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**Working Paper**

## A Comment on "Influence Motives in Social Signaling: Evidence from COVID-19 Vaccinations in Germany"

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August 2024

## I4R DISCUSSION PAPER SERIES

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## **A comment on “Influence Motives in Social Signaling: Evidence from COVID-19 Vaccinations in Germany”**

Emilio Esguerra, Leonhard Vollmer, and Johannes Wimmer

24 July 2024

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### **Abstract**

Esguerra, Vollmer and Wimmer (2023) examined respondents’ desire to influence other people’s choices via their own behaviour. They conducted a field study on German residents’ registration for the COVID-19 vaccination, where 1,401 “Senders” made their registration decision, which could then be shared with a peer before or after that peer’s decision, providing an understanding of motives and social pressure on decisions. The authors found that individual influence motives increase a participant’s likelihood to register for vaccination, but social pressure effects do not alter it. We reproduced the results using the original code and data. We tested the robustness of the primary analysis by (i) using a logistic regression model, (ii) limiting the analysis to participants who inform their partner of their decision, and (iii) changing the criteria by which participants are recorded as “verified registered”. We found that these tests did not materially change the effect size estimates or the conclusions to be drawn from the analysis. We also tested the authors’ sub-analysis by the level of trust in the vaccine. We found that an alternative cutoff for the high-trust group did not materially change the result.

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## 1. Introduction

The original study, Esguerra, Vollmer and Wimmer (2023), was based on a field experiment of residents in Bavaria concerning their willingness to register for their first COVID-19 vaccination in April 2021. The sample comprised 1,857 participants who had registered online. The authors randomly assigned participants to 3 experimental conditions: “*not informing partner*,” “*informing partner after*,” or “*informing partner before*”. Within these conditions, they were randomly assigned the roles of Sender and Receiver. Of the 1,857 participants, 1,401 were in the Sender group, which is the focus of this analysis.

Senders decided whether to register for vaccination. In the *not informing partner* condition, Senders made their vaccination decision knowing their partner would not be informed of that decision. In the “*informing partner after* condition”, Senders decided knowing Receivers would be informed of the Sender’s decision after the Receiver had made their decision. In this case, Senders cannot influence the Receiver’s decision via their decision. In the *informing partner before* condition, the Sender’s decision was given to the Receiver before the Receiver made their decision. Informing before the Receiver’s decision created the potential for the Sender to influence the Receiver. As social pressure could arise in both the *informing partner before* and *after* conditions, any additional level of vaccinations in the *informing partner before* condition can be attributed to the desire of the Sender to influence the Receiver.

The authors document the average treatment effects of observability on Senders’ behaviour. The analysis that we are interested in for our report is based on *Table 1: Average Treatment Effects on Senders’ Likelihood to Register for a COVID-19 Vaccination* in the original paper, specifically column 4. In column 4, the authors identify that influence motives (“*Informing partner before*”) increase verified registration shares among Senders by 4.12 percentage points above a baseline of 3.79 per cent (“*Informing partner after*”). This implies an increase in registration likelihood of 109 per cent, demonstrating that individuals, when choosing their privately optimal action, account for the externalities they may have on others’ decisions. Social pressure effects do not alter Senders’ likelihood to sign up for a COVID-19 vaccination. We report the results of column 4 of the table in the original paper in column (1) of Table 1 below.

## 2. Computational Reproducibility

The replication package was complete (available [here](#)). Raw data was provided in an RDS file, which had already undergone some processing (e.g. removal of personal data provided by the participants, addition of columns for analysis). Analysis code was provided across five R scripts. A setup script installed required packages. A Master script then set some analysis parameters and ran three other scripts, which cleaned and prepared the data, prepared the tables (including running the analytical models) and prepared the figures.

All results presented in the paper were computationally reproducible from the raw data (Tables 1, 2, 3 and 4 of the original paper). The point estimates are identical. We did not identify any coding errors.

	Fully	Partial	No
Raw data provided		x	
Cleaning code provided	x		
Analysis data provided	x		
Analysis code provided	x		
Reproducible from raw data	x		
Reproducible from analysis data	x		

### 2.1 Pre-analysis Plan

The authors preregistered the study on the AEA RCT Registry with ID [AEARCTR-0007437](#). A pre-analysis plan was not available for immediate download for the development of this paper.

The pre-registration identified four primary outcomes:

- (1) Stated willingness to get vaccinated against COVID-19
- (2) Stated willingness to register for a vaccination appointment
- (3) Revealed measure of actually registering for a vaccination appointment
- (4) Revealed measure of actually getting vaccinated in follow-up survey

The measure used in the analysis in Table 1 of the original paper is outcome 3, the revealed measure of actually registering for a vaccination appointment.

