Online Appendix of "Concentration and Variability of Forecasts in Artificial Investment Games: An Online Experiment on WeChat"

A A Summary of Payment in Experiments Conducted on MTurk

Table A.1 reviews payments of the studies that performed online experiments on MTurk, published from 2013 to 2018 by the "top-5" economics journals or by *Experimental Economics* (*EE*).

Table A.1: A Summary of Payment in Experiments Conducted on MTurk Published by the Top-5 Journals or *EE* in 2013-18

Study	Participation fee	Additional payment	Experimental duration	Approximate hourly payment
Kuziemko, et al. (2015, *AER*)			15 min	$6
Imas (2016, *AER*)	$0.30	Up to $1.75		
DellaVigna and Pope (2017, *RES*)	$1.00	$0.34	10 min	$8.04
Montiel Olea and Strzalecki (2014, *QJE*)	$5.00		5 min	$60
Bordalo, et al. (2016, *QJE*)	$0.30	Up to $1.00		
Bhargava, Loewenstein and Sydnor (2017, *QJE*)			5 to 10 min	
Bursztyn, et al. (2018, *QJE*)	$3.00			
Dreber, et al. (2013, *EE*)	$0.50	Up to $1.00	6 min	Up to $15.00
Spears (2013, *EE*) (Conducted in India)			5 to 10 min	$2.10
Jordan, McAuliffe and Rand (2016, *EE*)	$0.30	Up to $0.50	<10 min	Up to $5.00
Gächter, Huang and Sefton (2016, *EE*)	$3.00		50 min	$7.80
Arechar, Gächter and Molleman (2018, *EE*)	$1.00		28 min	$13.38
Freeman and Mayraz (2018, *EE*)	$1.00		6 min	$10.00 to $24.00
Ehm, Laudenbach and Weber (2018, *EE*)	$1.30	$0.34		

Note: "$" indicates the U.S. dollar. Unless otherwise specified, all the experiments were conducted in the U.S.

B Conducting Online Experiments on WeChat

B.1 Advantages of WeChat Platform for Online Experiments

Certain features of WeChat help avoid or mitigate potential problems of online experiments that other online experiments may encounter. First, WeChat helps overcome one of the most concerned problems of online experiments: security and credibility of payments. As consumer-to-consumer (C2C) online transactions are well developed, there are several widely-used and reliable online payment platforms. WeChat developed one of the most popular payment platforms, WeChat Pay. To pay subjects through WeChat, the only required information is the subject's WeChat user ID (recorded automatically when a subject participates in the experiment), which avoids the problem of having subjects disclose their financial information. Money transferred through WeChat goes directly to the Wallet, which is an online account available to every WeChat user without requiring a bank account linked to it. Account balance of the Wallet can be deposited to a linked bank account; alternatively, it can be spent directly for digital payments, as well as payments to participating offline vendors, or transfers between WeChat users.[1] The security and credibility of payment made via WeChat Pay to the widely used Wallet makes our experiment more appealing to participants.

Second, as WeChat is a cellphone-based application, the subjects participated in our experiment on their cellphones, while most other online experiments are designed and conducted based on desktops. This helps diversify our subject pool, as the worldwide mobile internet usage has surpassed desktop usage since 2016.[2] Thus, the sample from the population using cellphones to access the Internet could be more representative. The downside, however, is the inattentiveness problem: people may pay less attention when they play on their cellphones. Notwithstanding, Horton, Rand and Zeckhauser (2011) and Berinsky, Huber and Lenz (2012) find that this problem is minor. To further mitigate this problem, researchers should make

[1] As of 2017, WeChat Pay had more than 600 million active payment users worldwide; see the Wikipedia entry of WeChat.

[2] See, e.g. "Mobile and tablet internet usage exceeds desktop for first time worldwide" by StataCounter, available at: `http://gs.statcounter.com/press/mobile-and-tablet-internet-usage-exceeds-desktop-for-first-time-worldwide`. This happened even earlier in China, as noted by Chen and Konstan (2015). See also, e.g., "The 37th Statistical Report on Internet Development in China" by China Internet Network Information Center, available at: `http://www1.cnnic.cn/IDR/ReportDownloads/201604/P020160419390562421055.pdf`.

experimental instructions clear and the experimental interface user-friendly.

