview and country fixed effects. The demographic controls are age, dummy variables for female, post-Secondary education, partnered and parenthood. The economic controls are log equivalent household income (in PPP), a homeownership dummy and labour-force status dummies. The health controls are dummies for having a health condition (other than COVID-19) and for having been infected with COVID-19 in the past. The attitudes controls are confidence in the government (scale 1-7) and political-orientation dummies. The COVID-19 controls are the 4-week average number of COVID-19 deaths and the 2-week average of the Stringency Index.

Appendix:

Table A1: Risk Aversion and Vaccine Hesitancy – Robustness Checks

	Vaccine Hesitancy (0-1)					
	(1)	(2)	(3)	(4)	(5)	(6)
Risk Aversion (std)	-0.013**	-0.013***		-0.014**	-0.011*	-0.013***
	(0.005)	(0.005)		(0.005)	(0.006)	(0.005)
High Risk Aversion (dummy)			-0.027***			
			(0.011)			
Observations	3906	3906	3906	3906	3144	3906

Notes: Columns (1) and (2) respectively list the marginal effects from probit and logit regressions. Columns (3) to (5) refer to linear regressions. Standard errors are in parentheses. Risk aversion is a continuous score (from 0 to 10) measured between November and December 2020 in columns (1) to (4) and (6) and in June 2020 in column (5). "High Risk Aversion" is a dummy for respondents with risk aversion over the median estimation-sample figure. Column (4) uses an inverse probability weighting procedure to account for selective attrition. Column (6) controls for a patience score. All of the regressions include day-of-interview and country of residence fixed effects. The demographic controls are age, dummy variables for female, post-Secondary education, partnered and parenthood. The economic controls are log equivalent household income (in PPP), a homeownership dummy and labour-force status dummies. The health controls are dummies for having a health condition (other than COVID-19) and for having been infected with COVID-19 in the past. The attitudes controls are confidence in the government (scale 1-7) and political-orientation dummies. The COVID-19 controls are the 4-week average number of COVID-19 deaths and the 2-week average of the Stringency Index.

Table A2: Risk Aversion and Vaccine Status – Multinomial Logit Results

	Have you been vaccinated against COVID-19?		
	Yes	No, but I plan to	No and I do not plan to
	(1)	(2)	(3)
Model 1:			
Risk Aversion (std)	0.039***	-0.020***	-0.018***
	(0.008)	(0.007)	(0.005)
Observations	3906	3906	3906
Model 2:			
Risk Aversion (std)	0.001	0.011	-0.011**
	(0.007)	(0.007)	(0.005)
Observations	3906	3906	3906
Model 3:			
Risk Aversion (std)	0.002	0.010	-0.012**
	(0.007)	(0.007)	(0.005)
Observations	3906	3906	3906
Model 4:			
Risk Aversion (std)	0.003	0.010	-0.013**
	(0.007)	(0.007)	(0.005)
Observations	3906	3906	3906
Model 5:			
Risk Aversion (std)	0.003	0.010	-0.013**
	(0.007)	(0.007)	(0.005)
Observations	3906	3906	3906
Model 6:			
Risk Aversion (std)	0.003	0.010	-0.013**
	(0.007)	(0.007)	(0.005)
Observations	3906	3906	3906

Notes: These are marginal effects from multinomial-logit regressions. Standard errors are in parentheses. Risk aversion is a continuous score (from 0 to 10) measured between November and December 2020. Vaccine hesitancy is measured in June 2021. All of the models include day-of-interview and country fixed effects. Model 2 include the demographic controls (age, dummy variables for female, post-Secondary education, partnered and parenthood). Model 3 adds the economic controls (log equivalent household income (in PPP), a homeownership dummy and labour-force status dummies). Model 4 adds the health controls (dummies for having a health condition, other than COVID-19, and for having been infected with COVID-19 in the past). Model 5 adds the attitudes controls (confidence in the government (scale 1-7) and political-orientation dummies). Model 6 adds the COVID-19 controls (the 4-week average number of COVID-19 deaths and the 2-week average of the Stringency Index).

Table A3: Risk Aversion and Vaccine Hesitancy – Full LPM Results from Table 2

	Vaccine Hesitancy (0-1)					
	(1)	(2)	(3)	(4)	(5)	(6)
Risk Aversion[S]	-0.018***	-0.012**	-0.013**	-0.013**	-0.014***	-0.014***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Female		0.008	0.002	-0.000	0.007	0.007
		(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Age[S]		-0.051***	-0.038***	-0.036***	-0.034***	-0.034***
		(0.006)	(0.008)	(0.008)	(0.008)	(0.008)
Post-Secondary Education		-0.055***	-0.040***	-0.039***	-0.044***	-0.044***
		(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Living with a Partner		-0.034***	-0.020	-0.020	-0.017	-0.017
		(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Children in the Household		0.011	0.003	0.005	0.006	0.006
		(0.013)	(0.014)	(0.014)	(0.013)	(0.013)
Equivalised Monthly Net HH Income (in logs)[S]			-0.034***	-0.035***	-0.032***	-0.032***
			(0.006)	(0.006)	(0.006)	(0.006)
Home-owner			-0.035***	-0.035***	-0.035***	-0.035***
			(0.013)	(0.013)	(0.012)	(0.012)
Employment Status (Ref. = Employed)						
Unemployed			0.044*	0.044*	0.041*	0.041*
			(0.025)	(0.025)	(0.024)	(0.024)
Out of Labour Force (Working Age)			-0.026	-0.025	-0.018	-0.018
			(0.019)	(0.019)	(0.019)	(0.019)
Retired			-0.021	-0.021	-0.013	-0.013
			(0.016)	(0.016)	(0.016)	(0.016)
Underlying Health Condition				-0.034***	-0.036***	-0.036***
				(0.012)	(0.011)	(0.011)
Ever Tested Positive for Covid-19				-0.024	-0.027	-0.027
				(0.018)	(0.017)	(0.017)
Confidence in Government[S]					-0.062***	-0.062***
					(0.005)	(0.005)
Political Orientation (Ref. = Centre)						
Political Orientation: Left					0.022*	0.021
					(0.013)	(0.013)
Political Orientation: Right					0.034***	0.033***
					(0.013)	(0.013)
Number of daily deaths/100,000 inhabitants (4-week average)[S]						0.024
						(0.070)
Stringency Index (2-week average)[S]						-0.014
						(0.078)
Country Dummies (Ref. = France)						
Germany	-0.080***	-0.084***	-0.087***	-0.087***	-0.067***	-0.036
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.152)
Italy	-0.096***	-0.119***	-0.126***	-0.126***	-0.101***	0.091
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.198)

Spain	-0.145***	-0.145***	-0.150***	-0.146***	-0.145***	-0.099*
	(0.016)	(0.015)	(0.015)	(0.016)	(0.015)	(0.054)
Sweden	-0.088***	-0.101***	-0.114***	-0.113***	-0.106***	-0.064
	(0.019)	(0.019)	(0.019)	(0.019)	(0.018)	(0.049)
Observations	3906	3906	3906	3906	3906	3906

Notes: These are the results from linear regressions. Standard errors are in parentheses. Risk aversion is a continuous score (from 0 to 10) measured between November and December 2020. Vaccine hesitancy is measured in June 2021. All of the regressions include day-of-interview fixed-effects. All continuous independent variables are standardised: these are indicated by a ^{S} next to the variable name.

Table A4: Risk Aversion and Vaccine Hesitancy – Heterogeneity Results

	Vaccine Hesitancy (0-1)		
	(1)	(2)	(3)
Risk Aversion (std)	-0.018**	-0.011	-0.013*
	(0.007)	(0.007)	(0.007)
Interacted with:			
Female	0.008		
	(0.010)		
Above Median Age		-0.006	
		(0.010)	
Post-Secondary Education			-0.001
			(0.010)
Observations	3906	3906	3906

Notes: These are results from linear regressions. Standard errors are in parentheses. Risk aversion is a continuous score (from 0 to 10) measured between November and December 2020. Vaccine hesitancy is measured in June 2021. All of the regressions include day-of-interview and country of residence fixed effects. The demographic controls are age, dummy variables for female, post-Secondary education, partnered and parenthood. The economic controls are log equivalent household income (in PPP), a homeownership dummy and labour-force status dummies. The health controls are dummies for having a health condition (other than COVID-19) and for having been infected with COVID-19 in the past. The attitudes controls are confidence in the government (scale 1-7) and political-orientation dummies. The COVID-19 controls are the 4-week average number of COVID-19 deaths and the 2-week average of the Stringency Index.

Table A5: Risk Aversion and Vaccine Hesitancy in late October-early November 2021 – LPM Results

	Vaccine Hesitancy (0-1)					
	(1)	(2)	(3)	(4)	(5)	(6)
Risk Aversion (std)	-0.006	-0.005	-0.007	-0.007	-0.008*	-0.008*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	3707	3707	3707	3707	3707	3707
Demographic controls	.	✓	✓	✓	✓	✓
Economic controls	.	.	✓	✓	✓	✓
Health controls	.	.	.	✓	✓	✓
Attitudes controls	.	.	.	.	✓	✓
COVID-19 controls	.	.	.	.	.	✓

Notes: These are estimates from linear regressions. Standard errors are in parentheses. Risk aversion is a continuous score (from 0 to 10) measured between November and December 2020. Vaccine hesitancy is measured in late October-early November 2021. All of the regressions include day-of-interview and country fixed effects. The demographic controls are age, dummy variables for female, post-Secondary education, partnered and parenthood. The economic controls are log equivalent household income (in PPP), a homeownership dummy and labour-force status dummies. The health controls are dummies for having a health condition (other than COVID-19) and for having been infected with COVID-19 in the past. The attitudes controls are confidence in the government (scale 1-7) and political-orientation dummies. The COVID-19 controls are the 4-week average number of COVID-19 deaths and the 2-week average of the Stringency Index.

Table A6: Risk Aversion and Vaccine Reluctance late October-early November 2021 – LPM Results

	Vaccine Reluctant (0-1)					
	(1)	(2)	(3)	(4)	(5)	(6)
Risk Aversion (std)	-0.003	-0.002	-0.004	-0.004	-0.005	-0.004
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	3707	3707	3707	3707	3707	3707
Demographic controls	.	✓	✓	✓	✓	✓
Economic controls	.	.	✓	✓	✓	✓
Health controls	.	.	.	✓	✓	✓
Attitudes controls	.	.	.	.	✓	✓
COVID-19 controls	.	.	.	.	.	✓

Notes: These are estimates from linear regressions. Standard errors are in parentheses. Risk aversion is a continuous score (from 0 to 10) measured between November and December 2020. "Vaccine reluctant" is a dummy for those who those who were not vaccinated and who did not plan to be vaccinated in both June 2021 and late October-early November 2021. All of the regressions include day-of-interview and country fixed-effects. The demographic controls are age, dummy variables for female, post-Secondary education, partnered and parenthood. The economic controls are log equivalent household income (in PPP), a homeownership dummy and labour-force status dummies. The health controls are dummies for having a health condition (other than COVID-19) and for having been infected with COVID-19 in the past. The attitudes controls are confidence in the government (scale 1-7) and political-orientation dummies. The COVID-19 controls are the 4-week average number of COVID-19 deaths and the 2-week average of the Stringency Index.