Pre-analysis plan:
Incentives, economic preferences and vaccination uptake

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1) Motivation

We study the impact of different incentive schemes on COVID-19 booster shot uptake in Sweden. We look at actual vaccination behavior and vaccination intentions. We also collect data on peoples' preferences, vaccine beliefs and vaccine knowledge.

Our aim is to investigate 1) which incentive schemes work best to encourage people to get vaccinated quickly, 2) whether we can increase vaccination uptake by allowing for heterogeneity in motives to act, that is, by allocating different types of people (based on peoples' preferences) to suitable incentive schemes.

2) Design

To address our research questions, we conduct a survey with a general population sample of the Swedish population. In the online survey, we first measure participants' preferences. Then we randomly allocate participants to an intervention. Next, we measure participants' intentions to get vaccinated. Last, we examine whether people did or did not get a booster shot (third dose) using data from administrative registers.

2.1) Survey

Norstat, a well-established Swedish survey company, sends the survey to a general population sample of the Swedish population who received the first two doses of a COVID-19 vaccine.

First, we measure participants' economic preferences in two different ways using the following questions.

<u>Main measures</u> of social and risk preferences:

- **Altruism:** Willingness to donate endowment to charity: How much of SEK 200 do you want to donate to the charity *Save the Children*? (This choice is incentivized.)
- **Risk preferences:** Willingness to buy lottery tickets vs. getting a fixed amount: Each lottery ticket costs SEK 10 and has a 1 percent chance of paying SEK 1

000 and a 99 percent chance of paying nothing. How many lottery tickets do you want to buy with SEK 200? (This choice is incentivized.)

<u>Survey measures</u> of social and risk preferences:

- **Altruism survey:** How willing are you to give to good causes without expecting anything in return? (Response scale from 0 to 10)
- **Risk preferences survey:** In general, how willing are you to take risks? (Response scale from 0 to 10)

Additional preference measures, vaccination-related attitudes, and beliefs:

- **Norm following:** It is important for me to always behave properly and to avoid doing anything people would say is wrong. (Response scale from 0 to 10)
- **Self-image concerns:** Being generous is an important part of my sense of self. (Response scale from 0 to 10)
- **Social image concerns:** I attempt to appear generous in order to avoid disapproval from others. (Response scale from 0 to 10)
- **Autonomy:** It is important to me to make my own decisions about what I do. (Response scale from 0 to 10)
- **Extrinsic motivation:** I am strongly motivated by the money I can earn. (Response scale from 0 to 10)
- **Reciprocity:** When someone does me a favor, I am willing to return it. (Response scale from 0 to 10)
- **Trust:** I assume that people have only the best intentions. (Response scale from 0 to 10)
- **Time preferences:** How willing are you to give up something that is beneficial for you today in order to benefit more from that in the future? (Response scale from 0 to 10)
- **Present focus:** I postpone starting on things I dislike to do. (Response scale from 0 to 10)
- **Attitudes to payments for health behaviors:** I would support the introduction of regulated monetary payments for blood donations (Response scale from 0 to 10)
- **Beliefs about vaccine risk:** In general, COVID-19 vaccines are safe. (Response scale from 1 to 5)
- **Vaccine knowledge:** Diseases like autism, multiple sclerosis, and diabetes might be triggered through vaccination. (Response scale from 1 to 5)
- **Worries vaccine:** I am worried about the side effects from COVID-19 vaccines. (Response scale from 1 to 5)

We also collect variables on COVID-19 history, risk group status and socio-demographics.

Treatments:

Then, we randomly allocate participants to one of five conditions. First, we have a control condition:

- **Control condition:** We encourage participants to take the third dose of a COVID-19 vaccine.

Second, we study the impact of four incentive schemes which all have an expected payoff of SEK 200. All schemes include the same encouragement as in the control condition plus the treatment:

- **Guaranteed payment:** We offer people SEK 200 if they get vaccinated within 1 month, which we check using administrative data.
- **Lottery incentive:** We offer people a lottery ticket with a 1% chance of winning SEK 20,000 (expected value is SEK 200) if they get vaccinated within 1 month, which we check using administrative data.
- **Prosocial incentive:** We offer people a donation of SEK 200 to the charity *Save the Children* if they get vaccinated within 1 month, which we check using administrative data.
- **Choice of incentive:** We offer people the free choice of any of the three incentive schemes (guaranteed payment, lottery or prosocial incentive). We pay people the chosen incentive if they get vaccinated within 1 month, which we check using administrative data.

Next, we ask participants about their intentions to receive the COVID-19 vaccine:

- **Intention:** Do you think you will get a third dose of a COVID-19 vaccine within one month? (No/Yes)

Finally, we provide participants with a link to a governmental website where they can receive information about how they can sign up for a vaccine appointment in their region. We record whether they click on the link:

- **Survey behavior:** Did the participant click the link to get information of how to make a vaccination appointment? (0/1)

We send participants two treatment-specific reminders.

2.2) Administrative data

We will be able to match our survey responses with administrative data on vaccination uptake. For all participants we will see whether and when they received the third dose of a COVID-19 vaccine. Using these data, we construct the following variable:

- **Vaccination uptake (<u>main outcome</u> measure):** Did the participant get a third shot (booster shot) of a COVID-19 vaccine within the first month of trial participation? (0/1)

3) Analysis

3.1) Main analysis

We will study whether the guaranteed payment, lottery incentive, prosocial incentive, and choice of incentive affect actual vaccination uptake, Vaccination uptake.

We compare vaccination uptake in each of these treatment conditions to the uptake in the control condition using OLS. To do so, we regress Vaccination uptake$_i$ on a set of treatment condition dummies:

$$\text{Vaccination uptake}_i = b_0 + b_1 1(\text{guaranteed payment})_i + b_2 1(\text{lottery incentive})_i + b_3 1(\text{prosocial incentive})_i + b_4 1(\text{choice of incentive})_i + b_5 X_i + e_i$$

where $1(t)_i$ has a value of 1 if participant i is in treatment condition t and a value of 0 otherwise, X_i is a vector of control variables (consisting of gender dummies, age dummies, region dummies, interactions between age and region[1], being in an at-risk group for COVID-19, civil status dummies, a dummy for children in the household, dummies for employment status, dummies for education, dummies for parents' place of birth, and income, see section 3.5 for details on how we exactly define those variables), and e_i is an individual specific error robust to heteroscedasticity. We will test whether b_1, b_2, b_3 and b_4 are statistically significantly higher than zero.

3.2) Choice of incentive

Second, we test whether we can increase vaccination uptake the most by allowing for heterogeneity in motives to act. We can do this by studying whether the choice of incentive condition has a bigger impact than the other conditions. We first test this by pooling the guaranteed payment, lottery incentive and prosocial incentive and comparing their pooled impact to the choice of incentive impact as follows:

$$\text{Vaccination uptake}_i = b_0 + b_1 1(\text{choice of incentive})_i + b_2 X_i + e_i$$

For this regression, we only use observations from the guaranteed payment, lottery incentive, prosocial incentive, and choice of incentive conditions (so we do not include data from the control condition). Accordingly, b_1 estimates the impact of the choice of incentive condition vs. the 3 conditions pooled. The vector of controls includes the same controls as discussed in section 3.1.[2]

We will also study whether economic preferences (in particular Altruism and Risk preferences) predict the incentive scheme choice in the choice of incentive condition. We will test this by only using the data from the choice of incentive condition and regressing the choice of the incentive on Altruism and Risk preferences. This will allow us to assess whether people self-select into treatment and how that corresponds to the

[1] If there are heterogeneities in the rollout of the vaccination program, e.g., across age groups and regions, we will control for the exact level of the rollout dimension if we have the data available, see section 3.5 for details.

[2] We will also compare vaccination uptake in choice of incentives with each of the three other conditions (guaranteed payment, lottery incentive, prosocial incentive) separately, although we will have substantially less power for this comparison.

heterogeneous treatment effects based on social and risk preferences we examine in the next section (3.3).