Third, as Chen and Konstan (2015) discuss, the identification problem, namely, to uniquely identify subjects and track individual activities, remains a major concern for online experiments and cannot be fully addressed by current techniques with session tracking, IP addresses or cookies. Their suggestion is to conduct experiments on sites that require a login with an ID and password whenever possible so that an experimenter is able to track users across sessions and across devices. WeChat ensures that participants are verified users who have logged in with their user ID and password; moreover, as every WeChat account must be linked to a cellphone number and one cellphone number can only be linked to one account, it helps further alleviate the identification problem by reducing the possibility of a single user possessing multiple accounts or one online account being shared by multiple users, a problem that researchers using other experimental platforms may encounter.

B.2 Implementation Issues

B.2.1 Setting up an Experimental Webpage

Researchers should first create an experimental webpage. There are several ways to create the webpage: it can be written in HTML with the scripting language PHP, or can be generated using the software oTree (Chen, Schonger and Wickens, 2016) or the online platform Qualtrics. If the researchers would like to ensure that all participants are WeChat users so that they can be identified by the user IDs and payments can be made via WeChat, the webpage can be restricted to browsers within WeChat, meaning that one cannot open the webpage by copying the URL to browsers outside WeChat. Before the official launch of the experiment, researchers are advised to test the webpage in pilot experiments, to evaluate if it is clear enough for subjects whose attention to the experiment is typically no longer than 10 minutes.

B.2.2 Advertisement to Recruit Participants

Similar to traditional laboratory experiments, an advertisement (usually an advertising webpage for online experiments) is useful for subject recruitment. Besides the usual information on expected payment and expected duration of the experiment etc., the advertising webpage should

also include a link to the experimental webpage so that all the WeChat users who receive the advertisement can easily access the experiment by clicking the link. As an example, see Appendix D.1 for a translated version of the advertisement for our experiment.

In order for the advertisement to reach as many and as heterogeneous WeChat users as possible, researchers should pay special attention to the channel of distributing it. One useful channel is to post the advertisement on popular WeChat official accounts.[3] By doing so, all the subscribers of the official accounts will receive the advertisement. Meanwhile, the advertisement should also be compatible with various WeChat functions so that WeChat users are able to share it by sending it to WeChat contacts, WeChat groups, or posting it onto the Moments, a popular WeChat function where users share their lifestreams with WeChat friends.[4]

B.2.3 Implementation and Payment

Once a WeChat user opens the experimental webpage, the user ID is recorded and the subject is randomly assigned to one of the treatments. During the experiment, subjects' decisions in the experiment are stored in the server for real time monitoring.

As WeChat poses strict limits on monetary transfer for official accounts, payment can be made from the experimenter's private WeChat account. In this case, subjects who have completed the experiment should be instructed to add the experimenter's private account as a WeChat contact, often by scanning a QR code that can be easily generated by the experimenter's private account, so as to facilitate payment making. Experimenters then make payments through WeChat Pay according to the performance in the experiment and subjects' WeChat ID (see the screenshots in Appendix C.2 for an example).

B.2.4 Recent Advances on WeChat

Recently there has been development in official accounts specifically designed for economic experiments, providing services including subject recruitment, coding and operating online experimental programs, and even making payments to subjects. One example is "*Keyan Zhushou*"

[3] See Footnote 9 for a description of WeChat official accounts.

[4] To ensure this, researchers can create the advertisement through an online platform that WeChat opens for official account operators.

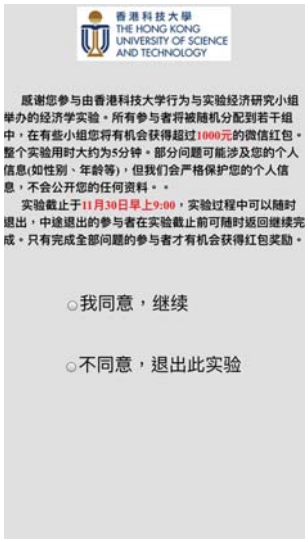
(meaning Assistant to Teaching and Research), developed by the experimental economics team at Wuhan University. The use of mini programs, which are "sub-applications" within the WeChat system, is also rapidly growing. With the development of such features, WeChat has become more convenient for experimenters to conduct experiments and more appealing for WeChat users to participate in them.

In addition, as the international version of WeChat is available, and WeChat Pay has started to accept bank cards issued outside China and allowed cross-currency settlements, conducting experiments on WeChat with non-Chinese speakers is now feasible.

