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The backfiring effects of monetary and gift incentives on Covid-19 vaccination willingness

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Abstract

Policies offering material incentives for Covid-19 vaccination have been widely used around the world as countries pursue the pressing objective of boosting immunity. This paper reports an experiment in China aimed at testing the effects of such interventions on vaccination willingness. We provide the first Covid-19 vaccine study to separately consider and directly compare the effects of both monetary and gift-based incentives, both of which have been commonly employed in practice. Results from a sample of 1,365 individuals suggest that incentives in the range of 8-125 USD backfire, inducing lower vaccination willingness than simply offering vaccines for free. The effects of money and gifts of equivalent value do not significantly differ. We compare our results against the burgeoning literature on Covid-19 vaccine incentives, and demonstrate that the negative effects we identify are stronger than those observed to date in other populations.

Keywords: Covid-19; Vaccine willingness; Incentives

JEL Codes: D91; I12; I18

Declarations: We have no conflicts of interest to report. The study received approval from our university's ethics committee. All data will be made available upon publication.

1. Introduction

Countries are currently experiencing outbreaks of Covid-19. Although vaccination can provide effective intervention for this disease, it is important to ensure that a large enough percentage of the population is vaccinated. High vaccination rates can not only protect the vaccinated people but also the unvaccinated, and further help boost societal immunity and lower the risk of virus variation (Metcalf et al. 2015). Although vaccines are provided free of charge in most countries, vaccination rates remain far below ideal. In order to accelerate the vaccination rate, countries have started to offer various incentives with the hope of motivating people's vaccination willingness. For example, the American government has encouraged businesses to offer many creative incentives, including free doughnuts, basketball tickets, and gift cards to people who get vaccinated (The White House, 2021). Many American companies have directly reimbursed vaccinated employees with money, ranging from $25 to $750 (Krouse, 2021). In an Indian city, women who got vaccinated were given gold nose pins, and men were given hand blenders (Anon, 2021). In China, people have received various rewards such as eggs, rice, and flour for vaccine uptake (Meng et al., 2021). Cash-formed incentives also exist - for example, in parts of Shanghai, people were offered a direct 200 RMB transfer (Zhang, 2021). In general, gifts and cash are both widely used to encourage vaccination uptake. The question then arises as to whether or not these strategies are effective in raising vaccine uptake willingness.

In this paper, we report an online experiment examining the impact of providing incentives on the willingness toward Covid-19 vaccination in China. This experiment is designed to address whether material inducements, at various different levels of value, can succeed in making citizens more prepared to accept vaccination – or, paradoxically, whether they may instead backfire and *lower* vaccine willingness, in the same vein that prior literature has sometimes found material incentives to negatively motivate

prosocial behavior. A key contribution of our paper is that we are, to the best of our knowledge, the first to test the effects for Covid-19 vaccination of both monetary incentives and those based on non-monetary gifts, and directly compare the impact of each.

In our study, we presented subjects with one of seven hypothetical scenarios, in which a new and effective Covid-19 vaccination is being distributed among the Chinese population. Across treatments, we varied the availability, type and value of incentives for those agreeing to take the vaccine. In the control treatment, the vaccine would simply be offered for free. In the other treatments, a payment of either money or goods would be provided for vaccine recipients, which we varied in value across three levels ranging from 50 to 800 RMB (approximately 7.85 to 125.90 USD). Our outcome variable is subjects' stated willingness to receive the vaccine.

We find a striking tendency for the incentives to backfire. Even at the highest incentive level, vaccination willingness is lower than under the control treatment, suggesting that far from supporting policymakers' aims of expanding vaccination coverage, the use of low-to-medium sized incentives in China is in fact likely to be counterproductive. We find only a weak tendency for their effects to become less negative as a result of increasing the value of the incentives. On the basis of previous literature showing stronger motivational effects of gifts than of monetary payments of the equivalent value (Heyman and Ariely, 2004; Lacetera and Macis, 2010; Kube et al., 2012), we hypothesized that our gift treatments would outperform those employing money. However, here too we provide disappointing news for policymakers: the effects of non-monetary incentives did not significantly improve upon those of purely financial rewards.

Our study contributes to the rapidly growing literature on policy interventions aimed at increasing Covid-19 vaccination rates. In Section 2, we provide what is, at the time of writing, the most thorough review to date of existing literature investigating the effects

of monetary incentives for Covid-19 vaccination. This will provide a background against which our results can be compared. Our study identifies more strongly negative effects than any of the others, some of which have instead found positive effects of relatively small incentives (e.g. Campos-Mercade et al., 2021; Klüver et al., 2021). There is quite some heterogeneity in the findings in this literature, which may be driven by various factors including those specific to the population upon which the research is run. We note that ours is the only of these studies to have been run in China (and one of only a few to focus on non-western countries).