3.3) Heterogeneous treatment effects according to economic preferences

We will then study whether there are heterogeneities in treatment effects of the guaranteed, lottery and prosocial incentive conditions for people with different economic preferences (we will call these different dimensions: "measure$_i$"). The measures of interest are the ones described in Section 2.1, with the main focus on altruism and risk preferences. We use a fully interacted OLS model where we prespecify all simple interactions of the guaranteed, lottery and prosocial incentive conditions with each of the different preference measures. That is, we regress vaccination uptake on a set of treatment condition dummies and the interaction between treatment dummies and preference measures:

$$\begin{aligned}\text{Vaccination uptake}_i = b_0 + b_1 1(\text{guaranteed payment})_i + b_2 1(\text{lottery incentive})_i \\ + b_3 1(\text{prosocial incentive})_I + b_4 1(\text{guaranteed payment})_i * \text{measure}_i \\ + b_5 1(\text{lottery incentive})_i * \text{measure}_i + b_6 1(\text{prosocial incentive})_i * \text{measure}_i \\ + b_7 X_i + e_i\end{aligned}$$

where $1(t)_i$ has a value of 1 if participant i is in the treatment condition t and a value of 0 otherwise, X_i is a vector of control variables (see section 3.1), and e_i is an individual specific error robust to heteroscedasticity. For this regression, we only use observations from the guaranteed payment, lottery incentive, prosocial incentive, and control conditions. For our main analysis, we use altruism and risk preferences as measure$_i$. We test whether the lottery incentive has a larger treatment effect for risk affine participants ($b_5 > 0$ for measure$_i$ = risk preferences / risk taking) and whether the prosocial incentive has a larger treatment effect for altruistic participants ($b_6 > 0$ for measure$_i$ = altrusim).

3.4) Targeting and individual treatment effect heterogeneity

We want to further improve our understanding of whether we can increase the effectiveness of the interventions by targeting incentive schemes to different types of participants. In section 3.2 we study whether vaccination uptake can be increased by letting people self-select into different incentives schemes that fit their preferences. In this section we study whether *we* can allocate them to different interventions to increase uptake ("behavioral targeting").

We will assess whether behavioral targeting can work by estimating the optimal targeting function (for instance, using OLS or tree-based methods such as in Wager and Athey, 2021). We then use these estimates to assess whether one can increase vaccination uptake by reassigning treatments. Among others, we compare the overall effectiveness of a reassigned intervention to random assignment of guaranteed payment, lottery incentive or social incentive (pooled specification) and to each of the individual treatment effects outlined in Section 3.1. We will do these comparisons estimating the targeting function using i) only sociodemographics, ii) sociodemographics plus the preference measures and iii) only the preference measures.

This allows us to examine whether targeting based on economic preferences can improve vaccination uptake.

3.5) Definition of Variables

We will treat all measures, in particular the preference measures, as continuous for regression analyses (unless indicated otherwise or when measures are binary). For instance, when participants are asked whether a statement describes them, we will code "does not describe me at all" as 0 and "describes me perfectly" as 10.

We will code the variables below for all OLS analyses indicated before as follows:

- Age: We will use 5-year age brackets as in Campos-Mercade et al. (2021).
- Gender: dummies for the categories indicating male/female.
- Region: dummies for each of the counties in Sweden.
- Being in a COVID-19 risk group: dummy for the category "yes."
- Civil status dummies for each status: single, sarbo, couple, married, others.
- A dummy for whether children live in the participant household: dummy for number of children in the household >0.
- Employment status dummies for each status: full-time, part-time, work, unemployed, student, pensioner, others.
- Educational attainment dummies for each group: elementary, high-school, professional training, ongoing university studies, university studies, research studies.
- Parental place of birth dummies: dummies for each place of origin of the mother and the father.
- Income dummies for each category of incomes used in the survey.

4) Data collection and sample size

4.1) Data collection

The surveys are collected through an online survey with the help of the Swedish survey company Norstat. We aim to collect data from about 6,000 participants. However, there is some uncertainty about the number of people that can be recruited, and we could end up with a higher or small sample size. Importantly, we will not have access to the vaccination data until we have finished data collection. We will field the survey at around the beginning of February.

4.2) Exclusion criteria

We exclude participants who have not yet received two doses and participants who already got their booster shot or already booked an appointment for a booster shot.

4.3) Power

We use simulations to estimate our power. With 6'000 observations and using a baseline in which 60% of the participants in the control group vaccinate, we will have 80% power to detect an effect size of about 5 percentage points.

References

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