C Cellphone Screen Captures

C.1 The experiment webpage

Figure C.1: Cellphone screen captures for Inter-FS-II



(a) Page 1: Introduction

(b) Page 2: Instruction

(c) Page 3: Examples of payoff calculation

(d) Page 4: Calculator and the tasks

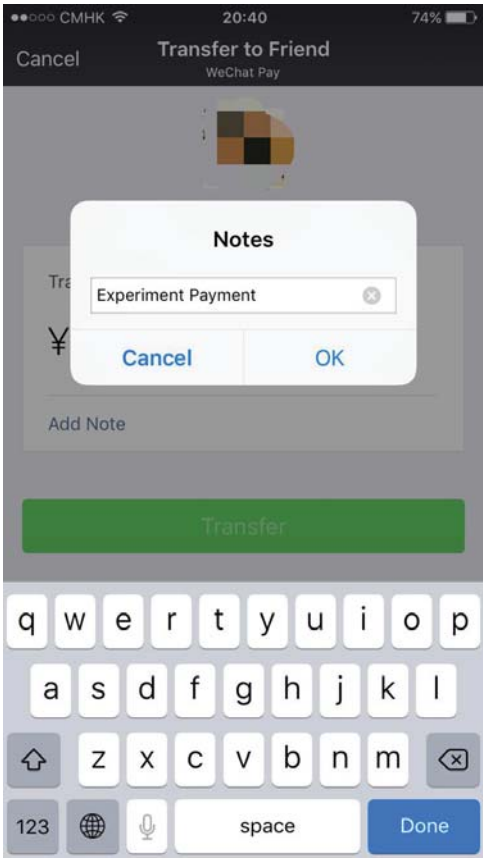
(e) Page 5: Demographic information

(f) Page 6: Payment information

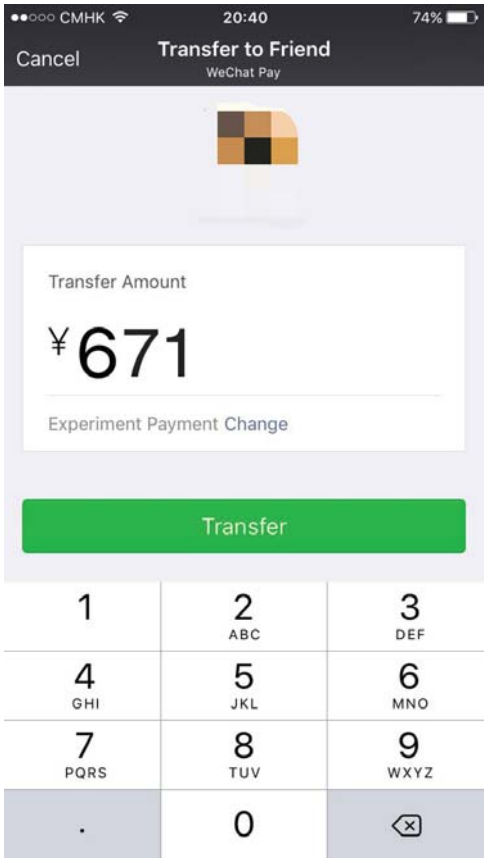
C.2 Payment transferred via WeChat

Figure C.2: WeChat transfer captures for a drawn participant

(a)



(b)



(c)

(d)

D Advertisement, Instructions and WeChat Payment in English

D.1 Translation of the advertisement mentioned in Appendix B.2.2

A behavioral and experimental research group in Hong Kong University of Science and Technology invites you to play an artificial investment game. To thank you for your support, we will randomly select 6 participants who complete the game and reward them with up to 1000 RMB. Click *Read More* and win the money. We are grateful for your participation.

D.2 Translation of Captures in Appendix C.1

D.2.1 Page 1: Introduction

Thank you for participating in the economic experiment conducted by Hong Kong University of Science and Technology Behavioral and Experimental Economics Research Team. All participants will be randomly assigned to several groups and in some of the groups, you may have the chance to obtain a cash payment of over 1000 Renminbi Yuan (RMB). The experiment would take about 5 minutes to complete. Some of the questions may be related to your private information (e.g. gender, age), but all of the information you provide will be kept confidential and used only for research purpose. This experiment will be closed at 9:00 a.m. on November 30. Before that, you are welcome to come back to change your answers. Cash payments will be available only to participants who complete all the questions.

- I agree. Proceed.
- I do not agree. Quit the experiment.

