Paying to avoid the spotlight*

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Abstract

In the digital age, privacy in economic activities is increasingly threatened. In considering policies to address this threat, it is useful to consider what value, if any, that people attach to privacy in economic activities. We study this question by eliciting individuals' willingness to pay (WTP) to avoid detection in an economic experiment involving a coin-flipping task. We collect data from Japan, China, and the U.S.A. to examine whether there are cross-country differences. Our findings reveal that people's WTP to "avoid the spotlight" is positive and economically sizable across all three countries and is the largest in Japan.

Keywords: Privacy, Monitoring, Surveillance, Willingness to Pay, Dishonesty, Lying, Social Image Concerns.

JEL Codes: C91, D83, D91.

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1 Introduction

In our increasingly digital world, the prospect of maintaining privacy in economic dealings is under significant threat (Acquisti et al., 2015, 2016). The majority of financial transactions, including those conducted using debit and credit cards, online banking, and mobile payment platforms, are now conducted electronically. These methods are all easily surveilled, with transaction records accessible through court orders in some jurisdictions or directly monitored by governments in others. Consequently, such transactions often lack any privacy protections. Indeed, the recent emergence of cryptocurrencies partly stems from a desire for financial autonomy from the uncertainties of government-issued fiat currencies and a critical need for privacy (Herskind et al., 2020). As a reaction to these stateless digital currencies, central banks from various countries, starting with China, have begun exploring the creation of Central Bank Digital Currencies (CBDCs) to maintain demand for their fiat currencies and thus preserve their ability to implement monetary policies. However, CBDC transactions, linked to electronic ledgers, will inevitably lead to further erosion of privacy (Ahnert et al., 2022; Wang, 2023).

There is a large literature on internet privacy that addresses topics such as the provision of personal information during online purchases (Beresford et al., 2012; Preibusch et al., 2013; Jentzsch et al., 2012; Tsai et al., 2011), and methods to hide various types of information such as browsing history, contact information, location, and text on smartphone apps (Savage and Waldman, 2015; Skatova et al., 2019). An existing international comparison across US, Germany, and several Latin American countries shows that Germans value these types of privacy concerns more than people in other countries (Prince and Wallsten, 2022). While such privacy concerns are certainly important, they are not the specific focus of our study. Instead, we are interested in privacy surrounding *economic transactions*, i.e., the desire that economic activity is not traceable, as would be possible in transactions using cash.

We are particularly interested in individuals' willingness to pay (WTP) to avoid being observed in reporting on economic activities.[1] By contrast with most of the literature on the value of privacy (Tsai et al., 2011; Savage and Waldman, 2015; Skatova et al., 2019; Prince and Wallsten, 2022), we use experimental methods that enable us to elicit peoples' WTP for privacy in an incentive-compatible manner. Indeed, Benndorf and Normann (2018) show a large "hypothetical bias" in people's willingness to disclose their personal information, namely, while five out of six respondents in a non-incentivized survey refused to disclose their personal information, it was only one of six participants who did the same in an incentivized experiment. Our incentivized experiment would not suffer from similar bias.

Our findings have important implications for understanding the acceptability, or reluctance to adopt media of exchange or institutions that forego privacy rights. Specifically we ask (1) How much are individuals willing to pay for privacy in economic transactions? (2) Does behavior differ if individuals do not have a private option or cannot pay for privacy? (3) Does the value of privacy differ across countries? If so, what are the correlates of those differences?

Using the lie-detection task of Fischbacher and Föllmi-Heusi (2013),

[1] While the well-known willingness-to-pay and willingness-to-accept gap (see, e.g., Plott and Zeiler, 2005, for a review) is also found in the valuation of privacy (Acquisti et al., 2013), we are not interested in this particular behavioral aspect in this current paper.

our experimental design directly reveals whether people desire privacy, or the unobservability of their economic activities in order to engage in lying or other forms of immoral behavior, in an incentive compatible manner. To the best of our knowledge, ours is the first study to elicit and compare the WTP for privacy in economic transactions across countries, specifically, China, Japan and the U.S. in a setting where there is some potential for dishonest behavior.

Our findings reveal that people's WTP to "avoid the spotlight" is positive and economically sizable, on average, it is more than 30% of expected monetary gain from lying, across all three countries and is the largest in Japan where, on average, it is more than 40% of such a gain. The observed high values placed on privacy in economic transactions suggest the need for a proper balance between fraud prevention and ensuring privacy in our increasing digital economy.

2 Experimental Design

In our experiment, as in Cohn et al. (2014), subjects flip a fair coin ten times and report the number of heads and tails (which must add up to ten). For each head that a subject reports, they receive 100 points. Thus, by reporting 10 heads, they earn the maximum of 1000 points. The earned points are converted into the local currency at the end of the experiment using a pre-specified exchange rate that adjusts for purchasing power differences across countries, so that all of our subjects face approximately the same monetary incentives. There is no explicit penalty for misreporting the number of heads and tails in any treatment of our study. Therefore, the predicted, profit-maximizing behavior by *homo-economicus* participants is to always report 10 heads. A meta-study of this task by Abeler et al. (2019), however, shows that most participants do not lie to such an extreme extent; rather they over-report the number of heads relative to expected numbers. What we add to this task is a willingness to pay elicitation and some further treatments.

Specifically, in our main, **CHOICE**, treatment, subjects can complete the task of flipping a coin 10 times using a freely provided virtual coin on our experimental software platform. Alternatively, they can choose to use their *own* coin to complete the 10 coin flips but only if they pay a fee. Subjects are told that if they use the virtual coin, the experimenters can later check the realized outcomes of the virtual coin flip. By contrast, if they use their own coin, it is not possible for the experimenter to observe the outcome of those coin flips. Subjects are also told that, regardless of the coin they use, virtual or own, the experimenters rely only on their own self-report of the outcome of the coin flip — the number of heads and tails that they report – to determine their payment.

Prior to the coin flip task, we use the Becker–DeGroot–Marschak [BDM] mechanism (Becker et al., 1964) to elicit subjects' WTP for the right to use their own coin to complete the coin flip task. As noted, there is no cost to using the virtual coin. Specifically, subjects submit their WTP^i in 10 point increments, $\{0, 10, 20, \ldots, 490, 500\}$. Notice that the upper bound of 500 points in the WTP elicitation is the expected gain (in points) from using one's own coin and reporting 10 as the number of heads. Once participants submit their WTP^i, the computer randomly draws a price (in points) $p^i \in \{10, 20, \ldots, 490, 500\}$ for each participant. If $p^i \leq WTP^i$, the subject i pays p^i (out of their experimental earnings) and uses his/her own coin, otherwise, s/he uses the virtual coin for free. Subjects who do not want to use their own coin could simply state that their WTP was 0, thereby ensuring that they would use the virtual coin and this possibility was carefully explained to them.

The elicited WTP captures the privacy concerns of subjects associated with using the virtual coin instead of their own coin. To make this more formal we adapt the framework of Abeler et al. (2019) who suggest that reporting behavior in experiments of this type is based on three determinants: (1) the material gain, (2) the self-image concern, and (3) the social-image concern. We will here refer to the social-image concern as the privacy concern.