Our findings are based on hypothetical responses, i.e. stated preferences for vaccination uptake, rather than revealed preferences uncovered by real vaccination behavior. In this regard, as demonstrated in Section 2, our study is typical of the vast majority of existing research on Covid-19 vaccination incentives and other types of intervention (see the review by Batteux et al., 2022). Field experiments offering genuine material rewards for taking vaccines are much more logistically challenging and are likely to take longer to emerge; only a handful have appeared so far in the context of Covid-19 (Campos-Mercade et al., 2021; Chang et al., 2021; Mehmood et al., 2022). Although there is some evidence that the effects of incentives on Covid-19 vaccination behavior may scale up from hypothetical to real decisions (Campos-Mercade et al., 2021), we acknowledge the understandable priority economists typically give to revealed preference data. However, when this is scarce or non-existent we argue that there is great value for policymakers provided by stated preference research. Covid-19 remains a new, and acutely pressing, problem facing humanity; at this stage where useful information remains both limited and greatly coveted by policymakers, our research provides the best publicly available evidence on the effects of monetary incentives for Covid-19 vaccination in China, and on how these compare against the effects of non-monetary gifts in any country.

The structure of the rest of this paper is organized as follows: Section 2 reviews related literature; Section 3 describes the experimental setup and methods. Hypotheses are set

out in Section 4. Results and analysis are presented in Section 5, followed by a related discussion and conclusion in Section 6.

2. Literature Review

Monetary incentives are common in health contexts, and it has been proven they can improve individuals' health-related behaviors. For example, prior studies have demonstrated that financial incentives can encourage people to improve diet (Gardiner and Bryan, 2017), increase health monitoring (Sen et al., 2014) and physical activity frequency (Patel et al., 2018), and quit smoking (Volpp et al., 2009). Prior to Covid-19, monetary inducements have been used to encourage people to vaccinate themselves against other diseases, and these interventions have sometimes been successful (e.g. Mantzari et al., 2015; Tressler and Bhandari, 2019; Sato and Fintan, 2020).

Nevertheless, there is an ongoing debate on the relationship between monetary incentives and intrinsic motivation (Gneezy et al., 2011; Kamenica, 2012). Researchers have found, across a wide range of contexts, that incentives can backfire and even decrease individuals' work efforts and prosocial behaviors, by crowding out intrinsic motivation. In one famous example, Gneezy and Rustichini (2000) found individuals were less motivated to raise charitable funds when paid a small amount than when not paid at all.

The stage was thus set for a contentious debate to emerge, as soon as vaccinations had presented themselves as a potential escape route from the pandemic, over the role that material incentives could and should play in advancing vaccine uptake. This debate played out in media, policy and academic circles from the first year of the pandemic, with scholarly contributions both arguing in favor of and warning against the use of incentives (e.g. Mankiw, 2020; Kim, 2021; Volpp et al., 2021). Of particular concern is that, unlike certain other health behaviors, becoming vaccinated may not only protect

oneself but also others; this prosocial dimension to the act may render it more reliant on intrinsic motivation and therefore more susceptible to the backfiring effects of any intervention liable to crowd this out. A compounding worry is that the offer of compensation may be taken as a signal that an act is unpleasant or dangerous (Cryder et al., 2010), the relevance of which may be especially high in the context of vaccine hesitancy.[1]

With a view to informing this debate, there has already emerged a rapidly growing body of empirical research exploring the effects of monetary incentives on Covid-19 vaccination. Overall, this literature suggests financial inducements *can* successfully encourage vaccination, but in many contexts appear to be ineffective or even counterproductive. A large portion of the research has used experiments to estimate the effects of hypothetical (or occasionally real) incentives on stated willingness to be vaccinated (or actual vaccination rate). The findings of these studies are summarized in Table 1. The table reports for each experiment whether there is evidence for a crowding out effect (i.e. a significant negative effect on vaccination willingness/uptake resulting from the presence of incentives), and an estimated range on the level of incentives required to induce any significant positive effect. The latter is constructed as the range between the lowest level of incentives found in the study to produce a significant positive effect and the highest level found to produce a null effect, if there was one. We only include studies which specified the fixed value of the incentives in their treatments and reported sufficient data to identify which incentive levels produced significant results.

As the table shows, results are mixed. Only one study finds a significant crowding out effect, for incentives equal to or less than 20 USD (Serra-Garcia and Szech, 2022). Some of the studies only test the effects of much larger incentives and therefore do not

[1] Aside from questions about the effectiveness of offering material incentives for vaccination, there has also been a debate about the ethics of doing so. See Giubilini, 2021; Jecker, 2021.

shed light on whether crowding out would occur at lower levels. Other experiments, which do test incentives at lower levels, find these have either insignificant effects

Table 1: Summary of experimental literature on effects of financial incentives on Covid-19 vaccination