### 3. Robustness Reproduction

We performed a series of robustness checks involving variations in the analytical model and the recording of the outcome variable. These were:

- Using a logistic regression model
- Limiting the analysis to the informed before and informed after conditions
- Changing the criteria by which participants are recorded as verified registered for vaccination to be more strict or lenient.

All these variations were made to the model reported in column (4) of Table 1 in the original paper.

We also performed a robustness check on the results presented in Table 2 of the original paper, whereby participants were divided into terciles. We examined an alternative cutoff of the top 20 per cent.

#### 3.1 Logistic regression model

The authors used a linear regression model to analyse the binary decision to register for vaccination. An alternative specification commonly used for binary variables is logistic regression.

Column (2) of Table 1 presents the results of a logistic regression model. As a logistic regression model requires a binary dependent variable, we coded the dependent variable as [0,1] rather than [0,100] as the authors did. Otherwise, the model specification is identical. The results presented in Table 1 represent the marginal effect of each independent variable, not the coefficients themselves, to enable direct comparison between the effect size estimates. The coefficient estimates for the model represented in equation (1) are contained in Table 2.

$$\begin{aligned} \text{logit}(P(y_i = 1)) \\ &= \beta_0 + \beta_1 \cdot \text{informing partner} + \beta_2 \cdot \text{informing partner before} + x_i \gamma \\ &+ \epsilon_i \end{aligned}$$

The marginal effect of 4.01 percentage points is close to the original estimate of 4.12 percentage points, with a similar significance level.

### **3.2 Linear model excluding “*not informing partner*” condition**

The linear model with a base of the “*not informing partner*” condition does not technically provide a direct test of whether there is a difference between the “*informing partner before*” and “*informing partner after*” conditions. We implement this test by running the linear model excluding the “*not informing partner*” condition and report the results in column (3) of Table 1.

Again, we find a similar result, with a percentage point difference between the two conditions of 4.06 percentage points and a similar significance level.

### **3.3 Changing criteria for “verified registered”**

In the original paper, individuals were recruited in the Bavarian region, with 1857 completing the survey. Before starting the survey, they were informed that they were about to take part in a scientific study on their attitudes toward COVID-19 vaccination. Next, the individuals were randomly assigned to a team where participants were paired due to the perceived social proximity between partners, following Götte and Tripodi (2021). Subsequently, teams entered the treatment stage where the authors varied whether the Sender’s decision to be registered for a COVID-19 vaccination is reported to a Receiver and whether this happens before or after the Receiver’s decision. Senders and Receivers were randomly assigned. The Senders were then asked how likely they believe their decision can influence their partner’s decision. However, the main outcome came out of the next stage, where participants answered whether they wished to register for a COVID-19 vaccination right away, and then they were forwarded to the registration website or to complete the survey. After completing the BayIMCO form, at their website – official registration, participants were verified based on the information matching email received after registration (email and subject line).

We noticed that although 1,857 individuals completed the survey, only 77 were recorded as verified registered in the experiment. Furthermore, the authors had to go through some data manipulation when the input from individuals did not exactly match



the email content requested. When the information was mismatched, such as a small mistake like misspelling, the authors made manual adjustments to include those, while in other cases the individuals were excluded from the final estimates.

We investigated whether changing the exclusion rules toward the verified individuals would result in a different effect. We (a) excluded all individuals who did not complete both ‘email and subject line’ exactly and, in another specification, (b) included any individual who had answered anything in the verification questions ‘email and subject line’, even if the answer was just a letter, expanding the total sample to 174 individuals in the later. In both specifications, the results have still held, although at a lower significance level. While neither of the below two tests is the optimal place to draw the line, the two extremes indicate the robustness of the result to varying degrees of discretion.

### **3.3.1 Recording participants with minor errors as not verified registered**

The authors manually recorded eight participants as verified registered based on minor errors in the entry of the subject line or email address. Recording those participants as not being verified registered marginally reduces the effect size of the “*informing partner before*” condition to 3.47 percentage points, although the significance of the result remains high. This result is reported in column (4) of Table 1.

### **3.3.2 Recording all participants who entered registration data as verified registered**

The authors recorded 77 participants as verified registered. However, 151 participants entered at least something in the email address and subject lines as evidence that they had registered. While some should likely be recorded as not registering (e.g. two participants entered ‘x’), many participants entered their own email addresses, possibly indicating confusion. We tested recording all 151 participants as verified registered to provide a possible bound to the discretionary choice of the authors.

Recording all 151 participants as verified registered results in a similar effect size to the initial analysis, with an increase of 4.26 percentage points. This is shown in column (5) of Table 1 below. The significance of the result is smaller, however, at

$p=0.018$ . This analysis is approaching the result reported by the authors in Table 3, Column 2 of the original paper, where they reported a test relating to all 190 participants who stated they had registered. There, the effect size of 3.18 percentage points was not significant.

### **3.4 Changing the bands for analysis based on trust in vaccines**

The author split the senders into tertiles, as shown in Table 2 of the original paper, based on the Sender's trust in the COVID-19 vaccine and coded 398 participants in the panel of High trust. The treatment effect for senders who are in both "Informing partner before" and in the High trust panel resulted in an 11.53 percentage point (137 per cent) increase in registration relative to a baseline of 8.44 per cent, which is significant at 5% level as shown in column (3) of Table 3 below.

By re-splitting senders based on trust in vaccines into quintiles (20% per panel) and coding 238 participants in the High trust. The Senders who had the highest trust, as shown in columns (2) and (4) of Table 3 below, tend to cause a 17.88 percentage point (177 per cent) increase relative to the new baseline of 10.11 per cent, which is even higher than the increase in the tertiles case. The treatment effect maintains significance at 5% level. This is consistent with the statement made by the authors that average treatment effects are highly likely driven by Senders exhibiting high levels of trust in COVID-19 vaccines.

## **4. Conclusion**

Esguerra, Vollmer and Wimmer (2023) examined respondents' willingness to register for COVID-19 vaccinations to influence other people's choices. Our team replicated the data to ensure computational reproducibility and robustness reproducibility. Our results support the original findings.

We subjected the results to several robustness checks, including using a logistic model, limiting the comparison to the informed before and informed after conditions, changing the criteria for recording participants as registered verified and considering alternative banding for participants' trust in vaccines. The results remained robust to all these specifications, with marginal changes in effect size.

While the author's research focused on respondents' willingness to register for COVID-19 vaccinations and investigated the desire to influence other people's choices that affect their behaviour, the desire to influence other people's behavioural choices is worthy of further study in different choice situations. In the medical area, this could include flu shots and blood donations. It could also be expanded to non-profit areas, such as voluntary donations and philanthropic giving to food choices. Esguerra, Vollmer and Wimmer (2023) have helped our understanding of the choice behaviour related to COVID-19 vaccines. We appreciate their analysis and see the importance of reviewing and replicating results.

## References

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Esguerra, E., Vollmer, L., & Wimmer, J. (2023). Influence Motives in Social Signaling: Evidence from COVID-19 Vaccinations in Germany. *American Economic Review: Insights*, 5(2), 275-291.

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**Tables**

**Table 1 – Alternative model specifications**

<b>Model</b>	<b>Original Study Table 1, Model 4</b>	<b>Logistic regression</b>	<b>Linear model excluding “not informing partner” group</b>	<b>Recording participants who made minor errors as not verified registered</b>	<b>Recording all participants who entered registration data as verified registered</b>
	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>
<b>Informed before</b>	4.12*** (1.37) [0.00276]	4.01*** (1.48) [0.00687]	4.06*** (1.37) [0.00320]	3.47*** (1.29) [0.00742]	4.26** (1.83) [0.0197]
<b>Informed</b>	-0.84 (1.39) [0.544]	-1.09 (1.78) [0.540]	NA NA NA	-1.11 (1.36) [0.414]	-0.85 (1.91) [0.658]
<b>Controls</b>	Yes	Yes	Yes	Yes	Yes
<b>N</b>	1401	1401	1073	1401	1401
<b>R<sup>2</sup></b>	0.094	NA	0.099	0.089	0.121

**Note: Standard errors are in parentheses. P-values are reported in square brackets.**

**Significant at the \*\*\*[1%] \*\*[5%] \*[10%] level.**

**Table 2 – Logistic model results**

<b>Model</b>	<b>Logistic model</b>
	(1)
<b>Informed before</b>	0.86*** (0.30) [0.00451]
<b>Informed</b>	-0.24 (0.37) [0.523]
<b>Controls</b>	Yes
<b>N</b>	1401

**Table 3 - Tertile and Quintile band comparison for High Trust in Vaccine**

<b>Model</b>	<b>Original Study Panel A Table 2 Colum 3</b>	<b>Quintile band Panel A Colum 3</b>	<b>Original Study Panel A Table 2 Colum 4</b>	<b>Quintile band Panel A Colum 4</b>
	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>
<b>Informing partner</b>	-3.56 (3.96) [0.370]	-5.14 (5.70) [0.368]	-3.23 (4.02) [0.422]	-5.66 (6.19) [0.361]
<b>Informing partner before</b>	11.70*** (4.04) [0.00399]	16.55*** (5.69) [0.00395]	11.53*** (3.88) [0.00315]	17.88*** (5.73) [0.00205]
<b>Mean, “Not informing partner”</b>	12.00	15.25	12.00	15.25
<b>Mean, “Informing partner after”</b>	8.44	10.11	8.44	10.11
<b>Observations</b>	398	238	398	238
<b>R<sup>2</sup></b>	0.02	0.04	0.13	0.14

**Note: Standard errors are in parentheses. P-values are reported in square brackets.**

**Significant at the \*\*\*[1%] \*\*[5%] \*[10%] level.**