Following this framework, the utility of reporting the number of heads, H, when the actual realization is R, $u^i(H|R)$, can be written as:

$$\begin{aligned} u^i(H|R) &= \pi^i(H) - c^i(H-R) - \gamma^i(H-R) && \text{if using the virtual coin,} \\ u^i(H|R) &= \pi^i(H) - c^i(H-R) && \text{if using one's own coin.} \end{aligned}$$

Here, $\pi^i(H)$ is the monetary gain, $c^i(H-R)$ is the cost associated with self-image concerns, and $\gamma^i(H-R)$ is the privacy concerns of reporting H heads when the actual realized number of heads was R. Intuitively, the first order derivatives of $c^i(H-R)$ and $\gamma^i(H-R)$ should be non-negative, i.e., the cost of social image concerns and privacy concerns should be greater when the participant deviates from honest reporting to a larger degree. When choosing their WTP to use their own coin instead of using the virtual coin for free, each subject i would compare the expected maximized utility of using the virtual coin with that of using his/her own coin. Therefore, the submitted WTP should be equivalent to the difference between the monetary value of the two maximized expected utilities, and that is primarily driven by the cost associated with the privacy concern in using the virtual coin unless the self-image concern dominates all the other considerations.[2]

In addition to the **CHOICE** treatment, we also design two *control* treatments, **VIRTUAL** and **OWN**, where subjects are not given a choice regarding the type of coin they can use. In the **VIRTUAL** treatment, subjects must use the *virtual coin.* In the **OWN** treatment, they must use their *own coin.* In these two treatments, therefore, there is no elicitation of WTP to use their own coin instead of the virtual coin, as there is no choice of the type of coin that will be used. Still, as in the **CHOICE** treatment, subjects in these two control treatments report the number of heads and tails and are paid solely on the basis of their own report.

2.1 Questionnaire

After reporting the number of heads and tails from the 10 trials, participants had to complete a questionnaire in which, in addition to providing information on their age and gender, they were asked the following questions:

(1) How many, out of 20 randomly chosen participants in the experiment, have reported the outcome of coin flips truthfully?

[2] Another possibility is that participants submit a positive WTP because they do not believe the virtual coin is a fair coin despite the fact the coin is in fact fair and we inform subjects of this fact in the instructions. Although we cannot eliminate this possibility for submitting a positive WTP, the fact that we have conducted our experiment in experimental laboratories where no deception is the rule and participants are aware of this rule should reduce the impact of such a consideration.

(2) How many have reported a $WTP > 0$? (only in the main treatment)

(3) In general, how willing are you to take risks? Please indicate on the scale below from 0 to 10, where 0 means you are "completely unwilling to take risks" and a 10 means you are "very willing to take risks."

(4) What do you think is the purpose of the experiment?

(5) Please indicate whether you think the following actions can be always justified, never be justified or something in between using the given scale. (1: Never justifiable.. .... 10: Always justifiable).

   (a) Claiming government benefits to which you are not entitled.

   (b) Cheating on taxes if you have a chance.

   (c) Telling the truth when it is costly for you to do so.

(6) Do you think your country's government should or should not have the right to do the following (1: Definitely should have right. 2: Probably should have right. 3: Probably should not have right. 4: Definitely should not have right.):

   (a) Keep people under video surveillance in public areas.

   (b) Monitor all e-mails and any other information exchanged on the internet.

   (c) Access to people's bank account balances and their history of payments.

Question (3) is from the Global Preference Survey (Falk et al., 2018). Question (5) is related to ethics, and question (6) is related to the government's rights. Questions (5-a), (5-b), (6-a), and (6-b) are from the World Value Survey Wave 7 (Haerpfer et al., eds, 2022).

From question (5) we construct a variable called "Ethics." Namely, Ethics = ((11 - claiming benefit) + (11 - cheating tax) + telling truth)/3. A Higher value of the Ethics variable indicates a participant considers unethical behavior to be less justifiable.

From question (6) we construct a variable called "Government's right." Namely, Government's right = ((5-video surveillance) + (5-internet) + (5-bank account))/3. A higher value of the Government's right variable indicates a participant agrees to a larger extent that the government has the right to monitor people.

The English instructions have been translated to Japanese and Chinese by our research assistants. We then ask different people to translate the instructions back into English to ensure consistency in the meaning.[3]

3 Results

The experiment was conducted online between October and December 2023 in Osaka (Japan), Irvine (USA), and Wuhan (China).[4] A total of 360 students from local universities (120 in each country) participated. In each location, we used the Zoom software to coordinate activity. Subjects arrived via the Zoom waiting room. One by one, we privately welcomed them and checked (via video) that they had brought their own coin (except for the treatment with a virtual coin only), as we had instructed them to do.

[3]The English instructions can be downloaded at `https://osf.io/mka75/?view_only=b4053e8c004d41f7812f31fc8827f5b2`. Chinese and Japanese translations are available upon request.

[4]The experiment is programmed using oTree (Chen et al., 2016).

They were then given a numerical ID to be used during the experiment to maintain their anonymity. Once these tasks were completed, they were sent back to the waiting room, where they waited until the start of the experiment.

Once all the subjects had been individually welcomed they were brought back to the main room of Zoom, where the experimenter gave general instructions and sent each subject a link to the experimental platform. Clicking on the link, subjects read through the instructions for the experiment online at their own pace and then completed a comprehension quiz. Once they had answered all the quiz questions correctly, the experiment started. For the CHOICE treatment with a WTP elicitation, there were two rounds of practice (with high and low realized prices) for the WTP elicitation.[5] During the experiment, subjects had their cameras and microphones turned off.

The experiment lasted about 25 minutes on average, including the post-experimental questionnaire. Subjects, on average, earned 13.30 USD, 1130 JPY, and 50 RMB, including 7 USD, 500 JPY, and 20 RMB show-up fees in Irvine, Osaka, and Wuhan.[6]

3.1 Descriptive statistics

The descriptive statistics regarding participants' characteristics in each location and treatment are reported in Table 1. P-values from the Kruskal-Wallis (KW) test to test for differences across the three locations are also

[5]We have introduced these practice rounds, in addition to questions about WTP and payoffs in the comprehension quiz, to ensure that subjects understood well the BDM procedure which can be confusing (see, for example, Cason and Plott, 2014).

[6]While performance-based payments were equalized based on the purchasing power parity, we respected the standard show-up fees used in each location.

reported.

There are some notable differences in participant's characteristics across the three locations. Namely, there are significantly fewer female participants in Osaka compared to Wuhan and Irvine, especially in the OWN and VIRTUAL treatments. Participants in Irvine are significantly more willing to take risks than those in Osaka and Wuhan. Those in Wuhan are more accepting of unethical behaviors and of the government's right to monitor people than those in Osaka and Irvine. We will, therefore, control for these individual characteristics in our regresssion analysis.

3.2 Willingness to pay to use own coin

We begin with the main variable of interest: subjects' WTP to use their own coin instead of the virtual coin. We then present participants' reporting behavior conditional on the coin they actually used.

Figure 1 shows the cumulative distribution of subjects' WTP to use their own coin instead of using the virtual coin for free in Osaka (red dash), Irvine (cyan dots), and Wuhan (gray long dash). This figure also reports the mean and the standard deviation of the WTP in each location.