Study	Date of research	Population	Stakes	Crowding out effect found?	Minimum incentives required for positive effect
Kreps et al. (2021)	October 2020	United States	Hypothetical	No (lowest incentive tested = $10)	Positive effect not found (highest incentive tested = $100)
Robertson et al. (2021b)	December 2020	United States	Hypothetical	No (lowest incentive tested = $1000)	≤$1000
Serra-Garcia & Szech (2022)	December 2020 – February 2021	United States	Hypothetical	Yes, for incentives ≤ $20	$50-100
Klüver et al. (2021)	March 2021	Germany	Hypothetical	No (lowest incentive tested = $29.4)	≤$29.4
Sprengholz et al. (2022)	April 2021	Germany	Hypothetical	No (lowest incentive tested = $294)	$3,531-3,825
Mehmood et al. (2022)	April 2021	Pakistan	Real	No (lowest incentive tested = $7.5)	Positive effect not found (highest incentive tested = $15)
Jacobson et al. (2022)	May-July 2021	United States	Real	No (lowest incentive tested = $10)	Positive effect not found (highest incentive tested = $50)
Campos-Mercade et al. (2021)	May-July 2021	Sweden	Real	No (lowest incentive tested = $24)	≤$24
Fishman et al. (2022)	September 2021	United States	Hypothetical	No (lowest incentive tested = $100)	≤$100
Stamm et al. (2022)	October 2021	Austria	Hypothetical	No (lowest incentive tested = $115.7)	≤$115.7

George et al. (2022)	November-December 2021	South Africa	Hypothetical	No (lowest incentive tested = $3.3)	$3.3-23.3

Notes for Table 1: The dependent variable is *stated willingness to be vaccinated* for studies with hypothetical stakes; *vaccination rate* for studies with real stakes. *Crowding out* is defined as a significant decrease in the dependent variable resulting from monetary incentives; a *positive effect* is defined as a significant increase in the dependent variable resulting from them. The currency is USD; for studies reporting monetary amounts only in local currencies, we converted these into USD using the exchange rate at the time the research was conducted. The table only includes results based on experimental methods, from studies reporting sufficient data for it to be possible to calculate ranges on the maximum/minimum required incentives for crowding out/positive effects to occur.

(sometimes in a negative direction) or even significantly positive ones. Experiments testing much larger incentives tend to find positive effects, though in some cases there are null effects up until rather high levels. The minimum amount needed to induce a significantly positive effect ranges from less than or equal to 23.3 USD (George et al., 2022) to more than 3,500 USD (Sprengholz et al., 2022). Robertson et al. (2021b) only tested incentives in the range above 1000 USD, finding these generated a strong increase in vaccine willingness of around 8 percentage points, suggesting positive effects could also be created by much smaller incentives. Differences between studies in the required thresholds for significant positive or negative effects may well be influenced by differences in the populations investigated, the time the research was conducted, and methodological features including sample sizes.

In addition to the experimental literature, a number of studies have attempted to assess the effects of incentives using real-world vaccination data. This method has the advantage of observing real behavioral outcomes, while it also faces the drawback that confounding variables inevitably make it more difficult to cleanly identify and/or quantity causal effects. Among these studies, many have focused on the effects of lottery incentives offered in some US states for vaccination (Acharya and Dhakal, 2021; Lang et al., 2021; Robertson et al., 2021a; Sehgal, 2021; Walkey et al., 2021; Barber and West, 2022; Brehm et al., 2022; Cohn et al., 2022; Grossi, 2022; Guo et al., 2022;

Law et al., 2022; Sload et al., 2022; Thirumurthy et al., 2022; Wang et al., 2022); the results of these are largely split between null and significantly positive effects, with some suggestion that patterns may differ across states. Others have addressed the effects of guaranteed payments for vaccinations, with Wong et al. (2022) finding a 25 USD incentive increased vaccination rates in North Carolina, and Chetty-Makan et al. (2022) identifying a positive effect of offering older adults in South Africa a shop coupon worth 7 USD. Erdem et al. (2022) found a positive effect of offering $50 gift cards for children to be vaccinated.

As noted in our introductory section, the real-world incentives implemented in for Covid-19 vaccinations have not been limited to money but have often involved goods. It is therefore surprising that, at the time of writing (September 2022) we have not identified any research within this rapidly developing literature studying the effects of non-monetary gift incentives, or how they compare against those of monetary payments.[2]

Previous literature provides justification for considering this question, since evidence shows that compensations of the same nominal value but in different forms can elicit different reactions (Heyman and Ariely, 2004; Kube et al., 2012; Gilchrist et al., 2016). The main argument of these studies is that in-kind compensations aimed at improving behaviors lead to better positive responses compared to directly incentivizing behavior with cash (especially for small values of cash). This is despite the fact that, from a traditional economics perspective, money should always be weakly preferred to equivalently priced gifts, since the money can be exchanged for whatever one wants

[2] As noted above, some studies (Chetty-Makan et al., 2022; Erdem et al., 2022) have studied the effects of vouchers, which may lie in a psychological category in between money and the type of physical gifts we feature in our experiment. With regard to the comparison of different incentive types, there have been some Covid vaccination studies exploring the effects of guaranteed payments versus lotteries (e.g. Duch et al., 2021; Fishman et al., 2022; Mehmood et al., 2022).

(Waldfogel, 1993). Notably, Kube et al. (2012) found that non-monetary gifts have a much stronger impact in triggering workers' reciprocity, in the form of work effort, than monetary gifts of equivalent value.[3] It therefore seems plausible that through similar effects on citizens' motivation to behave reciprocally toward policymakers, gift incentives for Covid-19 vaccine uptake may work more effectively than money. Our study aims to fill this gap in the literature.

Another feature of the existing literature on incentives and Covid-19 vaccination is that the large majority of research has been conducted in western countries. A few studies have been conducted in other parts of the world, but to the best of our knowledge our paper is the first to examine this topic in Mainland China, the world's most populous country.

3. Experimental Design and Procedures

We conducted an online, survey-based experiment from March 8-22, 2022, with respondents recruited via the panel service provided by the Chinese survey platform Wenjuanxing. During the survey, we asked respondents to imagine a new, hypothetical Covid-19 vaccination had been made available and was more effective than those distributed in China to date. We took this approach, rather than basing our study on existing Covid-19 vaccines, because by the time of the experiment many people in China were already vaccinated and asking them about their willingness to receive existing vaccines might create confusion.

Respondents' willingness to take the hypothetical vaccine was elicited under three different incentive type conditions: *Money*, *Gift*, and *Control*. In the *Control* treatment,

[3] Of closer direct relevance to the type of behavior our study considers is Lacetera and Macis (2010), who produced evidence that people would be less willing to donate blood if offered money than if offered a voucher of equivalent value. As noted above, vouchers may be regarded somewhere in between money and physical gifts.

no vaccination incentive was mentioned. Under *Money* it was mentioned that those opting for vaccination would receive a cash reward, while under *Gift* it was stated that they would receive a thank-you gift. This thank-you gift took the form of a daily necessity (rice), which reflects the type of item that has actually been offered in China for Covid-19 vaccination (Meng et al., 2021).

Both *Money* and *Gift* contained 3 sub-conditions, varying in the value of the incentive: 50, 200, or 800 RMB. We label these treatments *M50*, *M200* and *M800* for *Money* and *G50*, *G200* and *G800* for *Gift*. The middle incentive level of 200 RMB was chosen to be in line with what had been implemented in Shanghai (Zhang, 2021). At the time of the experiment, the three incentive levels equated to about 7.85, 31.50 and 125.90 USD respectively.

Figure 1: Example of picture of gift shown to subjects

In order to control participants' perceptions about the value of the gift, we provided a picture of the rice and set a price tag next to it which explicitly marked its market price (see Figure 1).[4] Thus, the perception of the monetary value of the incentive should be held constant between, for instance, subjects in the *M50* and *G50* treatments (although,

[4] For consistency, in the *Money* treatments, subjects also were presented with a picture, a screenshot of a WeChat receipt for the relevant amount of money.

as alluded to in the previous section, under standard economic theory individuals may tend to prefer the money).[5]

Each respondent was randomly assigned to one of the seven treatments with equal probability. In each treatment, they were asked to indicate their willingness to receive the vaccine on a scale from 0 to 100, where 100 meant "completely willing to accept" and 0 "completely unwilling to accept". The full wording of the questions is presented in the Online Appendix.

In order to negate any effects of the transportation cost of carrying the gifts, the wording specified that they would be delivered free of charge to vaccine recipients' homes within two working days. For consistency, the waiting time associated with the cash payment was the same; recipients were told the money would be sent to their WeChat account within two working days (this is a standard form of payment in China, where physical currency is almost never used).

At the end of the questionnaire, we collected information about gender, age, monthly income, and hometown. Several questions were also introduced to elicit participants' opinions on Covid-19, including whether they trusted existing vaccines, how anxious they felt about the disease, and whether they knew anyone closely who had been infected with it. Respondents were assured that responses to all parts of the survey were anonymous.

3.1 Sample characteristics

A total of 1365 respondents participated in the experiment. Subjects were drawn from across China. 50.3% of the sample was female. Participants were roughly evenly

[5] We note that, although in principle the presence of the price tag might psychologically induce subjects to think of the rice more in monetary terms and less as a gift, evidence against this is drawn from Kube et al. (2012), who found no significant effect of presenting their gift with or without a price tag.

distributed between the following five age categories: 18-25, 26-30, 31-40, 41-45, and 46 and above.[6] Low-income （less than 5000 RMB per month）, medium-income (5000-8000RMB per month), and relatively high-income individuals (8000-15000RMB per month) each represented about 30% of the sample, with the remaining 10% made up of respondents whose monthly income exceeded 15,000 RMB. 7% of the participants said they knew someone closely who had been infected with the coronavirus[7], and 65.1% of respondents reported having a high or moderate degree of concern about contracting it.

