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## Policy incentives and determinants of citizens' COVID-19 vaccination motives

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# University of Göttingen

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# Policy Incentives and Determinants of Citizens' COVID-19 Vaccination Motives\*

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## Abstract

This paper presents the results of a survey exploring the determinants of vaccinees' confidence in COVID-19 vaccines and their motivations to become vaccinated. At the threatening rise of the highly infectious Omicron variant, in December 2021, we interviewed people in waiting lines of vaccination centers. Our results identify risk-averse and social-distancing-compliant people as showing high confidence in the vaccine, which motivates them to receive it for reasons of protecting themselves and others. By contrast, policy incentives, such as “3G/2G” restrictions, motivate risk-tolerant people who opted for vaccination to get access to public areas. Trusting people who regularly vote are little afraid of vaccines' side effects. Our findings offer insights for policymakers in societies and firms that help to tailor policies promoting vaccination based on people's economic preferences.

JEL Classification numbers: C91, D81, H12, I12, I18

**Keywords:** Behavioral Economics, COVID-19, Policy Incentives, Vaccination Motives.

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# 1 Introduction

The ongoing COVID-19 pandemic causes a severe crisis for societies and the economy. To fight the dissemination of the virus, many states implemented policy measures, such as social-distancing rules, access restrictions, or lockdowns. Compliance to these measures is an important prerequisite for a healthy society and the functioning of labor markets. The pandemic reflects a social dilemma, where negative externalities affect the whole society if citizens do not cooperate (Müller and Rau, 2021). Examples relate to the break-down of the health-care system or the loss of human capital in the labor market, if too many people become seriously ill due to an unlimited spread of the virus (Aum et al., 2021; Cowan, 2020; Deng et al., 2021). In the short-run, missing workers lower output, causing gaps in supply chains with high economic costs for industries and the society. High infection rates pose the risk that workers are absent for a long time due to long-term effects of COVID-19, which further increase the costs for the society. Thus, firms have to minimize periodical absenteeism of employees, stabilizing economic growth in times of the pandemic.

In the battle against COVID-19, vaccines are a promising candidate to become a game changer. Importantly, they do not only protect vaccinated persons and their fellow people against infection (Polack et al., 2020), but also they most likely do prevent a serious course of disease and hospitalisation (Juthani et al., 2021). Due to the social-dilemma structure of the pandemic, vaccination campaigns target at a very high vaccination rate to curb the spread of the virus. However, many countries face the problem that the vaccination rate is too low. In February 2022, it is 64% in the USA, 71% in the UK, and 74% in Germany according to “Our World in Data” (Mathieu et al., 2021). An important reason for an insufficient vaccination rate in a country is a low degree of acceptance of COVID-19 vaccines among its citizens.

Recently, many German federal governments introduced “3G/2G” policies offering access to public areas (e.g., bars and restaurants) only to those people who are vaccinated (“Geimpft”) or recovered from a previous COVID-19 infection (“Genesen”) in the case of “2G” or negatively tested (“Getestet”) in the case of “3G”. Furthermore, boosted people have been offered shorter quarantine times and an exemption of the need for a negative COVID-19 test to access locations under a “2G+” rule. From a behavioral economics perspective, such policies may be interpreted as vaccination incentives. Experimental evidence shows that financial incentives may work, increasing vaccination rates in real (Campos-Mercade et al., 2021a) and in hypothetical scenarios (Serra-Garcia and Szech, forthcoming). However, little is known on the success of restriction policies and the determinants of people’s vaccination motivations. Therefore, a better understanding is needed, which helps to design policies that increase vaccination motivations.

In this paper, we fill this research gap with a survey study in Göttingen (Lower Saxony, Germany) that analyzes the determinants of vaccination motivations of citizens who get

in line at mobile vaccination centers at a time, when registration at the local stationary vaccination center was not yet again possible due to its temporary closure. To take into account the impact of the recent policy changes on subjects' motivation, we conducted the study in December 2021, shortly after the introduction of the 2G+ rule (December 1, 2021) and during the introduction of the exemption of boosted people from 2G+ locations (December 4, 2021) in Lower Saxony.

A growing literature applies survey studies on vaccine acceptance and finds that it is curbed by increased distrust in politics (Schernhammer et al., 2021), science (Viswanath et al., 2021), citizens' beliefs in conspiracy theories (e.g., Jennings et al., 2021; Khubchandani et al., 2021; Sowa et al., 2021), and a lack of information about COVID vaccines (Aw et al., 2021). Moreover, women have a lower vaccine acceptance (Ishimaru et al., 2021) and are more afraid of side effects than men (Neumann-Böhme et al., 2020). It was also found that people show a lower acceptance of vaccines when hypothetically assessing the scenario of compulsory vaccination (Schmelz and Bowles, 2021). Although, this literature adds important insights on the determinants of vaccination, a shortcoming is that all these studies rely on hypothetical answers whether people intend to get vaccinated or it is unknown whether they are really vaccinated.

By contrast, it is a strength of our study that we interview citizens in waiting lines of mobile-vaccination centers, shortly before they receive the vaccine. This allows us to study vaccination motivations of persons who definitely decided to uptake the vaccine. Following the insights of Müller and Rau (2021) and Campos-Mercade et al. (2021b) that economic preferences predict people's behavior in the pandemic, we elicit subjects' risk tolerance, trust, patience, altruism, social-distancing behavior, and their willingness to go voting. The goal of our study is to test whether these preferences and behaviors determine people's confidence in the vaccine and their motivation to uptake the vaccine. Our participants rate their vaccination motivations in categories, such as protection issues, reasons of getting access to restricted areas, and for reasons of peer pressure. Analyzing the role of preferences for subjects' vaccination motives allows us to elaborate what kind of people were attracted by incentivizing policies, which helps to tailor future policies.