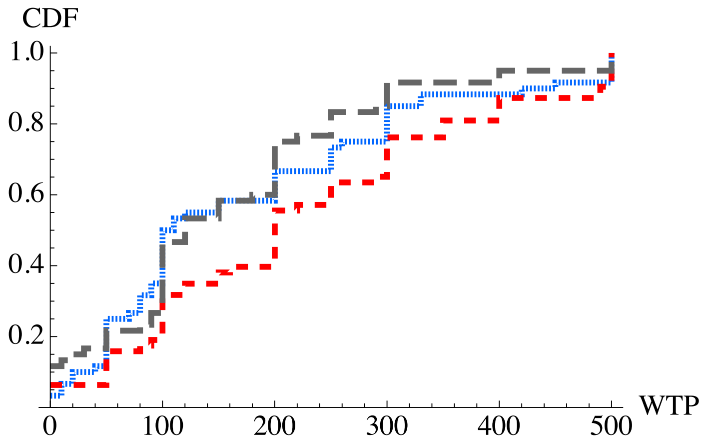
We see that the mean (std. dev.) WTP in Osaka is 225.56 points (150.48) which is more than 40% of the expected gain (500) from misreporting. This is significantly higher than the WTP in Irvine (mean (std. dev.) 177.0 points (146.20), p=0.0538, Mann-Whitney (MW) test) or in Wuhan (mean (std. dev.) 159.83 points (126.81), p=0.0148, MW). WTPs are not significantly different between Irvine and Wuhan (p=0.7766, MW).

Table 2 reports the results of ordinary least squares (OLS) regressions of WTP on country dummies as well as on individual characteristics and

Table 1: Mean (standard deviation) of participants' characteristics in each treatment and location

Treatment	CHOICE				OWN				VIRTUAL			
	Wuhan	Irvine	Osaka	p-value[a]	Wuhan	Irvine	Osaka	p-value[a]	Wuhan	Irvine	Osaka	p-value[a]
No. Obs.	60	60	63		30	30	30		30	30	27	
fraction	0.55	0.52	0.38	0.1385	0.73	0.70	0.33	0.0024	0.50	0.60	0.30	0.0689
female	(0.50)	(0.50)	(0.49)		(0.45)	(0.47)	(0.48)		(0.51)	(0.50)	(0.47)	
Age	21.12	21.58	22.60	0.0204	20.93	20.13	22.47	0.0004	21.4	20.6	22.63	0.0063
	(2.13)	(3.46)	(3.82)		(1.91)	(2.49)	(2.86)		(2.01)	(2.70)	(3.21)	
Risk taking	4.13	5.58	4.40	0.0034	4.07	5.87	4.33	0.0037	3.63	5.33	4.33	0.0262
	(2.62)	(2.20)	(2.32)		(2.45)	(2.01)	(2.43)		(2.39)	(2.44)	(2.22)	
Ethics[b,d]	6.38	7.79	7.45	0.0001	6.29	7.30	7.99	0.0007	7.07	7.16	7.85	0.1239
	(1.89)	(1.31)	(1.35)		(1.78)	(1.54)	(1.18)		(1.86)	(1.66)	(1.30)	
claiming	4.90	2.85	3.29	0.0002	5.17	3.73	3.31	0.0112	3.97	3.77	2.67	0.0240
benefit[d]	(2.89)	(1.94)	(2.51)		(2.67)	(1.74)	(2.32)		(2.57)	(2.14)	(2.17)	
cheating	3.36	2.73	2.57	0.3227	3.53	3.03	1.62	0.0023	2.57	3.33	2.11	0.0283
tax[d]	(2.69)	(2.02)	(2.18)		(2.50)	(1.97)	(0.82)		(2.30)	(2.38)	(1.83)	
telling	5.40	6.93	6.21	0.0007	5.57	6.67	6.90	0.0080	5.73	6.57	6.33	0.2814
truth[d]	(2.21)	(1.98)	(1.98)		(1.77)	(1.97)	(2.11)		(2.57)	(2.06)	(1.84)	
Government's	2.65	1.98	2.25	0.0001	2.78	2.22	2.33	0.0006	2.67	1.98	2.25	0.0006
right[c]	(0.67)	(0.53)	(0.71)		(0.62)	(0.35)	(0.66)		(0.69)	(0.63)	(0.70)	
video	1.78	2.53	2.17	0.0001	1.70	2.00	2.20	0.0271	1.90	2.20	2.19	0.3851
surveillance	(0.85)	(0.82)	(0.87)		(0.65)	(0.59)	(0.81)		(0.92)	(0.96)	(1.00)	
internet	2.68	3.44	3.10	0.0001	2.57	3.13	2.90	0.0195	2.60	3.37	3.15	0.0019
	(0.85)	(0.60)	(0.82)		(0.86)	(0.68)	(0.76)		(0.86)	(0.72)	(0.82)	
bank account	2.58	3.14	2.98	0.0041	2.40	3.20	2.90	0.0019	2.50	3.50	2.93	0.0002
	(0.94)	(0.92)	(0.85)		(0.93)	(0.61)	(0.88)		(0.94)	(0.82)	(0.96)	
No. Truthful	8.02	9.23	8.25	0.3640	6.23	9.83	9.50	0.0088	5.90	10.90	10.11	0.0046
reporting	(6.05)	(4.95)	(5.04)		(5.20)	(3.57)	(6.10)		(6.32)	(5.74)	(6.44)	
No. WTP>0	13.5	12.78	15.35	0.0095								
	(5.89)	(4.92)	(5.14)									
payoff	714.33	619.00	626.19	0.0355	796.67	636.67	640.00	0.0005	776.67	636.67	607.41	0.0151
	(238.93)	(214.42)	(205.36)		(158.62)	(140.16)	(201.03)		(256.88)	(245.63)	(218.26)	

Note:
a: p-values are for across country comparison (Kruskal-Wallis test).
b: Ethics = ((11 - claiming benefit) + (11 - cheating tax) + telling truth)/3.
c: Government's right = ((5-video surveillance) + (5-internet) + (5-bank account))/3.
d: Due to a technical problem, some answeres were not recorded. n=58 in Wuhan (main), n=59 in Irvine (main), n=29 in Osaka (own coin)



	Wuhan	Irvine	Osaka
Mean	159.83	177.00	225.56
(Std. Dev.)	(126.81)	(146.20)	(150.48)

Figure 1: Cumulative distributions of WTP to use own coin in Osaka (red), Irvine (cyan), and Wuhan (gray).

subjects' answers to our questions. The results largely confirm the non-parametric tests. Compared to Osaka (the baseline), WTP is significantly lower in Wuhan and Irvine, even after controlling for individual characteristics in models (2) to (4). In model (2), we control for demographics, risk preference, ethical considerations, and participants' views regarding the government's rights. In model (3), in addition to these, we control for the belief about how many others (out of randomly selected 20) truthfully report the outcome of coin flips. In model (4), instead of beliefs about others' truthful reporting, we control for the belief about how many others (out of a randomly selected 20) submit strictly positive WTP to use their own coin. When we also control for both beliefs (model 5), the difference between Osaka and Irvine loses significance. In all of these specifications, there is no significant difference in WTP between Wuhan and Irvine.