D.2.2 Page 2: Instruction

We now invite you to participate in an artificial investment game. When the game is over, we will randomly select 6 participants. They will be paid at the amount of their payoff in the game with real money.

Suppose we provide you with 500 RMB. You may choose to invest half of it, i.e. 250 RMB, or not to invest at all. In your group, your payoff will be calculated according to the following formula:

$$YourPayoff = 500 - YourInvest + ReturnMultiplier \times (YourInvest + AverageGroupInvest)$$

- If you choose to invest, then $YourInvest = 250$;
  if you choose not to invest, then $YourInvest = 0$.
- $AverageGroupInvest = (\#GroupInvestor \times 250)/\#GroupMember$, where $\#GroupInvestor$ means the number of investing members in your group
- *ReturnMultiplier* is decided by the opening price of SCI on Nov. 30 according to the following table:

Opening Price of the SCI	*ReturnMultiplier*
3560.01 or above	160%
3480.01 to 3560	120%
3380.01 to 3480	80%
3300.01 to 3380	40%
3240.01 to 3300	0%
3240 or below	-40%

Examples of payoff calculation

Next Page

D.2.3 Page 3: Examples of payoff calculation

Suppose there are 100 people in your group, and 20 of the 99 group members other than you decide to invest. If the opening price of SCI next Monday is 3570, then

- if you choose to invest
  $YourPayoff = 500 - 250 + 160\% \times (250 + 250 \times 21/100) = 734$
- if you choose NOT to invest
  $YourPayoff = 500 - 0 + 160\% \times (0 + 250 \times 20/100) = 580$

Suppose there are 100 people in your group, and 80 of the 99 group members other than you decide to invest. If the opening price of SCI next Monday is 3370, then

- if you choose to invest

  $YourPayoff = 500 - 250 + 40\% \times (250 + 250 \times 81/100) = 431$

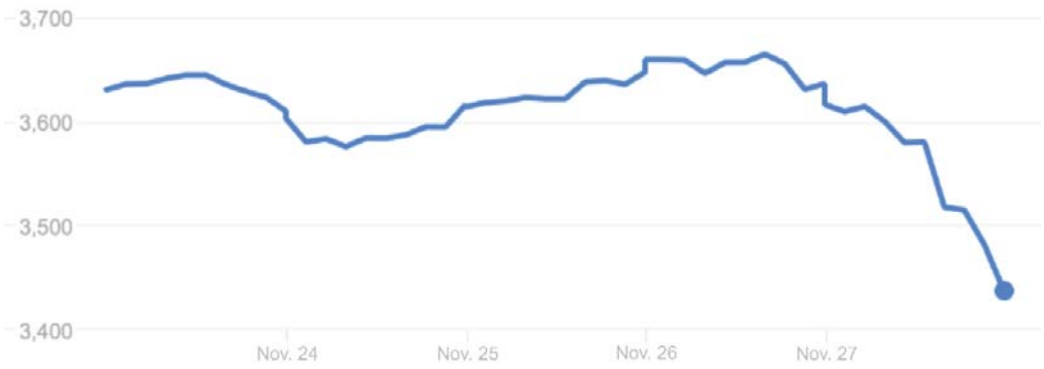
- if you choose NOT to invest

  $YourPayoff = 500 - 0 + 40\% \times (0 + 250 \times 80/100) = 580$

Return

D.2.4 Page 4: Calculator and the tasks

SCI (abbreviation for "Shanghai Composite Index") reflects the change of the stock market price. The following is the SCI in the latest 5 days:



Payoff Calculator

This calculator returns the payoff according to the SCI, the percentage of group member investing and your investment decision. You may adjust your selection as many times as you like to see the payoff in different cases. (The calculator will only help you calculate the payoff, and will not record your choices here.)

When SCI is - 3560.01 or above
- 3480.01 to 3560
- 3380.01 to 3480
- 3300.01 to 3380
- 3240.01 to 3300
- 3240 or below

The percentage of group members who invest 0% – – – – ○ – – – – 100%
None in the group invests. 50% All in the group invest.
Please move the slider to choose %

And I choose - to invest
- not to invest

Calculate Reset

In this case, my payoff will be: ____.

Now, please answer the following questions. Your following choices will be recorded.