4. Hypotheses

Theory and previous literature offer conflicting insights on the effects the incentives may have. From a traditional economic perspective, receiving either monetary or gift compensation would raise the utility levels associated with taking the vaccine, and should therefore increase demand. Moreover, the greater the value of the incentives provided, the greater this increase in demand should be. The latter prediction is consistent with the evidence of several of the studies reported in Table 1, which found the positive effects of incentives for Covid-19 vaccinations were stronger when the amounts offered were higher. The same has been found for other types of prosocial behavior, such as blood donation (Lacetera et al., 2014). On this basis, we offer the following hypotheses:

Hypothesis 1a: Incentives increase willingness to receive Covid-19 vaccination.

Hypothesis 1b: Willingness to receive Covid-19 vaccination increases in the size of the incentives offered.

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[6] The age distribution in our sample is skewed toward younger adults because older people in China are very difficult to reach in online research. Extremely few participants registered on the Wenjuanxing panel are above the age of 60.

[7] This rate would be very low in most other countries but does not seem unrepresentative in China, which has pursued a zero-case policy.

On the other hand, as mentioned earlier, previous literature – including in the context of Covid-19 vaccination (Serra-Garcia and Szech, 2022) – raises the possibility that incentives may backfire, especially at low levels. Offers of either money or gifts may crowd out individuals' intrinsic motivation to become vaccinated, or be interpreted as a signal of the vaccine's undesirability, leading to a negative impact on vaccination willingness relative to simply offering it for free. We therefore consider, in opposition to Hypothesis 1a, the following additional hypothesis:

Hypothesis 2: Incentives reduce willingness to receive Covid-19 vaccination.

As stated above, gifts have been shown to operate as better incentives than money in some contexts (Heyman and Ariely, 2004; Kube et al., 2012). Gift-based compensation might frame a transaction as a social interaction and produce positive psychological effects, whereas a direct cash transfer may instead be perceived as a pure market interaction. It is possible that gifts could therefore trigger a stronger willingness to adhere to a policymaker's wishes by becoming vaccinated. We propose the following hypothesis:

Hypothesis 3: Gifts are more effective than equivalent sized monetary incentives in raising vaccination willingness.

5. Results

Figure 2 presents the willingness to receive the vaccine for each treatment. As shown on the vertical axis, without any incentives, the average willingness toward vaccine uptake in the *Control* treatment is 85.42. It is clear that on average, there was no increase in vaccine uptake willingness when incentives were provided. On the contrary, it reduced in all treatments relative to the baseline. Two-tailed t-tests found the differences between each money or gift treatment and the control treatment to differ at

the 5% significance level or lower, except for the *M200* treatment in which vaccination willingness was not significantly different from in the *Control*. Hypothesis 1a is, therefore, never supported, while Hypothesis 2 is supported for all gift treatments and all bar one monetary incentive treatment. Overall, the results suggest that, far from helping to increase vaccination willingness, offering incentives at best has no effect and in most cases significantly backfires.

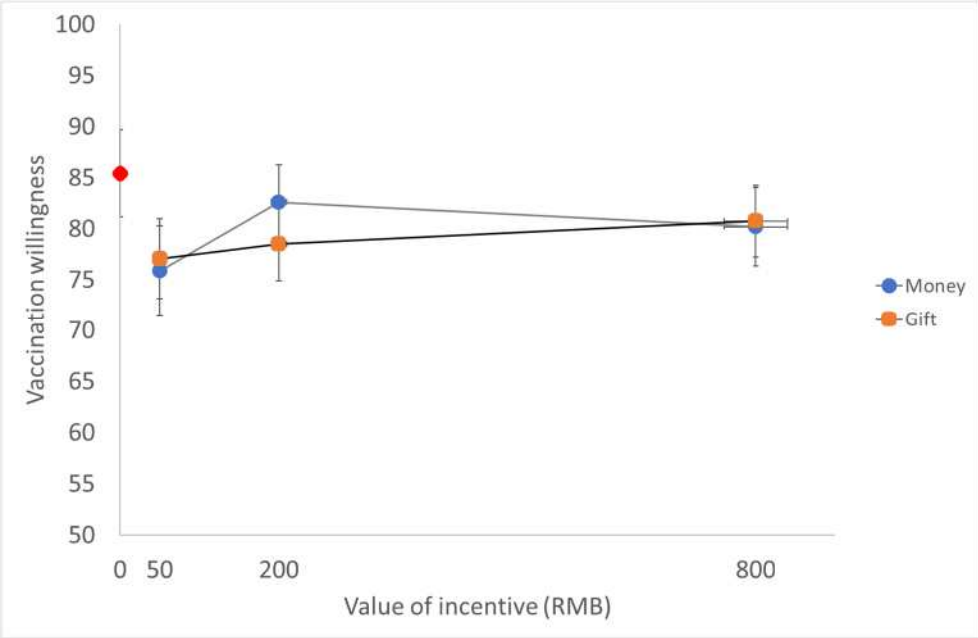

Figure 2: Vaccination willingness by treatment

Result 1: Incentives are either ineffective or reduce willingness to take the vaccine.

From Figure 2, we can see a mild increase in average vaccine uptake willingness as the magnitude of the incentives rises, for both money and gifts. In order to assess Hypothesis 1b, we run pairwise comparisons testing for significant differences across incentive levels, holding the incentive type constant: *M50* vs *M200*; *M50* vs *M800*; *M200* vs *M800*; *G50* vs *G200*; *G50* vs *G800*; *G200* vs *G800*. Two-tailed t-tests do not generate significant results on any of these tests, except for *M50* vs *M200*. There is, therefore, only limited support for our hypothesis that vaccination willingness increases in the level of incentives offered. We note that the decrease in willingness when offered

800 RMB relative to 200 RMB is counterintuitive, but as this is not significant it may be a mere statistical error. Overall, the results provide some weak evidence that increasing the size of incentives mitigates their backfiring consequences, but even the highest levels of incentives we tested failed to eliminate them, as evidenced by the significantly negative effects reported above for both the *M800* and *G800* treatments.

Result 2: Increasing the size of the incentives leads to a mild increase in vaccination willingness for monetary incentives, and does not significantly increase vaccination willingness for gift incentives.

We have shown that gift and money compensations lead to the reduction of vaccine uptake willingness, but do they erode willingness to different extents? To address Hypothesis 3, we ran two-tailed t-tests comparing vaccination willingness under *M50* vs *G50*, *M200* vs *G200* and *M800* vs *G800*. The results of these were all insignificant. Therefore, unlike in certain other contexts (e.g. Kube et al., 2012), we have not found that gifts work better than monetary inducements toward producing the desired behavior. Hypothesis 3, that gifts would better incentivize vaccination willingness than the equivalent money, is not supported.

Result 3: The effects of monetary incentives do not significantly differ from those of gift incentives of equivalent value.

5.1 Regression Analysis

Table 2 presents OLS regression models. The dependent variable is vaccination willingness. Treatment dummy variables are included; demographic control variables are also introduced, while models (2) and (3) control further for subjects' stated trust levels in existing Covid-19 vaccines, degree of worry about being infected, and

experience or not of a socially close person having been infected.[8] The significance levels of the treatment dummy coefficients corroborate the evidence presented above

Table 2: OLS Regressions

	Dependent Variable = Vaccination Willingness		
	(1)	(2)	(3)
Female	-5.055***	-5.605***	-5.589***
	(-3.53)	(-4.01)	(-3.99)
Age	0.688*	0.714*	0.774*
	(1.69)	(1.80)	(1.94)
Age^2	-0.006	-0.007	-0.008
	(-1.14)	(-1.43)	(-1.56)
Income	$2.76e^{-6}$	$5.81e^{-6}$	$-1.69e^{-4*}$
	(0.06)	(0.14)	(-1.88)
M50	-9.613***	-9.285***	-6.102
	(-3.62)	(-3.60)	(-1.60)
M50*Income			$-4.65e^{-4}$
			(-1.45)
M200	-3.006	-2.533	-5.979**
	(-1.13)	(-0.98)	(-1.98)
M200*Income			$2.78e^{-4**}$
			(2.18)
M800	-5.478**	-4.366*	-7.045**
	(-2.06)	(-1.69)	(-2.34)
M800*Income			$2.18e^{-4*}$
			(1.66)
G50	-8.634***	-8.584***	-11.488***
	(-3.26)	(-3.33)	(-3.62)
G50*Income			$2.48e^{-4}$
			(1.42)
G200	-7.163***	-6.775***	-7.240**
	(-2.70)	(-2.63)	(-2.20)
G200*Income			$1.86e^{-5}$
			(0.10)
G800	-4.883*	-5.593**	-9.185***
	(-1.85)	(-2.17)	(-3.05)
G800*Income			$2.18e^{-4**}$
			(2.26)
Trust Current Vaccine		8.415***	8.410***

[8] In order to use the control variables in the regressions, we needed to convert some of them from categorical to continuous variables. Age was estimated as the mid-point in the subject's age band; for those in the highest age band of 60 and above, we selected a value of 68.5, which is halfway between 60 and China's life expectancy. Income was similarly estimated as the mid-point of the subject's income band; for the few individuals in the highest category of monthly income above 100,000 RMB, we selected a value of 150,000 RMB. For the variables *Trust Current Vaccine* and *Worry about Covid* we assigned values of 1-4 for responses, with 1 representing the lowest level of trust/concern and 4 the highest.

		(8.03)	(8.02)
Worry about Covid		-0.201	-0.206
		(-0.24)	(-0.25)
Know Infected Person		-9.710***	-9.497***
		(-3.56)	(-3.48)
			(1.66)
Constant	72.119***	48.497***	49.541***
	(9.77)	(5.91)	(5.91)
N	1365	1365	1365
R^2	0.030	0.087	0.096

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

about the effects of each treatment. In model (1) the difference between the *Control* and *G800* treatments falls in significance to the 10% level, while in model (2) the difference between the *Control* and *M800* treatments does so. Otherwise, levels of significance are the same as identified by the t-tests. The regressions are also useful in quantifying the treatment effect sizes. The largest are for the *M50* and *G50* treatments, which reduce vaccination willingness by about 9.3 and 8.6 percentage points respectively, according to model (2).

Vaccination willingness was lower for females than males, consistent with previous research on Covid-19 (Zintel et al., 2022). Age was, with weak significance, positively associated with vaccination willingness[9], while income was unrelated with it. In model (3), however, we introduce interaction terms between income levels and the treatment dummies, and find some of these to be significant. Specifically, there is some tendency for both the money and gift incentives, at levels of 200 and 800 RMB, to have greater effectiveness on higher income individuals. In other models, which we do not report in the table, we tested for interactions between treatment effects and either gender or age, and found these to be insignificant in all cases.

[9] This may appear at first sight to contradict the actual situation in China, where vaccination levels have been relatively low among the very elderly (Kou, 2022; Xing, 2022). However, our sample contained very few elderly participants; only 12 were above the age of 60. Therefore, our data is not useful in comparing vaccination willingness between elderly and younger adults.

6. Discussion and Conclusion

Our results demonstrate that providing compensations for Covid-19 vaccination can backfire, reducing people's willingness to be vaccinated relative to merely offering the vaccine for free. Our results in this direction are striking, and stronger than those of previous literature. Of the experimental papers reviewed in Section 2, the only one to report significantly negative effects of Covid-19 vaccine incentives found that this effect, in the United States, was negated once incentives were raised to 50 USD (Serra-Garcia and Szech, 2022). Other studies have found significantly positive effects of incentives even smaller than this (e.g. Campos-Mercade et al., 2021; Klüver et al., 2021). In contrast, our experiment continues to identify a significant backfiring effect even for incentives worth roughly the equivalent of 125 USD. This is even despite the fact that these incentives are worth more in purchasing power – and represent a much higher proportion of average income – in China than in the US.

We identify a mild tendency for the incentives to work better (i.e. less badly) when they increase in value. We did not test incentives worth more than 800 RMB, and therefore cannot rule out that their effects may become positive at much higher levels. Nevertheless, our study offers a lesson to policymakers: the use of incentives, at small-to-medium levels, to encourage Covid-19 vaccination among the Chinese population does not seem to be an effective use of resources and may well be counterproductive toward achieving the policy goal of high vaccination rates. We speculate that the negative effects we identify may be due to incentives crowding out intrinsic motivation (Benabou and Tirole, 2006). Without material inducements individuals may wish to become vaccinated because this is what society promotes, and doing so gives them a positive feeling from performing their civic duty; the introduction of extrinsic incentives to vaccinate oneself may reduce the self-esteem or social-esteem benefits derived from the act. A supplementary explanation could be that the offer of material incentives sends negative signals about the quality or safety of a vaccine.

A further striking result is that the backfiring effects occur not only for monetary incentives but also for non-monetary gifts. The equivalent effectiveness of money and gifts in encouraging Covid-19 vaccination represents a novel research finding. Previous literature has shown gifts can be more successful than money in motivating certain behaviors, but disappointingly we find no evidence that this is the case for Covid-19 vaccination. It is possible that gifts provided by the government may fail to have the same positive motivating effects that gifts from employers have, because the exchange is more impersonal. However, we do encourage further research on the effects of gift incentives for Covid-19 vaccination. Our study only considers one type of gift (rice) and it is possible that others could be more successful. It is also possible that there is a cultural element to our results. In China, there is a relatively strong tradition of giving money as a gift (e.g. at weddings) and using it to cement interpersonal relationships; the distinction between money and non-monetary gifts may therefore be less pronounced than in other cultures.

The main limitation of this study is that we elicited hypothetical vaccination willingness rather than actual behavior. For practical reasons, the vast majority of existing research on Covid-19 vaccination interventions has investigated their effects using hypothetical methods like ours. We cannot, of course, guarantee that the patterns observed would be the same for real vaccination decisions. On this point, some reassuring evidence comes from Campos-Mercade et al. (2021), the only study we have encountered to date which measured the effects of monetary incentives on both stated vaccination intentions and subsequent actual behavior, finding very similar results for each. Nevertheless, we would certainly welcome any future research which tests whether our findings can be replicated under real scenarios. In the meantime, we encourage policymakers to give consideration to the implications held by the stated preferences of our experimental subjects for their attempts to devise effective Covid-19 vaccination interventions.

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Online Appendix

Below presents the survey text. Note that this is translated from the Chinese version used in the experiment.

Wording for each treatment (each subject only saw one of these)

Control treatment

Suppose there is a newly invented vaccine that proves to be more effective in preventing COVID-19 than the traditional Zhengxing and Kehui vaccines. Now, this free vaccine is available to you, how willing are you to accept this new vaccine?
Please indicate your answer on a scale from 0 to 100, where 100 means "completely willing to accept" and 0 represents "completely unwilling to accept".

G50 treatment

Suppose there is a newly invented vaccine that proves to be more effective in preventing COVID-19 than the traditional Zhengxing and Kehui vaccines. Now, this free vaccine is available to you, and you will receive an additional bottle of Mixed Grain Rice (valued at 50 RMB) as a thank-you gift if you decide to get vaccinated. This gift will be delivered to your home within 2 working days. How willing are you to accept this new vaccine?
Please indicate your answer on a scale from 0 to 100, where 100 means "completely willing to accept" and 0 represents "completely

unwilling to accept”.

50 RMB

G200 treatment

Suppose there is a newly invented vaccine that proves to be more effective in preventing COVID-19 than the traditional Zhengxing and Kehui vaccines. Now, this free vaccine is available to you, and you will receive additional 4 bottles of grain rice (valued at 200 RMB) as a thank-you gift if you decide to get vaccinated. This gift will be delivered to your home within 2 working days. How willing are you to accept this new vaccine?

Please indicate your answer on a scale from 0 to 100, where 100 means “completely willing to accept” and 0 represents “completely unwilling to accept”.

200 RMB

<u>G800 treatment</u> Suppose there is a newly invented vaccine that proves to be more effective in preventing COVID-19 than the traditional Zhengxing and Kehui vaccines. Now, this free vaccine is available to you, and you will receive additional 2 big packages of grain rice (valued at 800 RMB) as a thank-you gift if you decide to get vaccinated. This gift will be delivered to your home within 2 working days. How willing are you to accept this new vaccine? Please indicate your answer on a scale from 0 to 100, where 100 means “completely willing to accept” and 0 represents “completely unwilling to accept”.

_____

M50 treatment

Suppose there is a newly invented vaccine that proves to be more effective in preventing COVID-19 than the traditional Zhengxing and Kehui vaccines. Now, this free vaccine is available to you, and you will receive an additional cash reward of 50 RMB if you decide to get vaccinated. The money will be sent to your WeChat account within 2 working days. How willing are you to accept this new vaccine? Please indicate your answer on a scale from 0 to 100, where 100 means "completely willing to accept" and 0 represents "completely unwilling to accept".

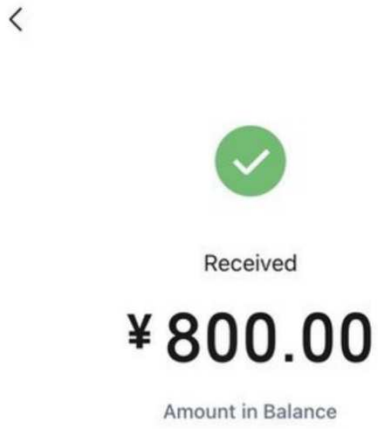
M200 treatment

_____

Suppose there is a newly invented vaccine that proves to be more effective in preventing COVID-19 than the traditional Zhengxing and Kehui vaccines. Now, this free vaccine is available to you, and you will receive an additional cash reward of 200 RMB if you decide to get vaccinated. The money will be sent to your WeChat account within 2 working days. How willing are you to accept this new vaccine?
Please indicate your answer on a scale from 0 to 100, where 100 means “completely willing to accept” and 0 represents “completely unwilling to accept”.

M800 treatment

Suppose there is a newly invented vaccine that proves to be more effective in preventing COVID-19 than the traditional Zhengxing and Kehui vaccines. Now, this free vaccine is available to you, and you will receive an additional cash reward of 800 RMB if you decide to get vaccinated. The money will be sent to your WeChat account within 2 working days. How willing are you to accept this new vaccine?
Please indicate your answer on a scale from 0 to 100, where 100 means “completely willing to accept” and 0 represents “completely unwilling to accept”.



Further questions

1. What is your gender?

○Male ○Female

2. What is your age? *

○18~25 ○26~30 ○31~40 ○41~50 ○51~60 ○Above 60

3. Where is your hometown? *

_____

4. What is your monthly income? *

○Less than 3,000 RMB

○3,000 RMB - 5,000 RMB

○5,000 RMB - 8,000 RMB

○8,000 RMB - 15,000 RMB

○15,000 RMB - 30,000 RMB

○30,000 RMB - 50,000 RMB

○50,000 RMB - 100,000 RMB

○More than 100,000 RMB

5. How much do you trust that the current used Coronavirus vaccine (Zhengxing/ Kehui) is effective? *

○Do not trust at all

○Do not trust very much

○Trust somewhat

○Trust completely

6. How worried are you about getting infected with Coronavirus? *

○A great deal

○A moderate amount

○A little

○Not at all

7. Do you know anyone in your family, friends, or acquaintances who have been infected with Coronavirus? *

○Yes

○No