Our results show that compliant, risk-averse people, who feel well-informed about the COVID-19 vaccination, believe in vaccines' efficacy and want them for reasons of protection and fear of Omicron. We find evidence of a gender effect in that significantly more women than men are motivated by this reason. By contrast, the incentivizing policies apparently attract risk-tolerant and less altruistic people who state that they decided to vaccinate because of the motive of getting access to restricted public areas. Moreover, risk-tolerant subjects are also motivated by getting the vaccination because of reasons of peer pressure. Finally, we find that trusting people are less afraid of side effects, which is in line with the literature (e.g., Schmelz and Bowles, 2021). Our correlation results can be used by policymakers and firms for the "prediction problem" (Kleinberg et al., 2015) when

designing tailor-made policies and institutions. Precisely, they may apply policies that grant access to restricted areas (or payment schemes) conditional on being vaccinated in regions or firms characterized by a high amount of risk-tolerant people.

## 2 Data and study design

### 2.1 Questionnaire

To collect the data of this study we interviewed people in the waiting lines of two mobile vaccination centers in Göttingen, which offered on a first-come-first-serve basis and without preregistration, COVID-19 vaccination on December 3, 10, and 17 in the year 2021. We collected most of the data (84%) at the mobile vaccination center located in the lecture hall building on the central campus side, whereas the remaining data were collected at the mobile vaccination center in the rooms of a former university restaurant in the city center. In total, we collected data of 172 participants (54% female). Participants' mean age is 33.31 (sd: 16.57) and 88% stated that they currently study or formerly completed their studies.<sup>1</sup> Due to missing information, where participants did not give an answer and because of non-binary gender, the main data are based on 156 observations.<sup>2</sup>

To collect the data, we employed two female research assistants who interviewed people who waited in the queue to receive the vaccine. Since we approached our participants in the vaccination waiting line, we know for sure that our interviewed participants intended to become vaccinated.<sup>3</sup> This allows us to derive important conclusions on vaccinated people's confidence in COVID-19 vaccines and the underlying motivations of their vaccination decisions. This is a strength of our study as compared to standard survey studies (typically) conducted online, where researchers do not know whether people claiming to be vaccinated actually tell the truth. Those studies might suffer from a social desirability bias regarding participants' statements on their vaccination status.

When collecting the data, our research assistants told participants that they are conducting a survey about vaccination, which would last approximately ten minutes. Participants were also told that they would receive a chocolate bar as a reward for participation. Our survey study is divided into three blocks, the elicitation of participants' (1) preferences and voter turnout, (2) perceptions of the COVID-19 vaccination, and (3) motivations to become vaccinated. We apply packages of questions to address measurement error.

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<sup>1</sup>The mean age (Campus side: 33.44; city center: 33.04) and the fraction of participants who indicated that they study or formerly completed their studies (Campus side: 89%; city center: 85%) are similar in both locations.

<sup>2</sup>In our regression analyses where we apply additional control variables including subjects' COVID-19 experiences, we have data of 154 participants, since two participants did not have an answer to this question.

<sup>3</sup>Given that the vaccines were rationed on each day of our data collection, participants did not know for sure whether they would manage to receive the vaccine, when we interviewed them in the queue.

The first block (1) applies a package of verbal questions on economic preferences similar to those investigated in the survey study of Müller and Rau (2021). This approach is based on the insights of verbal-preference elicitation provided by Falk et al. (2016, 2018). Precisely, we elicit subjects' risk tolerance and trust in other people on 11-point Likert scales (0 = the lowest degree; 10 = the highest degree). Since vaccination decisions are characterized by uncertainty and people have to rely on vaccines' efficacy, risk preferences and trust should be of importance. We measure time preferences, by asking participants about the level of immediate compensation in Euros they would request to forego a payment of €1000 in six months. We also ask them about their required level of compensation in six months to give up a payment of €1000 in twelve months. We use the mean of the two measures to account for patience, assuming that more (less) patient subjects claim a higher (lower) money amount. We focus on time preferences, as they have shown to be of importance in the context of compliance with health regulations (Müller and Rau, 2021). Moreover, we pose a verbal question on charitable giving to proxy altruistic preferences. Concretely, we ask participants how much money, out of ten 1-Euro coins in their wallet, they would donate when walking along the street and realizing that a charity asks for a donation. We use the donation amount as a proxy for altruism, which is in line with experimental dictator-game setups, with charities as recipients (Eckel and Grossman, 1996). We focus on altruism, since we expect that it should be of relevance in the context of vaccination decisions, which may protect others (Shim et al., 2012). To account for subjects' political participation, we ask participants on an 11-point Likert scale on their assessment of the importance (0 = totally unimportant; 10 = very important) to vote.

The second block (2) consists of contextual questions on participants' confidence in the COVID-19 vaccination. Again, we use 11-point Likert scales (0 = not at all; 10 = very good) to measure participants' assessments of the vaccination's protection against COVID-19 and their perception of how well they feel informed about the vaccines. Furthermore, participants state on another 11-point Likert scale (0 = not afraid; 10 = very afraid) their fear of vaccine side effects. Finally, we ask them whether today's vaccination would be their booster vaccination.<sup>4</sup>

The third block (3) consists of contextual questions on participants' motivations to receive the COVID-19 vaccination and on their experiences and behavior in the pandemic. First, participants answer five questions on their vaccination motives on 11-point Likert scales (0 = does not apply; 10 = does perfectly apply). In all of these questions, participants have to state to what extent the following motivations apply to get the vaccine: (i) to protect yourself against COVID-19; (ii) to protect fellow people against COVID-19; (iii) because of fear of the new Omicron variant from South Africa; (iv) to get access to

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<sup>4</sup>For people who already received two doses of the Biontech/Pfizer, Moderna or AstraZeneca COVID-19 vaccines, we count the next vaccination as booster. For people who already received a first COVID-19 vaccination of Johnson & Johnson, we count the next vaccination as booster.

public areas with “3G/2G” requirements, i.e., areas that are restricted to those who are vaccinated, have recovered from infection or are negatively tested for COVID-19.<sup>5</sup> Then, participants state the extent of their personal illness experience with COVID-19 (0 = not at all ill; 10 = hospital). Next, we ask them to what extent they keep distance to fellow people in public during times of high incidence values (0 = not at all; 10 = completely). We use this measure as a proxy for compliance, assuming that higher scores reflect increased compliance. Moreover, we asked subjects whether they regularly have contact to people who are at risk. Finally, we collect their demographics (age, gender, nationality, whether they study or have studied).