- 1. Please make a forecast of the opening price of SCI on next Monday (Nov. 30) (corresponding return multiplier in parentheses):
  - 3560.01 or above (160%)
  - 3480.01 to 3560 (120%)
  - 3380.01 to 3480 (80%)
  - 3300.01 to 3380 (40%)
  - 3240.01 to 3300 (0%)
  - 3240 or below (-40%)
- 2. Based on your forecast, please make your investment decision:
  - invest
  - not to invest

Previous Page Next Page

D.2.5 Page 5: Demographic information:

3. Your gender:
- Male
- Female

4. Your age:
_____

5. You currently live in:
- Eastern China
- Central China
- Western China
- Hong Kong, Macau, Taiwan or others

6. Your highest education is?
- Junior high school or below
- Senior high school
- Professional school
- University
- Graduate school

7. What is your occupation?
- Student
- Government officer
- Public institution employee
- State-owned enterprise employee
- Private sector employee
- Self-employer
- Unemployed
- Retired
- Other

8. Your annual household income (including salaries and investment returns) is about:
- 30,000 or below
- 30,000 to 80,000
- 80,000 to 300,000
- 300,000 to 500,000
- 500,000 to 800,000
- 800,000 to 2,000,000
- 2,000,000 or above

D.2.6 Page 6: Payment information

You have finished all the questions. You may come back to view the latest statistics and change your choice and decision anytime before 9:00 a.m. November 30. Only your final choice and decision will be recorded. Please press and identify the following QR code to become our WeChat contact. We will announce the participants who are selected to be paid through this WeChat account after the experiment is over. Thank you for your participation. The behav-

ioral and experimental economics research team of the Hong Kong University of Science and Technology reserves the right of final interpretation of this experiment.

D.3 Translation of Capture (d) in Appendix C.2

-Based on your decision and
the decisions of your group members',
your payoff is RMB 671.

-OK.

⇌ Experiment Payment
RMB 671.00

✓ Payment received
RMB 671.00

-Thanks.

-Good luck to your research.

E Regression Results on Demographic Correlates

Table E.1: Regression results on forecasts

Forecast		World I	World II
		(1)	(2)
FS		0.1809	-0.3943
		(0.4832)	(0.4386)
INTER		-0.3161	-0.1079
		(0.3159)	(0.2924)
FS·*INTER*		-1.0101	0.0174
		(0.6158)	(0.5207)
FEMALE		-0.2006	-0.0174
		(0.1492)	(0.1517)
AGE		-0.0050	0.0069
		(0.0056)	(0.0061)
RESIDENTIAL	Central	0.1948	0.1098
		(0.1935)	(0.2003)
	Western	0.2735	0.3337
		(0.2249)	(0.2960)
	HMT and Others	-0.0932	-0.1766
		(0.2837)	(0.2818)
EDU		-0.1300	-0.1550*
		(0.0713)	(0.0722)
OCCUPATION	Gov. officer	-0.4426	0.1743
		(0.4014)	(0.3269)
	Public institution	-0.0003	0.4522
		(0.2686)	(0.3056)
	SOE	-0.4171	0.3282
		(0.3072)	(0.2877)
	Private sector	-0.4836*	0.2703
		(0.2435)	(0.2463)
	Self-employer	-0.0156	-0.1812
		(0.3175)	(0.3247)
	Unemployed	0.0084	0.3870
		(0.3779)	(0.3481)
	Retired	-0.1336	-0.0419
		(0.3424)	(0.5115)
	Others	-0.2586	-0.0176
		(0.3212)	(0.3079)
INCOME		-0.0603	-0.0328
		(0.0837)	(0.0842)

Notes:
1. This table presents full results of the regressions in Table 8 including those on demographical variables.
2. Heteroskedasticity robust standard errors are presented in parentheses. *, **, and *** represent statistical significance at 0.05, 0.01 and 0.001 levels respectively.