Among the individual characteristics controlled for in model (2), i.e.,

Table 2: WTP to use own coin. Results of OLS regression

	(1)	(2)	(3)	(4)	(5)
Wuhan	-65.722**	-67.102**	-67.290**	-58.945**	-58.320**
	(25.56)	(27.22)	(26.74)	(26.73)	(26.09)
Irvine	-48.556*	-65.151**	-61.368**	-43.901*	-37.457
	(25.56)	(26.05)	(25.64)	(26.41)	(25.86)
female		-21.482	-12.568	-19.416	-9.156
		(20.54)	(20.46)	(20.09)	(19.89)
Age		-0.774	-0.164	0.183	0.970
		(3.62)	(3.56)	(3.55)	(3.47)
Risk		20.230***	20.412***	16.569***	16.400***
		(4.41)	(4.33)	(4.48)	(4.37)
Ethics		-4.511	-1.954	-6.408	-3.719
		(6.84)	(6.78)	(6.71)	(6.61)
Gov. right		15.634	17.117	16.638	18.412
		(16.13)	(15.86)	(15.77)	(15.40)
No. Truthful			-5.048***		-5.691***
			(1.89)		(1.85)
No. WTP>0				5.820***	6.417***
				(1.93)	(1.89)
Constant	225.556***	160.747	162.034	76.945	69.801
	(17.85)	(110.49)	(108.58)	(111.48)	(108.83)
Adjusted R^2	0.028	0.132	0.162	0.171	0.210
N	183	180	180	180	180
p-value[a]	0.5078	0.9469	0.8372	0.6033	0.4615

* p<0.10, ** p<0.05, *** p<0.01

a: p-values for testing H_0: Wuhan = Irvine. Wald test

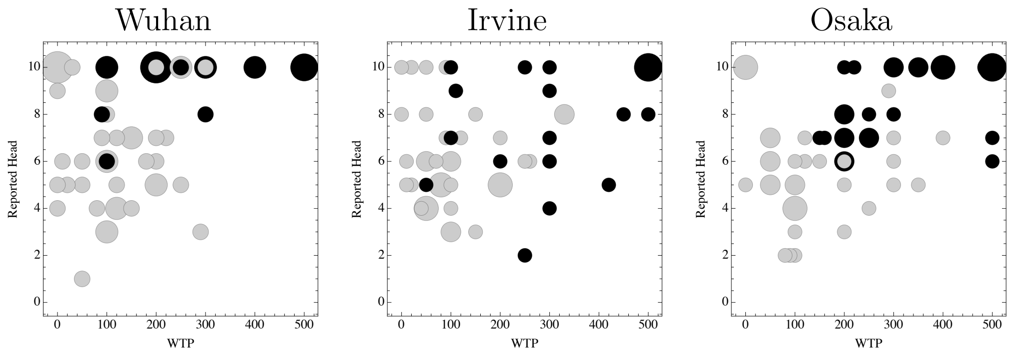
demographics, risk preference, views on ethics, and views about the government's rights, only the self-reported willingness to take risks is statistically significant. Specifically, a higher willingness to take risks is associated with a higher WTP to use one's own coin. We interpret the positive and significant coefficient on the risk measure to indicate participants' desire to use their own coin, even when the price for doing so is high.

The estimated coefficient of the belief about others' truthful reporting is negative and significant in models (3) and (5). That is, the more likely participants believe that others report truthfully, the lower is their WTP to use their own coin. The estimated coefficient of the belief about others' submitting a positive WTP is positive and significant in models (4) and (5). That is, the more likely participants believe that others submit a strictly positive WTP to use their own coin, the higher is their own WTP. We interpret these two findings as resulting from *social norm considerations*. In the first case, participants who believe that others are more likely to report truthfully, may be less likely to misreport themselves in accordance with their perceived norm. Consequently their WTP to use their own coin is lower. In the second case, those who believe that others are more likely to report a positive WTP, will seek to conform to this norm and submit a higher WTP.

3.3 Reporting behavior

Let us next turn to the actual reported number of heads. Figure 2 shows, using bubble plots, the relationship between subjects' WTP (horizontal axis) and their reported number of heads (vertical axis) depending on the coin used (Own coin in black and Virtual coin in gray) in each of the three locations. Reflecting the higher WTP submitted by the Osaka subjects, the number of subjects who used their own coin, instead of the virtual coin, is higher in Osaka as compared to Wuhan and Irvine.

There are several things to note in these figures. In all the locations, some subjects submitted WTP=0 and reported 10 heads (homo-economicus) as can be seen in the upper left corner of Figure 2. We also see in the upper right corner that some subjects submitted a WTP=500 and reported 10 heads. While there are positive correlations between WTP and the reported number of heads when the own coin is used in all the locations, none of these correlations is significant at the 10% level once individ-



	Own	Virtual
N	17	43
%	28.33%	71.67%

	Own	Virtual
N	19	41
%	31.67%	68.33%

	Own	Virtual
N	29	34
%	46.0%	54.0%

Figure 2: Submitted WTP and reported number of heads depending on the coin used. Own coin (black). Virtual coin (gray). The size of the point is proportional to the number of observations for the same WTP-Report combination.

ual characteristics are controlled for (See Table S1 in Online Supplementary Material (OSM) I). There is a marginally significant positive relationship between the price subjects actually paid and the reported number of heads in Irvine once individual characteristics are controlled for (See Table S2 in OSM I). When the virtual coin is used, there is no significant relationship between the WTP and the reported number of heads in all three locations (See also Table S1 in OSM I).

Figure 3 compares the cumulative distribution of the reported number of heads depending on the coin used in each of the three locations. The top panel (A) compares CHOICE vs. OWN when the own coin is used. The middle panel (B) compares or CHOICE vs. VIRTUAL when the virtual coin is used. The bottom panel (C) compares the extent of *misreporting* when the virtual coin is used in CHOICE vs. VIRTUAL (C). See OSM II for the analyses comparing OWN and VIRTUAL treatments.

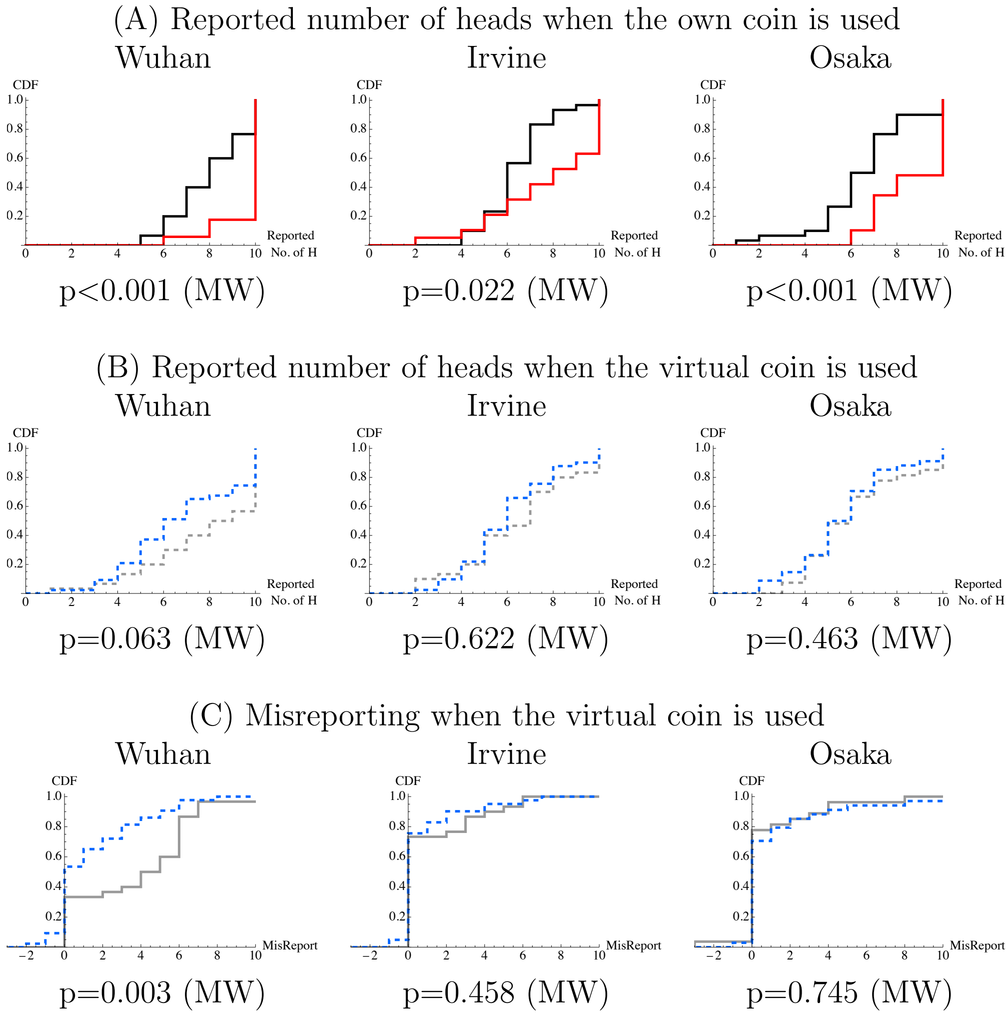
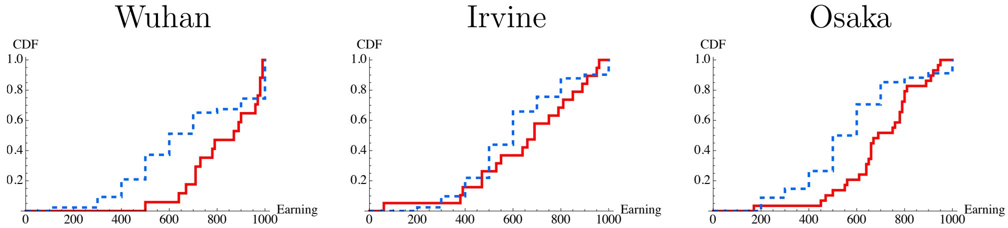


Figure 3: Distribution of the reported number of heads by treatment conditions: (A) when the own coin is used, (B) when the virtual coin is used, and (C) the extent of misreporting when the virtual coin is used. Red (CHOICE) and Black (OWN) in (A). Blue-dashed (CHOICE) and gray-dashed (VIRTUAL) in (B) and (C).

When the subject's own coin is used in the CHOICE treatment (shown in red in Figure 3 (A)), the reported number of heads is significantly larger than in the OWN treatment. This is so even after controlling for individual characteristics (see Table S5 in OSM III). This finding could be the result of two forces: "sorting" and "licensing." Regarding "sorting," recall that in the CHOICE treatment, those subjects who have submitted a higher WTP to use their one coin are more likely to be selected to use their own coin. This means that, their willingness to use their own coin so as to misreport is likely higher than for participants assigned to the OWN treatment. Regarding "licensing," the fact that subjects have paid a price to use their own coin may have justified their reporting a higher number of heads in the CHOICE treatment as compared with the OWN treatment, where they do not pay anything to use their own coin.

When the virtual coin is used, the reported numbers of heads and the extent of misreporting (panels B and C) are not significantly different between the CHOICE treatment and the VIRTUAL treatment, except for the Wuhan subjects. In Wuhan, the reported number of heads is marginally significantly higher, and the extent of misreporting is significantly higher in the VIRTUAL treatment as compared with the CHOICE treatment. While the difference in the reported number of heads between VIRTUAL and CHOICE loses its significance once individual characteristics are controlled for, the extent of misreporting continues to be significant (see Columns Wuhan (1) and Wuhan (2) in Tables S5 and S6, OSM III). This is puzzling in light of "sorting." In the CHOICE treatment, those subjects who have submitted low WTPs to use their own coin are more likely to be selected to use the virtual coin. Thus, these participants have low costs associated

Own coin vs virtual coin in the CHOICE treatment



p=0.066 (MW) p=0.331 (MW) p=0.004 (MW)

	Wuhan		Irvine		Osaka	
	Own	Virtual	Own	Virtual	Own	Virtual
mean (std.dev)	827.06 (149.20)	669.76 (254.05)	654.74 (234.20)	602.44 (205.53)	698.28 (170.90)	564.71 (214.45)

Figure 4: Distribution of net payoffs depending on the coin used in the CHOICE treatment. Red (own coin) and Blue-dashed (virtual coin)

with privacy concerns. In other words, they are more willing to use the virtual coin and misreport than the average participants in the VIRTUAL treatment. If participants are mainly concerned about their self-image (and thus do not misreport regardless of the type of the coin used), however, we may observe a low WTP and low misreporting. Unfortunately, it is not possible to test this hypothesis using our data.

3.4 Payoffs

We have seen that subjects who used their own coin in the CHOICE treatment reported significantly more heads than those who used the virtual coin in the same treatment. They also reported more heads compared to those in the OWN treatment. What about subjects' payoffs? Did subjects in the CHOICE treatment who used their own coin earn more than those who used the virtual coin taking into account the price they actually paid to use their own coin?

Figure 4 shows the distribution of the payoffs (net of the price paid to use one's own coin) in the CHOICE treatment depending on the coin used (own coin in red and virtual coin in blue-dashed) in the three locations. The mean payoff in points, the standard deviations, as well as *p*-values from MW tests are also reported. Except for Irvine, those subjects who used their own coin obtained significantly higher payoffs than those who used the virtual coin in the CHOICE treatment. In Wuhan, those who used their own coin earned 827.06 points on average, while those who used virtual coin earned 669.76 points (p=0.066, MW). In Osaka, similarly, the average payoffs are 698.28 points with their own coin and 564.71 points with the virtual coin (p=0.004, MW). In Irvine, the average payoffs for those who used their own coin and the virtual coins were 654.74 and 602.44 points, respectively (p=0.331, MW).

In general, participants who chose to use their own coins earn a higher average net payoff than those who used the virtual coin. One may argue that those who purchased the right to use their own coin were "rational" in doing so, at least in terms of material payoff.

The net payoffs of those who used their own coin in the CHOICE treatment are not significantly different from the payoffs earned by those in the OWN treatment. The average payoffs (standard deviations) in the OWN treatment were 796.67 (158.62) in Wuhan, 636.67 (140.16) in Irvine, and 640.00 (201.03) in Osaka. The p-values from a MW test (comparing the net payoff earnings of those who used their own coin in the OWN vs. CHOICE treatments) are 0.788, 0.626, and 0.236 in Wuhan, Irvine, and Osaka, respectively.

4 Discussion and conclusion

We have reported on a laboratory experiment that measures participants' willingness to pay to avoid the spotlight regarding the reported number of heads and tails in a coin-flipping task. We conducted this experiment on populations in three countries: Osaka (Japan), Wuhan (China) and Irvine (U.S.A). What can we learn from such as study?

First and most importantly we find that participants' willingness to pay to avoid scrutiny is large and economically substantial, amounting to more than 40% of the expected gain from misreporting in Osaka, and around 30% of this expected gain in Wuhan and Irvine.

Second, there is heterogeneity across countries. The difference in WTP between Osaka and Wuhan and between Osaka and Irvine are statistically significant at the 5% and 10% levels, respectively, while the difference between the latter two, Wuhan and Irvine, is not statistically significant.

Overall, these findings underscore the substantial value that people place in avoiding the negative social and psychological implications of being observed in economic activities, particularly those that may be prone to dishonest behavior, highlighting a universal desire for privacy in economic activities. These concerns will need to be addressed in the design of new digital payment systems.

To better understand the source of this substantial WTP, we examined a variety of individual characteristics. Among those that we considered, the participant's self-reported willingness to take risks is significantly and positively related to their WTP to use their own coin. Age, gender, and subjects' views of ethical behavior or of the government's right to monitor people's activities are *not* related to WTP. Interestingly, WTP is higher among those who believe that others are less likely to truthfully report the outcomes of their coin flips, suggesting that social or cultural norms likely play an important role.

In our main treatment, there is no significant correlation between the WTP to use one's own coin and the reported number of heads regardless of the type of coin eventually used. However, participants who actually paid to use their own coin reported a significantly higher number of heads than those who used the virtual coin in Osaka and Wuhan. As a consequence, those who used their own coin by paying a price earned significantly more than those who used the virtual coin for free in these two locations.

What is the driving factor behind the different WTPs for privacy in economic transactions across the three countries? In our regression analysis, we considered several possible explanations, including people's self-assessed honesty and their attitudes toward government monitoring. As noted, none of these factors turned out to be significant in explaining the differences that we observe across countries.

Based on the above findings, we speculate that the observed differences across the three countries may reflect current cultural norms with regard to payment methods and, in particular, concerning the use of cash. Indeed, according to FIS (2023), Japan is an outlier in its use of cash relative to digital payments and credit cards which are more widely used in China and the U.S., respectively.

As shown in Table 3, the share of cash as the method of payment for point of sale purchases is 51% in Japan, 12% in the US, and 8% in China. The higher frequency of cash usage may be associated with a higher level of privacy-preserving preference in Japan, and thus, the significantly higher

	Cash	Credit Card	Debit Card	Digital Wallet	Other
US	12	40	31	12	5
China	8	18	15	56	3
Japan	51	32	3	10	4

Table 3: Payment Methods Usage by Country (in %), Source: FIS (2023)

WTP. The policy implications of these findings are that it might be more difficult to implement CBDC in Japan than in China, where pilot studies of the new government issued e-CNY digital currency are ongoing (Orcutt, 2023). Alternatively, preferences for transactional privacy might influence the design and adoption of digital payment systems, ensuring they offer some type of privacy protections.

While some might seek privacy to engage in dishonest or illegal activities, it is important to recognize that there can be other motivations for paying to avoid the spotlight. People may seek to avoid scrutiny because it is closely linked to their sense of personal autonomy and freedom (Van Aaken et al., 2014). For some, the ability to control who has access to personal information and one's choices is fundamental to individual liberty and self-expression (Oshana, 2016). People may also seek privacy to better manage their social interactions and personal boundaries, contributing to their own psychological well-being (Roessler and Mokrosinska, 2013).

In future research, it would be of interest to consider other tasks with economic consequences where people face weaker or no material incentives to dishonestly engage in the task in order to investigate whether such diminished motives matter for the WTP for privacy. While we suspect that there would be some reduction in the WTP for privacy in such settings, it could still be the case that individuals have a positive WTP for privacy in their economic transactions beyond the desire to avoid detection of cheating behavior.

Furthermore, the observed high values placed on privacy in economic transactions suggest a need for finding the right balance between fraud prevention and ensuring privacy in our digital economies. Effective fraud prevention, when balanced with privacy concerns, can enhance the functioning of the digital economy (Romanosky, 2016). Getting the right balance, however, can be a complex task because there are not only fraud prevention and privacy trade-offs but also trade-offs between different aspects of privacy itself, as noted by (Pozen, 2016). Future studies might explore these varied trade-offs with the aim of discovering an optimal balance.

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Online Supplementary Material for Bao, Duffy, Hanaki (2024) “Paying to avoid the spotlight”

This supplementary information contains the following

I Regression results for the reported number of heads, WTP, and the price paid in the CHOICE treatment

II Results of the control treatments

III Regression results for the reported number of heads, misreporting and the coin used. Comparison of the CHOICE and the control treatments

I Regression results for the reported number of heads, WTP, and the price paid in the CHOICE treatment

Table S1: Reported number of heads and WTP. Regression results

	All (1)	All (2)	Wuhan (1)	Wuhan (2)	Irvine (1)	Irvine (2)	Osaka (1)	Osaka (2)
Wuhan	1.014***	0.987**						
	(0.38)	(0.40)						
Irvine	-0.073	0.008						
	(0.38)	(0.38)						
WTP	0.005**	0.002	0.003	0.001	0.005	0.005	0.006**	0.002
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Virtual Coin Used	-0.943	-1.434**	-1.900	-2.535**	0.033	-0.149	-0.908	-1.917**
	(0.71)	(0.67)	(1.34)	(1.21)	(1.28)	(1.34)	(1.10)	(0.94)
WTP×	-0.006**	-0.002	-0.004	0.005	-0.006	-0.004	-0.006	-0.001
Virtual Coin Used	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)
Female		0.281		0.176		0.496		0.007
		(0.30)		(0.51)		(0.63)		(0.42)
Age		0.037		0.119		0.150		-0.032
		(0.05)		(0.13)		(0.14)		(0.06)
Risk		-0.002		-0.248**		-0.133		0.327***
		(0.07)		(0.11)		(0.17)		(0.09)
Ethics		0.020		0.162		-0.201		0.092
		(0.10)		(0.16)		(0.24)		(0.16)
Gov. right		-0.081		0.051		-0.408		-0.115
		(0.23)		(0.40)		(0.60)		(0.28)
No. Truthful		-0.180***		-0.221***		-0.110*		-0.177***
		(0.03)		(0.05)		(0.06)		(0.04)
Constant	6.891***	7.796***	8.710***	9.808***	6.172***	2.397	6.611***	8.467***
	(0.67)	(1.56)	(1.20)	(3.32)	(1.15)	(3.85)	(0.97)	(1.71)
Adjusted R^2	0.266	0.386	0.220	0.494	0.103	0.072	0.397	0.594
N	183	180	60	58	60	59	63	63
p-value[a]	0.601	0.821	0.811	0.136	0.681	0.731	0.891	0.735

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

a p-value for testing H_0: WTP + WTP × Virtual Coin Used = 0. Wald test.

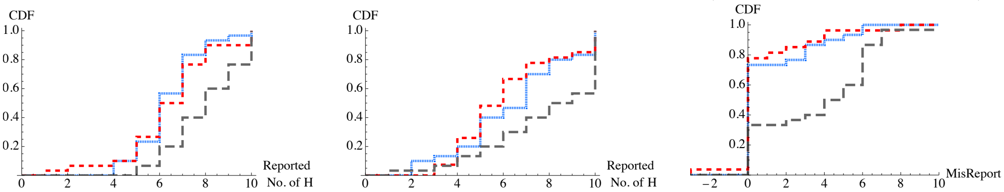
Table S2: Reported number of heads and Price. Results of OLS regressions

	All (1)	All (2)	Wuhan (1)	Wuhan (2)	Irvine (1)	Irvine (2)	Osaka (1)	Osaka (2)
Wuhan	1.072*	1.032*						
	(0.54)	(0.57)						
Irvine	-0.728	-1.064*						
	(0.53)	(0.61)						
Price	0.004*	0.001	0.001	-0.000	0.007	0.010*	0.003	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Female		0.181		0.069		1.387		0.483
		(0.47)		(0.34)		(1.27)		(0.64)
Age		-0.023		0.131		0.284		-0.031
		(0.06)		(0.07)		(0.23)		(0.07)
Risk		0.010		-0.103		-0.377		0.280**
		(0.10)		(0.07)		(0.31)		(0.13)
Ethics		-0.034		-0.052		-1.110*		0.211
		(0.16)		(0.11)		(0.53)		(0.22)
Gov. right		-0.667**		-0.460*		-1.846		-0.268
		(0.33)		(0.22)		(1.08)		(0.38)
No. Truthful		-0.106**		-0.130***		-0.118		-0.147**
		(0.04)		(0.03)		(0.11)		(0.07)
Constant	7.988***	7.673***	9.417***	6.736***	6.892***	-5.809	8.110***	9.058***
	(0.46)	(1.66)	(0.44)	(1.61)	(0.78)	(7.22)	(0.53)	(1.68)
Adjusted R^2	0.139	0.233	-0.059	0.526	0.055	0.270	0.005	0.213
N	65	63	17	16	19	18	29	29

* p<0.10, ** p<0.05, *** p<0.01

Reported number of head

OWN treatment | VIRTUAL treatment | Misreport (Reported - realized)



p=0.005 (KW)
p-values (MW)

	Irvine	Wuhan
Osaka	0.7334	0.0017
Irvine		0.0002

p=0.0151 (KW)
p-values (MW)

	Irvine	Wuhan
Osaka	0.4774	0.0069
Irvine		0.0264

p=0.0001 (KW)
p-values (MW)

	Irvine	Wuhan
Osaka	0.5061	0.0002
Irvine		0.0005

Figure S1: Cumulative distribution of the reported number of heads in OWN treatment (left) and VIRTUAL treatment (center) as well as the extent of misreporting in VIRTUAL treatment (right) in Osaka (red), Irvine (cyan), and Wuhan (gray).

II Results of the control treatments

Figure S1 shows the distribution of the reported number of heads in the OWN treatment (left), the VIRTUAL treatment (center) as well as the extent of misreporting (the reported number of heads - the realized number of heads) in the VIRTUAL treatment (right) in Osaka (red), Irvine (cyan), and Wuhan (gray).[7] The p-values from KW tests as well as MW tests for all pair-wise comparisons are also reported. The left and the center panels reveal that for both treatments, there are significant differences between Wuhan and two other locations in terms of the reported number of heads. The reported number of heads are not significantly different between Osaka and Irvine in either treatment. Similarly, the extent of misreporting shown in the right panel is significantly greater in Wuhan as compared with Irvine and Osaka.

[7]In the Wuhan session, the realized outcome of the virtual coin flips were not fully recorded for one participant. Thus, there are only 29 observations, instead of 30, for the misreport.

Table S3: Reported number of heads (No. Head) and misreporting Results of OLS regressions.

Dep. Var. Treatment	No. Head Own (1)	No. Head Own (2)	No. Head Virtual (1)	No. Head Virtual (2)	Misreport Virtual (1)	Misreport Virtual (2)
Wuhan	1.567***	0.992**	1.693***	1.014*	2.779***	1.573***
	(0.44)	(0.48)	(0.64)	(0.61)	(0.61)	(0.50)
Irvine	-0.033	-0.113	0.293	0.775	0.363	0.481
	(0.44)	(0.45)	(0.64)	(0.62)	(0.61)	(0.51)
Female		0.095		-0.741		-0.404
		(0.35)		(0.46)		(0.38)
Age		0.008		0.069		-0.001
		(0.07)		(0.09)		(0.07)
Risk		0.143**		-0.019		0.055
		(0.07)		(0.10)		(0.08)
Ethics		-0.012		-0.045		-0.241**
		(0.11)		(0.14)		(0.12)
Gov. Right		0.329		-0.173		0.083
		(0.29)		(0.34)		(0.28)
No. Truthful		-0.152***		-0.223***		-0.251***
		(0.03)		(0.04)		(0.03)
Constant	6.400***	7.781***	6.074***	6.448***	0.704	2.620
	(0.31)	(1.74)	(0.46)	(2.16)	(0.44)	(1.80)
Adjusted R^2	0.150	0.351	0.067	0.332	0.212	0.573
N	90	89	87	87	86	86
p-value[a]	0.0004	0.0161	0.0274	0.7116	0.0001	0.0458

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

a: p-value for testing H_0: Wuhan = Irvine. Wald test

Table S3 shows the outcome of OLS regressions in which the dependent variables are the reported number of heads (No. Head) or the extent of misreporting (Misreport). In one specification (specification 2), we control for individual characteristics. Those who believe others are reporting truthfully (No. Truthful) tend to report a lower number of heads and also misreport less. The dummy variable "Wuhan" is significant at the 10%level (and in most specifications at the 5% level) in all the specifications. We also observe a negative and significant correlation between the "Ethics" variable and the Misreporting amount. Thus, those who consider claiming public benefits that they are not entitled to, cheating on their taxes, or not

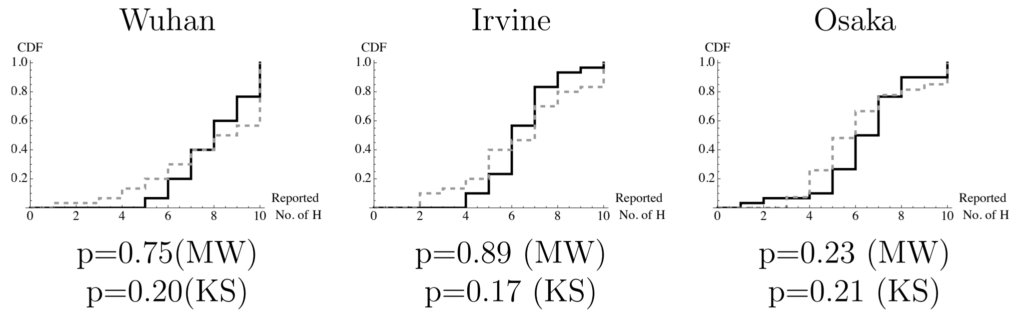


Figure S2: Cumulative distribution of the reported number of head in OWN treatment (black) and VIRTUAL treatment (gray) treatments. Wuhan (left), Irvine (cyan), and Osaka (right).

telling the truth when it is costly to do so are more unjustifiable are less likely to misreport.

Figure S2 compares the distributions of the reported number of head between the OWN treatment (black) and the VIRTUAL treatment (gray) in each location. P-values from MW and Kolmogrov-Smirnov (KS) tests are also reported. These non-parametric tests indicate that neither the distribution nor the median reported number of heads is significantly different between the two treatments in any of the locations. The reporting of 10 heads, however, is marginally significantly more frequent in the VIRTUAL treatment than in OWN treatment in Wuhan and Irvine once individual characteristics are controlled for, but not in Osaka (see, the results of OLS regressions (model (2) for each location) reported in Table S4). This is consistent with existing studies (see Abeler et al., 2019) suggesting that subjects are less likely to misreport when they are concerned about their social images, but if they do misreport, they do so to the maximum extent to overcome the cost associated with such concerns.

Table S4: Reporting 10 heads. Results of OLS Regressions

	Wuhan (1)	Wuhan (2)	Irvine (1)	Irvine (2)	Osaka (1)	Osaka (2)
Virtual Coin	0.200	0.204*	0.133*	0.147*	0.048	0.091
	(0.12)	(0.11)	(0.08)	(0.08)	(0.09)	(0.07)
Female		0.008		0.025		-0.111
		(0.11)		(0.09)		(0.08)
Age		-0.022		-0.002		-0.000
		(0.03)		(0.02)		(0.01)
Risk		-0.025		0.035*		0.042**
		(0.02)		(0.02)		(0.02)
Ethics		-0.017		0.002		-0.000
		(0.03)		(0.03)		(0.03)
Gov. Right		0.027		-0.093		0.062
		(0.08)		(0.08)		(0.06)
No. Truthful		-0.042***		-0.014		-0.022***
		(0.01)		(0.01)		(0.01)
Constant	0.233***	1.037	0.033	-0.265	0.100	0.302
	(0.09)	(0.67)	(0.05)	(0.39)	(0.06)	(0.32)
Adjusted R^2	0.029	0.319	0.033	0.074	-0.013	0.289
N	60	60	60	60	57	56

* p<0.10, ** p<0.05, *** p<0.01

Dependent variable =1 if the subjected reported 10 heads, =0 otherwise.

III Regression results for the reported number of heads, misreporting and the coin used. Comparison of the CHOICE and the control treatments.

Table S5: Reported number of heads and coin used. Regression results

	All (1)	All (2)	Wuhan (1)	Wuhan (2)	Irvine (1)	Irvine (2)	Osaka (1)	Osaka (2)
Wuhan	1.280***	0.981***						
	(0.27)	(0.27)						
Irvine	0.013	0.132						
	(0.27)	(0.26)						
own coin only	-1.751***	-1.409***	-1.563**	-1.519***	-1.318**	-0.927	-2.186***	-1.668***
	(0.34)	(0.31)	(0.66)	(0.53)	(0.61)	(0.66)	(0.52)	(0.45)
virtual coin only	-1.918***	-1.479***	-1.763***	-1.890***	-1.318**	-0.841	-2.512***	-1.802***
	(0.34)	(0.31)	(0.66)	(0.52)	(0.61)	(0.65)	(0.53)	(0.46)
choice and virtual coin	-2.541***	-1.992***	-2.832***	-2.102***	-1.660***	-1.339**	-2.939***	-2.230***
	(0.33)	(0.30)	(0.63)	(0.52)	(0.58)	(0.61)	(0.50)	(0.44)
female		0.023		-0.013		0.235		-0.267
		(0.20)		(0.32)		(0.41)		(0.33)
Age		0.034		0.006		0.016		0.011
		(0.04)		(0.08)		(0.08)		(0.05)
Risk		0.034		-0.121*		0.107		0.208***
		(0.04)		(0.07)		(0.09)		(0.07)
Ethics		-0.009		0.049		0.095		-0.003
		(0.06)		(0.09)		(0.14)		(0.12)
Gov. right		-0.055		0.050		-0.406		0.062
		(0.16)		(0.24)		(0.37)		(0.23)
No. Truthful		-0.188***		-0.238***		-0.092**		-0.181***
		(0.02)		(0.03)		(0.04)		(0.03)
Constant	8.231***	8.454***	9.529***	11.676***	7.684***	6.307***	8.586***	8.799***
	(0.29)	(1.02)	(0.53)	(1.95)	(0.48)	(2.19)	(0.37)	(1.31)
Adjusted R^2	0.184	0.374	0.134	0.495	0.043	0.061	0.230	0.471
N	360	356	120	118	120	119	120	119
p-value[a]	0.036	0.049	0.042	0.618	0.498	0.330	0.408	0.323

* p<0.10, ** p<0.05, *** p<0.01

a p-value for testing H_0: virtual coin only = choice and virtual coin. Wald test.

Table S6: Misreporting. Regression results

	All (1)	All (2)	Wuhan (1)	Wuhan (2)	Irvine (1)	Irvine (2)	Osaka (1)	Osaka (2)
Wuhan	1.553***	0.845**						
	(0.38)	(0.34)						
Irvine	0.118	0.158						
	(0.38)	(0.32)						
Virtual Coin Only	0.823***	0.695***	2.041***	1.168**	0.384	0.518	-0.084	-0.083
	(0.31)	(0.25)	(0.61)	(0.46)	(0.43)	(0.43)	(0.50)	(0.41)
Age		0.009		-0.130		0.052		-0.050
		(0.05)		(0.10)		(0.10)		(0.08)
Risk		-0.001		-0.180*		0.027		0.267***
		(0.06)		(0.09)		(0.10)		(0.10)
Ethics		-0.150*		-0.056		-0.139		-0.181
		(0.08)		(0.12)		(0.14)		(0.17)
Gov. right		0.141		0.280		0.196		0.302
		(0.20)		(0.32)		(0.37)		(0.31)
No. Truthful		-0.219***		-0.267***		-0.151***		-0.174***
		(0.02)		(0.04)		(0.04)		(0.04)
Constant	0.380	2.328*	1.442***	7.732***	0.683**	1.039	0.788**	2.786
	(0.31)	(1.39)	(0.38)	(2.76)	(0.28)	(2.21)	(0.33)	(1.99)
Adjusted R^2	0.113	0.420	0.128	0.590	-0.003	0.093	-0.017	0.324
N	203	202	72	71	71	71	60	60

* p<0.10, ** p<0.05, *** p<0.01