## 2.2 Data analysis and construct validity

We standardize all variables, except the dummy variables. Our main analyses focus on regressions that investigate the determinants of two different dimensions, (i) people’s confidence in the vaccine and (ii) people’s motivations to get vaccinated. The first dimension, confidence in the vaccine, measures an important basis for people’s acceptance of COVID-19 vaccines. In this respect, we consider (and run regressions on) two contrary aspects, believed efficacy of the vaccine and the fear of potential side effects. The second dimension, motivations to get vaccinated, aims to dig deeper into subjects’ vaccination motives by distinguishing between precautionary measures vs. reasons of increased personal freedom and social status. In this respect, we run regressions that study the determinants of subjects’ motivations to receive the vaccine for reasons of protection and fear, for getting access to restricted areas, and for reasons of peer pressure.

Since the protection motivation is multidimensional and in order to address measurement error, we ask several questions to account for it. Based on the answers to these questions, we compute a *protection & fear* index as an outcome variable. We follow a similar approach to Stango et al. (2017) and Müller and Rau (2021), where we take the arithmetic mean of different variables of COVID-19 protection issues, that we think are theoretically connected. We compute the index based on participants’ answers regarding their motivations based on: “self-protection,” “protection of others,” and “their fear of Omicron.” We believe that the two reasons of protection are closely interrelated, since both motivations depend on the risk of getting infected and spreading the virus. The same should be true for subjects’ fear of the Omicron variant. Cronbach’s alpha shows sufficient reliability of the protection index (0.602).

In all of our regression models, we use a set of variables on economic preferences, compliance, and political participation. We conduct a principal component analysis (pca)

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<sup>5</sup>In Germany many public areas, such as retail, bars, and restaurants had restricted access during the time of our study. The so called “2G” rule implied that only people who either are vaccinated or have recovered from COVID-19 get access. In the case of the “3G” rule, only people who either are vaccinated or have recovered from COVID-19 or can prove a recent COVID-19 test with a negative result get access.



to reduce the number of variables and to identify specific types of relevant combinations (Müller and Rau, 2021; Snowberg and Yariv, 2021). In the pca, factors are extracted based on eigenvalues above one, which is in line with Kaiser’s rule. A factor loading of greater than 0.50 is used to identify items. We identify four components with eigenvalues exceeding one. Afterward, a varimax rotation is applied. As a result, in component one, two items load positively and very strongly, *trust others* (0.71) and *voter turnout* (0.56). The component can be interpreted as reflecting the characteristics of a trusting person who feels obliged to vote. Therefore, we call the first principal component (pc) “PC1: Trust others & Political participation.” In component two, two items load positively and very strongly, *complying with social distance* (0.81) and *feeling well-informed on the vaccine* (0.56). Thus, the pc reflects the characteristics of a compliant person who feels well-informed. Therefore, we label it “PC2: Compliant & Feels informed.” In component three, results show that *donations to the charity* loads positively and very strongly (0.75). Whereas, *mean patience* loads negatively (-0.60). Thus, we call the pc: “PC3: Altruistic & Impatient.” Finally, in component four, only *risk tolerance* loads very strongly (0.81). Thus, we label this pc “PC4: Risk tolerant.”

### 3 Behavioral predictions

In this section, we present behavioral predictions on the determinants of (i) people’s confidence in COVID-19 vaccines and (ii) their motivations to get vaccinated.

With respect to our first dimension, confidence in vaccines, we focus on previous survey findings on people’s COVID-19 vaccine acceptance. Trusting people show a higher acceptance of COVID-19 vaccines (Lazarus et al., 2021; Schmelz and Bowles, 2021), which should be reflected in increased confidence about the efficacy of the vaccine. Moreover, we expect that people who want to become vaccinated are more convinced that the vaccine protects them against COVID-19, when they feel well-informed about the vaccine.

Evidence on individual risk preferences suggests a negative relationship between risk tolerance and people’s willingness to take health risks (Dohmen et al., 2011; Falk et al., 2018). Thus, we expect that risk-tolerant people are less convinced about the efficacy of vaccines and show less fear of side effects.

#### **Behavioral Prediction 1: Confidence in the vaccines**

- (a) *Trust is positively related with confidence in vaccine efficacy and negatively related with the fear of side effects.*
- (b) *Feeling well-informed is positively related with confidence in vaccines’ efficacy.*
- (c) *Risk tolerance is negatively related with confidence in vaccine efficacy.*

We turn to the determinants of people’s motivation to become vaccinated. In this respect, we expect that people who follow the rules are convinced of the meaningfulness

of government recommended COVID-19 vaccines as a means to protect against the virus. We expect that altruistic people vaccinate against COVID-19 to protect others, given the evidence that influenza vaccines are commonly used to protect others (Shim et al., 2012). Moreover, risk-averse people are known to uptake vaccines for protection issues (Tsutsui et al., 2012). By contrast, less altruistic and risk-tolerant people should be attracted by reasons of increased personal freedom. That is, they may be the people who are attracted by the incentives to receive the vaccine for accessing restricted areas. Moreover, we expect that risk-tolerant people are more likely to receive the vaccine for reasons of peer pressure. Since they are not afraid of the virus, it is possible that they vaccinate because of social status.