Table E.2: Regression results on investment

Investment		World I			World II		
		(1)	(2)	(3)	(4)	(5)	(6)
FS		-0.0787	-0.1904	-0.1633	0.4513	0.6399	0.6817
		(0.4615)	(0.4742)	(0.4704)	(0.4592)	(0.4991)	(0.5067)
$INTER$		-0.4741	-0.4510	-0.4947	0.2828	0.2779	0.2897
		(0.3685)	(0.3859)	(0.3921)	(0.3739)	(0.3856)	(0.3935)
$FS \cdot INTER$		0.6308	1.1235	1.1277	-0.8857	-1.0368	-1.0042
		(0.6604)	(0.6928)	(0.6934)	(0.6528)	(0.6952)	(0.7069)
Forecast			0.6083***			0.5774***	
			(0.0910)			(0.0919)	
f_E				1.0078			0.1036
				(0.6462)			(0.6814)
f_D				1.7030***			1.2800*
				(0.4957)			(0.5623)
f_C				2.2819***			1.4219**
				(0.4985)			(0.5403)
f_B				3.0107***			2.4557***
				(0.5544)			(0.5706)
f_A				3.0668***			2.5877***
				(0.5748)			(0.5892)
$FEMALE$		0.1149	-0.1901	0.1807	0.5417**	-0.6082**	0.6068**
		(0.1928)	(0.2034)	(0.2072)	(0.2094)	(0.2194)	(0.2223)
AGE		0.0080	0.0093	0.0095	0.0256***	0.0253**	0.0250**
		(0.0070)	(0.0076)	(0.0075)	(0.0076)	(0.0082)	(0.0084)
$RESIDENTIAL$	Central	0.0305	-0.0694	-0.1003	0.3624	0.4069	0.3780
		(0.2524)	(0.2654)	(0.2700)	(0.2725)	(0.2873)	(0.2904)
	Western	0.2169	0.1112	0.0997	0.4183	0.3744	0.4178
		(0.2902)	(0.3017)	(0.3045)	(0.3496)	(0.3563)	(0.3493)
	HMT and Others	-0.4309	-0.4434	-0.4502	-0.0055	0.0433	-0.0119
		(0.3804)	(0.3807)	(0.3808)	(0.4376)	(0.4695)	(0.4802)
EDU		-0.1618	-0.1258	-0.1397	-0.0951	-0.0597	-0.0584
		(0.0894)	(0.0915)	(0.0925)	(0.1028)	(0.1095)	(0.1103)
$OCCUPATION$	Gov. officer	-0.3161	-0.1558	-0.1570	-0.3289	-0.3700	-0.2940
		(0.4596)	(0.4683)	(0.4752)	(0.4534)	(0.4539)	(0.4520)
	Public institution	-0.1141	-0.1062	-0.0981	-0.1614	-0.1869	-0.1215
		(0.3550)	(0.3648)	(0.3712)	(0.4049)	(0.4267)	(0.4286)
	SOE	-0.2948	-0.1231	-0.1212	0.1224	0.0308	0.0829
		(0.3851)	(0.3771)	(0.3840)	(0.4160)	(0.4310)	(0.4359)
	Private sector	-0.0519	0.0910	0.0629	0.4748	0.4449	0.5127
		(0.3197)	(0.3270)	(0.3296)	(0.3672)	(0.4925)	(0.3804)
	Self-employer	0.2818	0.3203	0.3462	0.2728	0.4869	0.4925
		(0.4037)	(0.4157)	(0.4227)	(0.4511)	(0.5028)	(0.4931)
	Unemployed	0.0191	0.1235	0.1919	-0.2978	-0.4413	-0.3716
		(0.4248)	(0.4511)	(0.4608)	(0.4958)	(0.5028)	(0.5051)
	Retired	0.3878	0.3256	0.2900	-0.5045	-0.5239	-0.3727
		(0.8111)	(0.8113)	(0.8143)	(0.8134)	(0.8699)	(0.9405)
	Others	-0.6277	-0.4874	-0.4576	-0.4426	-0.3519	-0.2723
		(0.3754)	(0.3919)	(0.3988)	(0.4209)	(0.4225)	(0.4314)
$INCOME$		-0.0079	0.0038	0.0033	-0.1970*	-0.2031*	-0.2002*
		(0.0903)	(0.0993)	(0.1007)	(0.0991)	(0.1008)	(0.1013)

Notes:

1. This table presents results of the regressions in Table 10 including those on demographical variables.

2. Heteroskedasticity robust standard errors are presented in parentheses. *, **, and *** represent statistical significance at 0.05, 0.01 and 0.001 levels respectively.

References

[1] Arechar, A. A., Gächter, S. and Molleman, L. (2018). Conducting Interactive Experiments Online. *Experimental Economics,* 21(1), 99–131.

[2] Bhargava, S., Loewenstein, G. and Sydnor, J. (2017). Choose to Lose: Health Plan Choices from a Menu with Dominated Option. *Quarterly Journal of Economics,* 132(3), 1319–1372.

[3] Bordalo, P., Coffman, K., Gennaioli, N. and Shleifer, A. (2016). