COVID-19 VACCINE LOTTERY FIELD EXPERIMENT

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Behavioural Economics 871 Essay

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1. Introduction

One critical mechanism through which epidemics are contained is through herd immunity. 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[1]. 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. Section 2 briefly reviews the relevant literature on behavioural economics and vaccine lotteries. 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 (8) 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.

2. Behavioural Economics and Health Incentives

behavioural economics theory and health incentive applications gambling in SA

This paper addresses the gap pf vaccine lotteries in SA.

[1]Statistics reported as of 11 October 2021

3. The South African 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 Research question: could a vaccine lottery improve vaccination rates in South Africa?

The sample used will be the same as for NIDS CRAM. Nationally representative, other data included, only pay for marginal cost of including extra questions

The NIDS CRAM sample will be split into 4 random groups, 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. 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. For the first treatment group, if an individual has received a vaccination shot[2] within a given month, she will be entered into that months's vaccine lottery. At the end of the month, a name is randomly selected from the lottery and receives a cash prize. Once it is verifed that the winner has been vaccinated, she will be privately contacted. It will be announced via sms to the entire sample that the lottery has been won, the amount of the lottery prize and the winner's province. The amounth 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 is entered into the lottery but an individual is eligible to win the lottery only if they have been vaccinated (had at least 1 shot of either vaccine).

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 is entered into a lottery and they are elgible to win if vaccinated
Group 3	Individual is entered if they referred a friend to get vaccinated and friend gets vaccinated

Table 4.1: Treatment Summary

Have 1 control group: no messages, no lotto Have 4 treatment groups: • Send messages • 1 lottery where you are entered if you got at least 1 vaccination • 1 lottery where a friend has to refer you • 1 regret lottery: everyone is entered into the lotto (receive sms) and can only win if vaccinated Can randomize across municipalities or provinces size of sample population for experiment

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, Lit Review Theory: overweight small probabilities, gambling, social preferences, regret

[2]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

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

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 intuitive for you to remember. Do not change the rest of the code. Also, be mindful of the fact that bib references from google scholar may at times be incorrect. Reference Latex forums for correct bibtex notation.

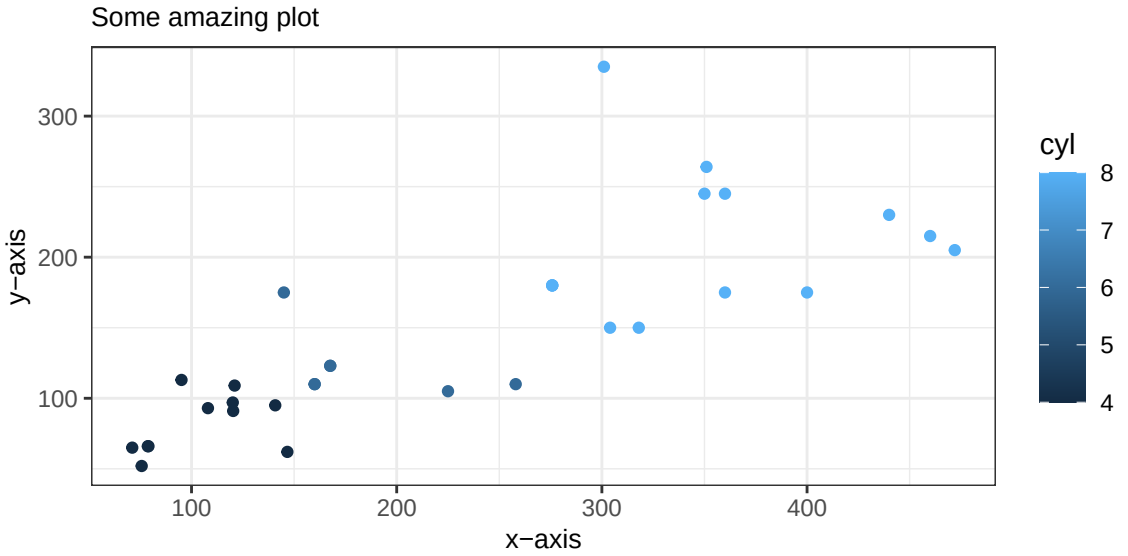

Figure 6.1: Caption Here

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

Continued on next page

Table 6.1: Long Table Example

mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
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

Table 6.2: Regression Output

	Reg1	Reg2	Reg3
(Intercept)	-2256.361 ***	5763.668 ***	4045.333 ***
	(13.055)	(740.556)	(286.205)
carat	7756.426 ***		7765.141 ***
	(14.067)		(14.009)
depth		-29.650 *	-102.165 ***
		(11.990)	(4.635)
N	53940	53940	53940
R2	0.849	0.000	0.851

*** p $<$ 0.001; ** p $<$ 0.01; * p $<$ 0.05.

FYI - R also recently introduced the gt package, which is worthwhile exploring too.

7. Lists

To add lists, simply using the following notation

- This is really simple
  - Just note the spaces here - writing in R you have to sometimes be pedantic about spaces...
- Note that Rmarkdown notation removes the pain of defining LaTeXenvironments!

8. 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).

References

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Appendix

Appendix A

Some appendix information here

Appendix B