### **Behavioral Prediction 2: Motivations to get vaccinated**

- (a) Compliance, altruism and risk aversion are positively related with the motivation to receive the vaccine for protection issues.*
- (b) Altruism is negatively, and risk aversion is positively related with the motivation to get vaccinated for accessing restricted areas.*
- (c) Risk tolerance is positively related with the motivation to become vaccinated because of peer pressure.*

## **4 Results**

Before we turn to our main results on participants' vaccination motives in Section 4.2, we analyze in Section 4.1 the determinants of people's confidence in COVID-19 vaccines.

### **4.1 Confidence in COVID-19 Vaccines**

We analyze in this section the determinants of people's confidence in the vaccine's efficacy and their fear of side effects. Overall, we find that 90% of people who approached the vaccination centers expected their booster COVID-19 vaccination, which corresponds to their third vaccination. Whereas, 7% (3%) of the people did not receive any (received one) COVID-19 vaccination before. The findings are in line with the German phenomenon of that time, that only a small percentage of people approached vaccination centers to receive their initial vaccination.<sup>6</sup>

We start our analysis with an overview on the impact of our principal components (PCs). Figure 1 displays an overview on the relation of our PCs on the "efficacy of the vaccine" (left panel) and their "fear of side effects" (right panel). We focus on median splits of the PCs. In each panel, PC1 (PC2) is represented by the black (grey) solid line. Whereas, PC3 (PC4) is represented by the black (grey) dashed line.

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<sup>6</sup>Unfortunately, due to the small percentage of initial vaccinees, we cannot investigate people's motivations for late initial vaccinations.

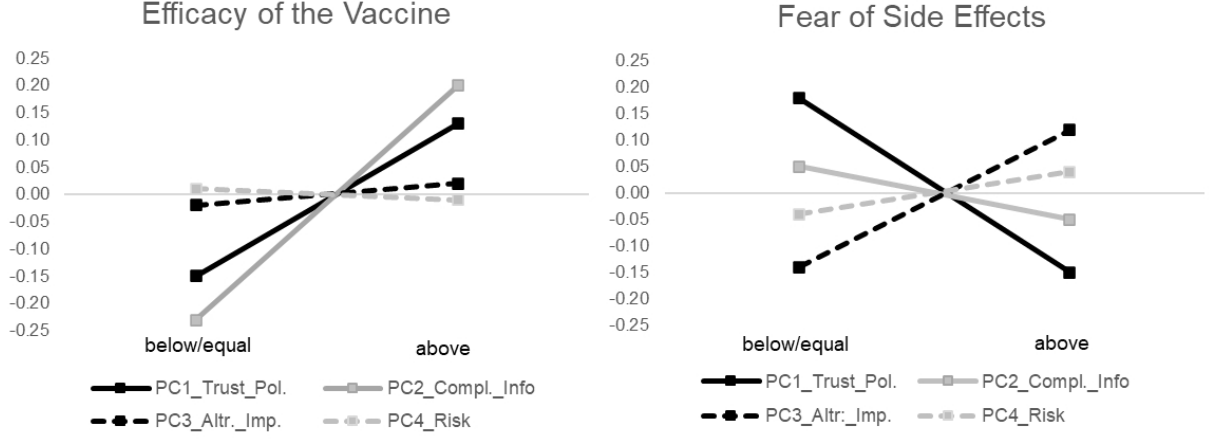


Figure 1: The determinants of people’s confidence in the vaccine and of their fear of side effects.

The most conspicuous finding in the left panel is that people with an above-median level of PC2 have a higher belief (0.20) of the vaccine’s efficacy than people with a below/equal median PC2. Thus, compliance and being well-informed about the vaccine, seem to be positively correlated with confidence in the efficacy of the vaccine. The diagram also suggests that a higher PC1 has a similar, though less pronounced, effect (-0.15 vs. 0.13). Turning to people’s fear of side effects, the most obvious effect that we observe in the right panel is that a higher PC1 is related with less fear of side effects. Thus, above-median trusting people who vote are less afraid of sides effects (-0.15) than those with a below/equal-median value of PC1 (0.18). In the next step, we make use of parametric-regression analyses to test for statistical significance.

## Regression Analyses

Table 1 presents OLS regressions on subjects’ confidence in vaccines, focussing again on the two aspects, subjects’ perception of the efficacy of the vaccine (models (1)–(2)) and their fear of possible side effects (models (3)–(4)).

Our basic models contain in regressions (1) and (3) the estimated principal components (PCs). *PC1: Trust others & Political participation* is our first PC, where trust and voter turnout load high and positive. *PC2: Compliant & Feels informed* is our second PC, with high positive loadings for subjects who take great care about social distancing and who feel well-informed about the vaccine. *PC3: Altruistic & Impatient* is our third PC with a high positive loading for subjects who donate much and a negative load of patience. *PC4: Risk tolerant* is our fourth PC with a high positive loading for risk-tolerant subjects. In our regressions, we also control for gender effects with *female*, a dummy that is positive for women. Models (2) and (4) add control variables. *Age* is subjects’ age in years, *current/former student* is a dummy, which is positive for students (or those who formerly have completed studies). *German* is a dummy that is positive for German participants.

	efficacy of the vaccine		fear of side effects	
	(1)	(2)	(3)	(4)
<i>PC1: Trust others &amp; Political participation</i>	0.132* (0.069)	0.064 (0.071)	-0.243*** (0.067)	-0.149** (0.069)
<i>PC2: Compliant &amp; Feels informed</i>	0.212*** (0.071)	0.239*** (0.071)	-0.044 (0.069)	-0.056 (0.069)
<i>PC3: Altruistic &amp; Impatient</i>	-0.017 (0.072)	0.037 (0.094)	0.096 (0.070)	0.034 (0.092)
<i>PC4: Risk tolerant</i>	-0.137* (0.072)	-0.155** (0.078)	-0.002 (0.070)	-0.044 (0.076)
<i>female</i>	-0.130 (0.156)	-0.173 (0.152)	0.254* (0.151)	0.231 (0.148)
<i>age</i>		-0.242*** (0.085)		-0.131 (0.083)
<i>current/former student</i>		-0.294 (0.312)		-0.573* (0.303)
<i>German</i>		0.228 (0.346)		0.145 (0.337)
<i>contact with people at risk</i>		0.002 (0.160)		0.148 (0.156)
<i>COVID-19 experience</i>		-0.118 (0.072)		-0.015 (0.071)
<i>receive booster vaccination</i>		1.040*** (0.367)		-1.053*** (0.357)
<i>constant</i>	0.061 (0.115)	-1.019* (0.562)	-0.168 (0.112)	1.370** (0.548)
controls for location and wave	no	yes	no	yes
obs.	156	154	156	154
R <sup>2</sup>	0.112	0.242	0.107	0.233
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

Table 1: OLS regressions on subjects' trust in the COVID-19 vaccines.

We also add a dummy variable (*contact with people at risk*) that controls whether our participants commonly meet people endangered by the Coronavirus. We also control for the impact of participants' reported level of the experience with the virus (*COVID-19 experience*). Moreover, we include a dummy that is positive for those participants who attempt to receive their booster vaccination. Finally, we include a variable *wave* to account for possible time dynamics during the pandemic. The variable is one when the data collection was on December 3, it is two when it was on December 10, and it is three when it was on December 17. Moreover, we add a *location* dummy, which is one (zero) when the data were collected at the campus (city center). All regressions report standard errors in parentheses.

Models (1) and (2) highlight that compliant and informed people believe in the effec-

tiveness of the vaccine. That is, the coefficient of  $PC2$  is significant and positive, i.e., a one standard deviation (sd) increase leads to a 0.239 sd increase in subjects' perceived efficacy of the vaccines. Moreover,  $PC4$  is significantly negative, i.e., risk-averse (or, less risk tolerant) subjects believe that the efficacy of the vaccines is higher. We also find that  $PC1$  is positive and weakly significant. However, Model (2) confirms that this effect is not robust when adding controls. By contrast, the model confirms the effects of  $PC2$  and  $PC4$ . Model (2) reveals a highly significant negative relation with age, i.e., younger people are more convinced about the efficacy of the vaccine. Finally, we find a highly significant positive relation for people who plan to receive a booster vaccination. That is, people who frequently received the vaccine believe that it works. The findings confirm the pattern of Figure 1.

**Result 1:** *Compliant and risk-averse people who feel well-informed about the vaccine are convinced about its efficacy. Younger people show higher confidence in the vaccine.*

Turning to people's fear of side effects, we find a strong negative relation for  $PC1$ . That is, trusting people who show a high political participation are less afraid of side effects. Model (3) shows that this effect is of slightly higher magnitude than the effect of  $PC2$  in Model (1). It turns out that a one sd increase in  $PC1$  leads to a 0.243 sd decrease in subjects' fear of side effects. Model (4) shows that the effect is robust when adding control variables, although the effect becomes weaker in this case. Model (3) documents that women tend to be more afraid of side effects than men, which is in keeping with the literature on the perception of vaccines (Neumann-Böhme et al., 2020). However, the effect is not robust in Model (4). Model (4) shows that younger people and current or former students tend to be less afraid of side effects. In line with that, we also find that the campus dummy is negatively significant. Furthermore, results show an intuitive highly significant negative relation of the dummy, which controls whether subjects come to receive a booster vaccination and their fear of side effects. Put differently, people who plan to receive the booster vaccine show lower levels of fear of side effects. Again, the results are in line with the pattern of Figure 1.

**Result 2:** *Trust and political participation are associated with less fear of side effects.*

In summary, we find partial support for Behavioral Prediction 1a, since trust is negatively associated with people's fear of side effects, but its positive association with confidence in vaccine efficacy is not robust to the inclusion of control variables. Moreover, we find strong support that the feeling of being well-informed is positively associated with people's confidence in the vaccine's efficacy, which also holds for risk-averse people. Thus, our results are in line with Behavioral Predictions 1b and 1c.

## 4.2 Motivations to become Vaccinated

In this section, we report our main results on the determinants of contrasting motivations of receiving the vaccine. In our analyses, we compare the determinants of precautionary measures vs. motives of increasing the personal freedom vs. motives of keeping social status. Before that, we present an overview of the means of participants’ answers regarding the vaccination motives. This is displayed by Figure 2. The black bar presents the mean of the protection & fear index. Whereas, the grey (white) bar presents the mean score of receiving the vaccine because of reasons of access to restricted areas (peer pressure).

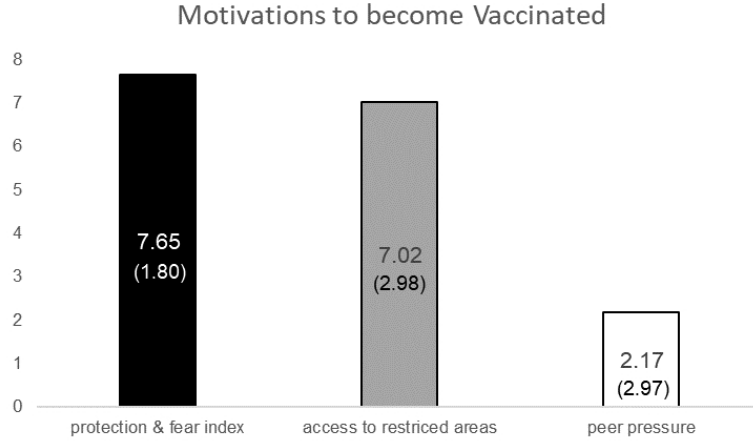


Figure 2: Participants’ stated motivations to become vaccinated.

Results show that the scores of the “protection & fear index” and “access to restricted areas” are significantly higher than “peer pressure” (Wilcoxon sign-rank tests,  $p < 0.001$ ). Whereas, no significant difference occurs between “protection & fear index” and “access to restricted areas” (Wilcoxon sign-rank test,  $p = 0.121$ ).

Next, we turn to our main results on the determinants of vaccination motives. Therefore, Table 2 presents OLS regressions on the three motivations of receiving a vaccine that we have discussed above. The first motivation is directly related to the Coronavirus in that it focusses on protection issues and subjects’ fear of Omicron. It is captured by our index *protection & fear* (models (1)–(2)). The second motivation analyzed in models (3)–(4) concerns the effect of receiving the vaccine to get *access to restricted areas*, such as the retail sector or restaurants and bars. Finally, we consider *peer pressure* as a motivational factor to maintain one’s social status by getting vaccinated (models (5)–(6)). In all these models, we correspondingly apply the same independent variables and controls as in Table 1.

In models (1)–(2), we find a strong effect for *PC2*, which is positive and highly significant. Thus, compliant subjects who feel well-informed want to receive the vaccine to protect themselves and others. Another reason is that they fear Omicron. Precisely,

	protection & fear index		access to restricted areas		peer pressure	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>PC1: Trust others &amp; Political participation</i>	0.175** (0.068)	0.083 (0.067)	0.016 (0.071)	0.031 (0.076)	-0.037 (0.070)	0.029 (0.073)
<i>PC2: Compliant &amp; Feels informed</i>	0.249*** (0.070)	0.230*** (0.066)	-0.126* (0.074)	-0.104 (0.075)	-0.005 (0.072)	-0.012 (0.072)
<i>PC3: Altruistic &amp; Impatient</i>	0.034 (0.070)	0.149* (0.088)	-0.229** (0.091)	-0.227** (0.100)	-0.002 (0.072)	-0.062 (0.096)
<i>PC4: Risk tolerant</i>	-0.061 (0.070)	-0.160** (0.073)	0.159* (0.082)	0.157* (0.083)	0.201*** (0.072)	0.150* (0.081)
<i>female</i>	0.471*** (0.152)	0.386*** (0.143)	0.087 (0.163)	0.082 (0.162)	0.216 (0.158)	0.222 (0.157)
<i>age</i>		0.020 (0.080)		-0.034 (0.090)		0.008 (0.088)
<i>current/former student</i>		-0.496* (0.290)		-0.242 (0.331)		-0.706** (0.319)
<i>German</i>		0.209 (0.322)		-0.329 (0.369)		-0.311 (0.354)
<i>contact with people at risk</i>		0.092 (0.151)		-0.286* (0.171)		-0.268 (0.165)
<i>COVID-19 experience</i>		0.074 (0.067)		-0.175** (0.077)		0.084 (0.075)
<i>receive booster vaccination</i>		1.674*** (0.341)		0.103 (0.390)		-0.515 (0.376)
<i>constant</i>	-0.290** (0.113)	-1.608*** (0.524)	-0.028 (0.119)	0.487 (0.598)	-0.129 (0.117)	1.797*** (0.576)
controls for location and wave	no	yes	no	yes	no	yes
obs.	154	152	156	154	154	154
R <sup>2</sup>	0.183	0.350	0.069	0.143	0.062	0.167
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1						

Table 2: OLS regressions on subjects' motivations to become vaccinated.

model (2) shows that a one sd increase in PC2 leads to a 0.230 sd increase in subjects' motivation to receive the vaccine for reasons of protection and fear. Moreover, models (1)–(2) highlight a gender effect. That is, the coefficient of *female* is positive and highly significant. Thus, it is particularly the women who are afraid of Omicron and who receive the vaccine for reasons of protection. Model (1) indicates a significantly positive effect of *PC1*. However, this effect disappears in Model (2), when applying control variables. In this case, model (2) reveals a significantly negative effect of *Risk tolerance*. That is, a one sd decrease in risk tolerance leads to a 0.160 sd decrease in subjects' motivation to receive the vaccine for reasons of protection & fear. Finally, we find that the dummy controlling for the booster vaccination is positive and highly significant. Thus, people, who want to receive a booster vaccine, do this particularly for reasons of protection and fear of Omicron. Overall, the results of the positive association of compliance, altruism and risk aversion with the motivation to get the vaccine for protection issues, support Behavioral Prediction 2a. A closer look at disaggregated analyses of the components of the index reveals that the gender effect is particularly driven by women's pronounced motivation to protect others (see Table 3 in the Appendix).<sup>7</sup>

<sup>7</sup>Moreover, we find a positive significant relation between altruistic people and the motive to get vaccinated

**Result 3a:** *Compliant and risk-averse people who feel well-informed want to get vaccinated for reasons of protection and fear. It is particularly the women, who want the vaccination for protective issues.*

A main finding in models (3)–(4) is that the coefficient of  $PC3$  is significantly negative. Pearson’s correlation coefficients show that this relation is entirely driven by altruism.<sup>8</sup> Thus, less altruistic people want the vaccine for motives of getting access to restricted areas. The effect is of the same size as the effect of  $PC2$  in model (2). That is, a one sd increase in  $PC3$  leads to a 0.227 sd decrease in the access motivation. Moreover, we find a weakly significant effect for  $PC4$ . Thus, it is the risk tolerant people who tend to be motivated by reasons of getting access to restricted areas. Thus, our results find support for Behavioral Prediction 2b. Moreover, model (4) reveals that a motivation to become vaccinated because of reasons to get access is more likely when people have no contact to people at risk. Finally, we find a significantly negative effect of *COVID-19 experience*. Thus, people who had only minor personal experience with COVID-19 want to get the vaccine for motives of personal freedom.

