COVID-19 VACCINE LOTTERY FIELD EXPERIMENT

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Behavioural Economics 871 Essay

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1. Introduction

Coronavirus disease 2019 (COVID-19) has caused the largest public health crisis, and economic disaster of the 21st century so far (Kadkhoda (2021) p.471). According to the World Health Organisation (2021), COVID-19 has directly resulted in 4,859,277 deaths worldwide[1], and the impact on the global economy has been severe (World Bank (2020)). Policymakers are in urgent need of evidence-based strategies to contain the pandemic. One critical mechanism through which epidemics are controlled is through herd immunity (Fontanet & Cauchemez (2020)). Herd immunity is where a certain amount of the population is immune to a disease and can be achieved through a certain threshold of the population being vaccinated.

The South African government has stated that it aims to have 67% of the population vaccinated by the end of 2021 (RSA (2021a)). In spite of this, many South Africans are hesitant to get the COVID vaccine; RSA (2021b) reports that only 25% of South Africa's adult population have been fully vaccinated[2]. Governments around the world are devising strategies to contain the pandemic; one solution is to incentivise vaccinations. Here, insights from behaviourial economics could provide a cost-effective solution: a vaccine lottery.

This essay proposes a field experiment to investigate whether a vaccine lottery could improve vaccination rates in South Africa. The experiment explores the effect of three different lottery types - standard, regret and referral - on the take up of vaccines. This essay is structured as follows. Section 2 briefly reviews the relevant literature on behavioural economics and vaccine lotteries. Section **??** elaborates on the South African context. Section 4 describes the design of the experiment and outlines the three types of treatment groups. Section discusses how the treatment will be administered and how the data will be collected. Lastly, section 6 gives a pre-analysis plan of the empirical analysis that will be performed on the data, and the final section (7) concludes.

- a clear statement of the research question and motivation for why this is interesting and important;
- a brief review of the relevant literature (both theoretical and empirical) which highlights the research gap your experiment will address;

- a clear description of the experimental design and the theory of change; • an explanation of how the treatments will be administered and data gathered (including proposed partner institutions); • a pre-analysis plan of the empirical analysis that will be performed on the data.

amount of people have received the vaccine so far. Critical to reach herd immunity is improving vaccination rates.

[1] As of 13 October 2021
[2] Statistics reported as of 11 October 2021

2. Behavioural Economics and Health Incentives

It is not unprecedented to use lotteries in public health interventions. To the best of my knowledge, this experiment would be the first randomized field experiment to assess the impact of lotteries on COVID-19 vaccine take-up in South Africa. Several papers show that regret lotteries can improve health outcomes, such as Husain, Diaz, Schwartz, Parsons, Burg, Davidson & Kronish (2019) and Humphrey, Small, Jensen, Volpp, Asch, Zhu & Troxel (2019)

Loss aversion, regret avoidance, social preferences

Individuals have a tendency to overweight small probabilities and this overestimate their chances of winning a lottery. behavioural economics theory and

health incentive applications gambling in SA

This paper addresses the gap pf vaccine lotteries in SA.

3. The South African Context {context}

There are currently four vaccines which have been approved by the South African Health Products Regulatory Authority for use in South Africa: Johnson & Johnson (J&J), Pfizer, Sinovac and AstraZeneca. The two main vaccines being rolled out in South Africa are the J&J and Pfizer, which are both available for free. Vaccines are currently only available to individuals over the age of 18. The J&J vaccine only requires 1 dose; and the Pfizer vaccine requires two doses, 6 weeks apart. For the purposes of this field experiment, *fully vaccinated* refers to an individual who has had either 1 J&J shot, or both shots of the Pfizer vaccine. *Vaccinated* refers to an individual who has had 1 shot of either vaccine.

According to RSA (2021b), 34% of South Africans are vaccinated, while only 25% are fully vaccinated.

Province	Total Adults Vaccinated	Adult Population	Percentage Vaccinated
Eastern Cape	1 603 045	4 099 543	39%
Free State	735 696	1 914 521	38%
Gauteng	3 523 373	11 311 326	31%
KwaZulu-Natal	2 170 526	7 219 795	30%
Limpopo	1 437 846	3 695 801	39%
Mpumalanga	831 759	3 039 520	27%
North West	835 206	2 693 247	31%
Northern Cape	290 962	847 545	34%
Western Cape	2 141 933	4 976 903	43%
Total	13 570 346	39 798 201	34%

Table 3.1: Vaccination Statistics

4. Experiment Design

The field experiment is designed to address the research question: could a vaccine lottery improve vaccination rates in South Africa?

The sample used will be the same sample used for the Coronavirus Rapid Mobile Survey (NIDS-CRAM). NIDS-CRAM was created in response to the pandemic as a way to build a representative data set of the South African population to inform decision-making (Ingle (2021)). Thus far, there have been five waves of NIDS-CRAM surveys, with wave 5 comprising a sample of 5,862 people being surveyed during 6 April to 11 May 2021 (Ingle (2021) p.14). Wave 3 consisted of a total of 8,157 potential participants, of which 6,130 were successfully interviewed. For the purposes of this field experiment, the 8,157 people from Wave 3 will be contacted and asked to participate in the experiment. It seems reasonable to expect between 5,500 and 6,200 people to participate, given the previous rates of attrition experienced in NIDS-CRAM.

The NIDS-CRAM sample will then be split into 4 groups of equal size. Assuming a conservative sample size of 5,500, each of the 4 groups will comprise 1,375 individuals. Duflo, Glennerster & Kremer (2007) which will be randomised using the randomisation technique as proposed by @. The first group is the control group, where individuals will not be entered into any vaccine lottery. The other 3 groups are will receive different lottery treatments, which are explained below. There will be 3 monthly lotteries for each treatment group, which will run simultaneously. Thus, in total there will be 9 lotteries for this field experiment, with 3 lotteries every month. Each lottery will award a cash prize of R1,000,000.

NIDS-CRAM is a special follow-up survey of a subsample of adults from households that were part

of the last wave (2017) of the National Income Dynamics Study (NIDS). NIDS was a large-scale longitudinal survey, run by the Southern Africa Labour and Development Research Unit (SALDRU), that tracked the social and economic well-being of South Africans from 2008 up to 2017. SALDRU (based at the University of Cape Town) was responsible for the NIDS-CRAM survey data collection, quality assurance and production. The NIDS-CRAM survey instrument includes a wide range of questions on income and employment, sociodemographic characteristics, and household welfare. This paper draws on questions about vaccine acceptance that were included in Waves 4 and 5 of the NIDS-CRAM survey. Wave 4 was conducted from 2 February to 10 March 2021 with a sample of 4,792 individuals, and Wave 5 was conducted from 6 April to 11 May 2021 with a sample of 4,996. Compared to NIDS-CRAM Wave 1 (May and June 2020), Wave 4 had 31% attrition and Wave 5 had 28% attrition.

For the first treatment group, if an individual has received a vaccination shot[3] within a given month, she will be entered into that month's vaccine lottery. At the end of the month, a winner is randomly selected from the lottery pool. Once it is verifed that the winner has been vaccinated, she will be privately contacted and will receive a cash prize. It will then be announced via sms to everyone in the treatment group (group 1) that the lottery has been won, the amount of the lottery prize, and the winner's province.

Following the approach of Gandhi, Milkman, Ellis, Graci, Gromet, Mobarak, Buttenheim, Duckworth, Pope, Stanford, Thaler & Volpp (2021), the second lottery is a "regret lottery". Every individual in the sample is entered into a monthly lottery but an individual may only claim her prize if she has been vaccinated (i.e. had at least 1 shot of any vaccine). At month end, a winner is randomly drawn from the lottery pool. If the winner has been vaccinated, she will be privately notified and will receive a cash prize. It will then be announced via sms to everyone in the treatment group (group 3) that the lottery has been won, the amount of the cash prize, the winner's province and a reminder that only vaccinated individuals are eligible to win the lottery.

The final treatment is a "referral lottery". An individual is entered into the monthly lottery if 2 conditions are met: he is vaccinated, and he refers a friend to get vaccinated and the friend gets vaccinated. Both the individual from the sample and his friend are entered into the lottery. At the end of the month, a winner is selected, verified to be vaccinated and privately informed. An SMS is sent out to the treatment group with the same information as for group 2 and group 3, in addition to a message thanking the sample for protecting their friends as well as a reminder that they can refer more friends to be eligible for the following month's lottery.

Including an SMS after the lottery has won serves as a reminder that there is a

[3] An individual only need a receive one shot of any vaccine - receiving the first shot of the Pfizer qualifies an individual for that month's lottery

Table 4.1 summarises the different treatments administered.

Group	Treatment
Control	No lottery
Group 1	Individual is entered into a lottery once they are vaccinated
Group 2	Everyone in the group is entered into a lottery; only vaccinated individuals can claim the prize
Group 3	Individual is entered if she is vaccinated and refers a friend, who gets vaccinated

Table 4.1: Treatment Summary

Many South Africans are hesitant to get the COVID vaccine. As STATSA shows, amount of people have received the vaccine so far. Critical to reach herd immunity is improving vaccination rates. In order to improve the take-up of vaccinations, a field experiment designed around a vaccination lottery is proposed. While some governments have considered and experimented with lump-sum payments, behavioural economics could provide a more cost-effective solution. Individuals have a tendency to overweight small probabilities and this overestimate their chances of winning a lottery. In South Africa,

Theory: overweight small probabilities, gambling, social preferences, regret avoidance Empirical: vaccine field designs, lottery incentives, regret lottery incentives Several authors have experimented with lotteries as an incentive for vaccinations, although there have been no studies as of yet on the South African population. Probles with vaccine studies: too few participants. A larger study could fill this gap in the literature.

5. Treatment and Data

The CRAM survey exists to provide monthly nationally-representative data on key outcomes such as unemployment, household income, child hunger and access to government grants.

Partner with NIDS, department of health, vaccine administer, funding data collected at vaccine add 3 questions to NIDS data cram

6. Pre-analysis plan

Students must submit an essay in which they design a field experiment that could answer an interesting behavioural economic question. The essay must contain the following:

• a clear statement of the research question and motivation for why this is interesting and important;
• a brief review of the relevant literature (both theoretical and empirical) which highlights the research gap your experiment will address;

• a clear description of the experimental design and the theory of change; • an explanation of how the treatments will be administered and data gathered (including proposed partner institutions); • a pre-analysis plan of the empirical analysis that will be performed on the data.

Overview In this field experiment, a person who refers his/her friend to receive a vaccine would be entered into a lucky draw, with a monetary prize, created by the government. The purpose behind this nudge is to encourage people who would otherwise not have got a Covid vaccine, to do so. The hypothesis is that there should be an increase in the total number of people receiving a Covid vaccine after the nudge is implemented. Increasing the number of vaccinations is important as medical research shows that vaccines decrease the probability of contracting Covid-19 and are also effective at reducing the severity of the symptoms of the virus for those who do contract it. The Nudge The nudge addresses behaviour by creating an environment where there is social pressure to get a vaccine (if I wanted to enter the lucky draw, I would pressure my friend into getting the vaccine). It is also likely that if a person asks her friend to get the vaccine so she can enter the lucky draw, she will reciprocate and get the vaccine as well so that her friend may enter the draw, which will also increase the number of people getting vaccinated. For the vaccines that require two doses (e.g. Pfizer), a person's name could be withdrawn, if the second shot is not given within a certain amount of time. This makes use of loss aversion, where people who already have their names in the draw feel the pain of having their names withdrawn more intensely than the pleasure of having their names added a second time to the draw for getting their second shot. Target Group The lucky draw is anticipated to attract people who are risk-on (they enjoy gambling, and are less worried about getting vaccinated), and poorer individuals for whom winning money is more attractive. These target groups are desirable as they are less likely to get the vaccine, and the government would like to maximise the number of vaccinated people. Additionally, if there are individuals who want to be vaccinated but procrastinate getting the vaccine (e.g. naïve hyperbolic discounters), setting a deadline for the lucky draw could increase the utility of getting the vaccine earlier enough to overcome the procrastination problem. There is no downside or extra cost for having people enter the lucky draw who would otherwise still have got the vaccine. Proposed Partner Institutions This field experiment would be in collaboration with the South African government and facilities that conduct vaccinations (e.g. Clicks). The government would be where the data is centralized and the administers of vaccines would all be data collection nodes. After a person has received a vaccine, the administer would ask if the person received a referral for the shot, and then note the ID number of the friend in addition to the individual's details.