**Result 3b:** *Less altruistic and more risk tolerant people want the vaccine for reasons of getting access to restricted areas. People who have contact to people at risk and people who had strong personal experiences with COVID-19 are not motivated by this reason.*

Models (5)–(6) highlight significantly positive coefficients of  $PC4$ : *Risk tolerant*. The effect becomes less pronounced, though, when adding controls. Thus, peer-pressure motives matter for risk-tolerant people. In model (6), we find that a one sd of  $PC4$  leads to a 0.150 sd increase in peer-pressure motives, which adds support to Behavioral Prediction 2c. Moreover, model (6) shows that current or former students are less motivated by peer pressure.

**Result 3c:** *Peer-pressure motives matter for risk tolerant subjects, whereas they are less important for current or former students.*

## 5 Conclusion

In times of the pandemic, a key goal is the avoidance of high infection rates, as this prevents congestion in hospitals and the lack of human capital in labor markets. Based on data of 2020, Aum et al. (2021) report that a one-per-thousand increase in infections caused a two-to-three-percent drop in local employment in Korea. Thus, vaccines fighting

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for protecting others. The significantly negative effect of risk tolerance is induced by risk-averse people’s motivation to protect others. Moreover, we additionally find that women are more afraid of Omicron than men.

<sup>8</sup>Pearson’s correlation coefficients, altruism:  $\rho = -0.171$ ,  $p = 0.027$ ; patience:  $\rho = -0.021$ ,  $p = 0.793$ .



the spread of the virus are a central mean to guarantee economic growth during the COVID-19 pandemic. In our paper, we studied individual motives to get vaccinated and their determinants by applying economic preferences, individual compliance and voting behavior. An important strength of our approach is that we interviewed people in waiting lines of mobile vaccination centers who ultimately decided to get vaccinated. Thus, we are confident about the knowledge that these people really wanted to become vaccinated. Our analysis of the determinants of their vaccination motives identifies different types of people according to their preferences. This allows policymakers to predict what type of person (e.g., risk-averse vs. risk-tolerant, altruistic, vs. non-altruistic) will be attracted by specific policies, such as information campaigns or access restrictions to public areas.

We find that economic preferences and compliance are predictors of citizens' confidence in the vaccines and their motivations to receive it. We identify risk-averse, compliant people, as showing high confidence in the vaccine. Moreover, their risk attitude explains their motivation to receive the COVID-19 vaccine to protect themselves and others against the virus and newer variants, such as Omicron. The same is true for female participants, who are particularly motivated by protection issues. By contrast, risk-tolerant and less altruistic people are attracted by policies granting access to restricted areas, or they receive the vaccine because of status effects. Finally, our results reveal that trusting people who participate in voter turnout are not affected by fear of vaccine side effects.

A limitation of our study is that we focus on a rather small sample that mainly encompasses current or former students, which complicates the generalization of the results. Nevertheless, our results of the pca add interesting first insights on the correlations of the preferences of people who definitely want the vaccine and their motivations to do so. To increase the generalizability, more evidence is needed. Although, students might not be representative for the whole population, they represent an important age cohort, which was documented as least compliant with Corona regulations (Brouard et al., 2020; Daoust, 2020; Moore et al., 2020). Thus, we focus on an age cohort that is of importance for vaccination campaigns. The behavior of students is important for firms, as they represent an age group that is pretty close to enter the labor market. Moreover, the waiting-line approach did not allow for randomization, which may cause selection effects. However, selection effects may also affect data collection of experiments with students. Importantly, student subject pools have the advantage that they are homogenous and therefore less prone to measurement error. This was shown in a large study that their behavior correlates with a representative US population (Snowberg and Yariv, 2021). Another limitation is that our results are correlational results, where we cannot draw causal relations.

However, the findings can be used by policymakers and decision-makers in firms addressing the "prediction problem" (Kleinberg et al., 2015; Müller and Rau, 2021). In this respect, decision-makers have to identify characteristics of people in certain regions

or firms to target tailored policies. Suppose, they have knowledge about a significant positive correlation between risk tolerance and people’s motivation to receive the vaccine for reasons of getting access. In this case, decision-makers in firms may use this insight together with data that represents risk attitudes of branches and departments, predicting where they can attract employees by offering vaccination incentives that grant access to certain payment schemes. Since the problem is one of predicting the right target for policies, the policymaker does not need to know what the cause-and-effect relation between risk tolerance and the vaccination motive of getting access is (Kleinberg et al., 2015; Müller and Rau, 2021). For instance, in the financial sector, firms may offer “access” to bonus payments conditional that the potential recipient is vaccinated. Transferred to public economics, policymakers may target access policies to federal states with high infection rates that suggest a pronounced risk-taking behavior in their population. Moreover, the positive correlation between compliance, information about the vaccine and the motive to become vaccinated for protective reasons adds further insights. For firms and federal states, this suggests that information campaigns may help to convince compliant people to become vaccinated.<sup>9</sup> This may apply to regions characterized by lower incidence levels. In labor markets, this may be of importance in non-financial branches (e.g., care facilities) with employees, characterized by a lower appetite for risk. Moreover, the gender effect adds further interesting insights, suggesting that information campaigns may be particularly successful in branches or departments with a high share of female workers. Our findings mark a promising first step to a better understanding of the determinants of people’s vaccination motives. We believe that these insights may stimulate further research on the predictive power of economic preferences on individual behavior, which will allow policymakers to target tailored policies in public economics and in labor markets. Improved public policies based on (non-monetary) incentives to increase vaccination rates may work as “gentle rule enforcement” (Erev et al., 2020). Gentle rule enforcement may be an interesting alternative to be considered in the recent debate on the introduction of compulsory COVID-19 vaccination in Germany. The start of this debate triggered an emotional discussion, which seems to have the potential to divide the society. A possible path for future research is the elaboration on the motives of vaccine hesitancy and the underlying determinants.

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<sup>9</sup>However, care should be taken in the design of the information campaigns when promoting information on vaccines’ effectiveness and their safety, as this may lead to adverse effects regarding people’s willingness to comply with public-health guidelines (Andersson et al., 2021).

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## Appendix A - Tables

	self-protetction		protection of others		fear of Omicron	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>PC1: Trust others &amp; Political participation</i>	0.171** (0.067)	0.010 (0.070)	0.141** (0.070)	0.053 (0.071)	0.129* (0.071)	0.077 (0.074)
<i>PC2: Compliant &amp; Feels informed</i>	0.281*** (0.070)	0.269*** (0.070)	0.201*** (0.072)	0.209*** (0.070)	0.096 (0.073)	0.060 (0.073)
<i>PC3: Altruistic &amp; Impatient</i>	0.003 (0.070)	0.074 (0.093)	0.079 (0.073)	0.190** (0.093)	-0.016 (0.074)	0.054 (0.098)
<i>PC4: Risk tolerant</i>	-0.066 (0.070)	-0.125 (0.078)	-0.131* (0.073)	-0.211*** (0.077)	0.014 (0.074)	-0.057 (0.081)
<i>female</i>	0.284* (0.152)	0.205 (0.151)	0.417*** (0.158)	0.351** (0.151)	0.316** (0.160)	0.264* (0.158)
<i>age</i>		-0.008 (0.084)		-0.178** (0.084)		0.175** (0.088)
<i>student</i>		-0.442 (0.308)		-0.568* (0.306)		-0.252 (0.323)
<i>German</i>		0.190 (0.342)		-0.007 (0.340)		0.267 (0.359)
<i>contact with people at risk</i>		0.036 (0.158)		0.079 (0.159)		0.108 (0.166)
<i>COVID-19 experience</i>		-0.003 (0.072)		0.074 (0.071)		0.076 (0.075)
<i>receive booster vaccination</i>		1.325*** (0.363)		1.416*** (0.360)		1.150*** (0.380)
<i>constant</i>	-0.180 (0.113)	-0.904 (0.556)	-0.242 (0.117)	-0.943* (0.553)	-0.196* (0.118)	-1.570*** (0.583)
controls for location and wave	no	yes	no	yes	no	yes
obs.	156	154	154	152	156	154
R <sup>2</sup>	0.166	0.268	0.152	0.308	0.059	0.166
Standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

Table 3: OLS regressions disaggregated results of the “protection & fear” index.

# Appendix B - Questions of the survey

(Translated from German)

## Preferences

[Risk tolerance]

- *How do you assess yourself? Are you generally willing to take risks?* (0 = not at all; 10 = completely)

[Time Preferences]

- *How much money do you want to receive today, such that you give up a sure payment of €1000 in 6 months?* (Please state an amount between €0 and €1000.)
- *How much money do you want to receive in 6 months, such that you give up a sure payment of €1000 in 12 months?* (Please state an amount between €0 and €1000.)

[Altruism]

- *Imagine you are walking down the street. You have exactly ten 1-euro coins in your wallet. You pass a booth of a well-known charity.* (How many of your euro coins (0-10) do you put in the organization's donation box?)

[Trust in others]

- *In general, how much trust do you have in other people?* (0 = not at all; 10 = completely)

[Voting behavior]

- *How important do you think it is to vote?* (0 = totally unimportant; 10 = very important).

## Contextual questions on confidence in COVID-19 vaccination

[Information about COVID-19 vaccines]

- *To what extent do you feel correctly informed about the COVID-19 vaccination?* (0 = not at all; 10 = very good)

[Efficacy of the vaccines]

- *How well do you think vaccination protects against COVID-19?* (0 = not at all; 10 = very good)

[Fear of side effects]

- *How worried are you about the side effects of vaccinations?* (0 = not afraid; 10 = very afraid)

[Amount of COVID-19 vaccinations]

- *Is this your booster shot?* (yes/no)

[Only asked, if subjects answered the previous question with “yes”]

- Did you receive a vaccination or two before your booster vaccination? (one/two)

[Only asked, if subjects answered the booster question with “no”]

- *Is this your first or second vaccination?*

## Contextual questions on motivations to receive the COVID-19 vaccination and experiences and behavior in the pandemic

[Motivations to become vaccinated]

*Why do you want to be vaccinated today? Please rate the following reasons.* (0 = does not apply; 10 = does perfectly apply)

- For reasons of self-protection against COVID-19.
- To protect people from COVID-19.
- For reasons of fear of the new Omicron variant from South Africa.
- To access 2G/3G restricted areas.
- To avoid peer or societal pressure.

[Experiences with COVID-19]

- *Have you had a COVID-disease experience?* (0 = not at all ill; 10 = hospital)

[Social distance and compliance]

- *How hard do you try to keep your distance from other people in times of high incidences in public?* (0 = not at all; 10 = completely)

[Contact to people at risk]

- *Do you have regular contact with people who are particularly threatened by COVID?* (yes/no)

## Demographics

- *How old are you?*
- *What gender are you?*
- *What is your nationality?*
- *Have you studied or are you studying?*