Data Collection There is a data collection system already set up at the vaccination sites so this extra data point would not be difficult to collect within the current tracking system. Depending on costs, the referral friend could be sent an sms thanking her for caring about others and getting

them vaccinated, and letting her know that she has been entered into the draw. This is a positive reinforcement technique and shows people that the government is following up on their promise. This acknowledgement and transparency is expected to encourage more referrals. Once the lucky draw has been concluded, the data can be analysed, the purpose of which is to uncover whether the nudge increased vaccinations.

References are to be made as follows: Fama & French (1997: 33) and Grinold & Kahn (2000) Such authors could also be referenced in brackets (Grinold & Kahn, 2000) and together Grinold & Kahn (2000). Source the reference code from scholar.google.com by clicking on "cite'' below article name. Then select BibTeX at the bottom of the Cite window, and proceed to copy and paste this code into your ref.bib file, located in the directory's Tex folder. Open this file in Rstudio for ease of management, else open it in your preferred Tex environment. Add and manage your article details here for simplicity - once saved, it will self-adjust in your paper.

> I suggest renaming the top line after @article, as done in the template ref.bib file, to something more intuiti

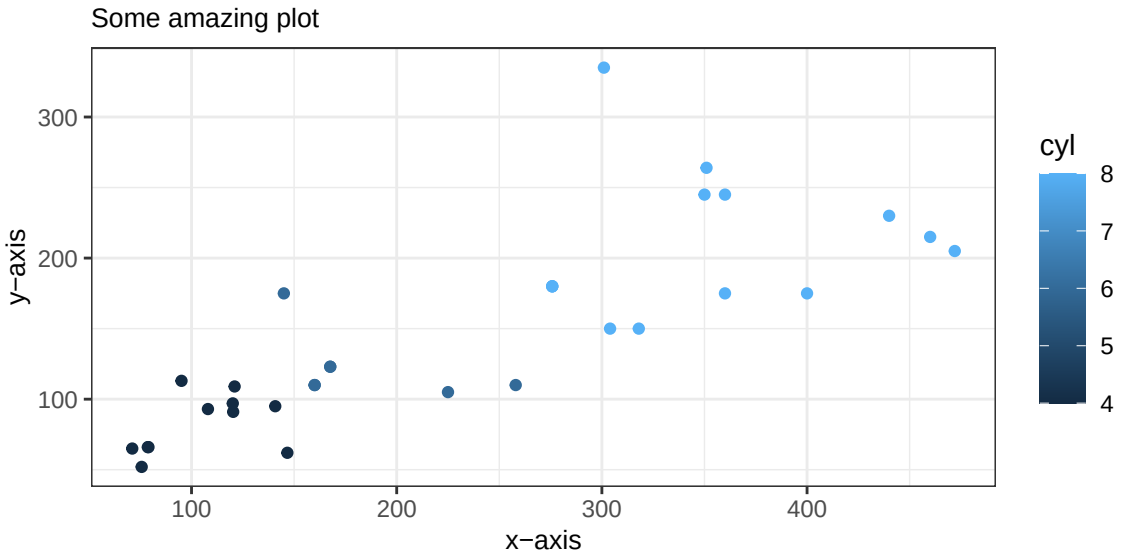

Figure 6.1: Caption Here

To reference calculations **in text**, *do this:* From table 3.1 we see the average value of mpg is 20.98.

Table 6.1: Long Table Example

mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
21.00	6.00	160.00	110.00	3.90	2.62	16.46	0.00	1.00	4.00	4.00
21.00	6.00	160.00	110.00	3.90	2.88	17.02	0.00	1.00	4.00	4.00
22.80	4.00	108.00	93.00	3.85	2.32	18.61	1.00	1.00	4.00	1.00
21.40	6.00	258.00	110.00	3.08	3.21	19.44	1.00	0.00	3.00	1.00
18.70	8.00	360.00	175.00	3.15	3.44	17.02	0.00	0.00	3.00	2.00
18.10	6.00	225.00	105.00	2.76	3.46	20.22	1.00	0.00	3.00	1.00
14.30	8.00	360.00	245.00	3.21	3.57	15.84	0.00	0.00	3.00	4.00
24.40	4.00	146.70	62.00	3.69	3.19	20.00	1.00	0.00	4.00	2.00
22.80	4.00	140.80	95.00	3.92	3.15	22.90	1.00	0.00	4.00	2.00
19.20	6.00	167.60	123.00	3.92	3.44	18.30	1.00	0.00	4.00	4.00
17.80	6.00	167.60	123.00	3.92	3.44	18.90	1.00	0.00	4.00	4.00
16.40	8.00	275.80	180.00	3.07	4.07	17.40	0.00	0.00	3.00	3.00
17.30	8.00	275.80	180.00	3.07	3.73	17.60	0.00	0.00	3.00	3.00
15.20	8.00	275.80	180.00	3.07	3.78	18.00	0.00	0.00	3.00	3.00
10.40	8.00	472.00	205.00	2.93	5.25	17.98	0.00	0.00	3.00	4.00
10.40	8.00	460.00	215.00	3.00	5.42	17.82	0.00	0.00	3.00	4.00
14.70	8.00	440.00	230.00	3.23	5.34	17.42	0.00	0.00	3.00	4.00
32.40	4.00	78.70	66.00	4.08	2.20	19.47	1.00	1.00	4.00	1.00
30.40	4.00	75.70	52.00	4.93	1.61	18.52	1.00	1.00	4.00	2.00
33.90	4.00	71.10	65.00	4.22	1.83	19.90	1.00	1.00	4.00	1.00
21.50	4.00	120.10	97.00	3.70	2.46	20.01	1.00	0.00	3.00	1.00
15.50	8.00	318.00	150.00	2.76	3.52	16.87	0.00	0.00	3.00	2.00
15.20	8.00	304.00	150.00	3.15	3.44	17.30	0.00	0.00	3.00	2.00
13.30	8.00	350.00	245.00	3.73	3.84	15.41	0.00	0.00	3.00	4.00
19.20	8.00	400.00	175.00	3.08	3.85	17.05	0.00	0.00	3.00	2.00
27.30	4.00	79.00	66.00	4.08	1.94	18.90	1.00	1.00	4.00	1.00
26.00	4.00	120.30	91.00	4.43	2.14	16.70	0.00	1.00	5.00	2.00
30.40	4.00	95.10	113.00	3.77	1.51	16.90	1.00	1.00	5.00	2.00
15.80	8.00	351.00	264.00	4.22	3.17	14.50	0.00	1.00	5.00	4.00
19.70	6.00	145.00	175.00	3.62	2.77	15.50	0.00	1.00	5.00	6.00
15.00	8.00	301.00	335.00	3.54	3.57	14.60	0.00	1.00	5.00	8.00
21.40	4.00	121.00	109.00	4.11	2.78	18.60	1.00	1.00	4.00	2.00

7. Conclusion

I hope you find this template useful. Remember, stackoverflow is your friend - use it to find answers to questions. Feel free to write me a mail if you have any questions regarding the use of this package. To cite this package, simply type citation("Texevier") in Rstudio to get the citation for Katzke (2017) (Note that uncited references in your bibtex file will not be included in References).

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Appendix

Appendix A

Some appendix information here

Appendix B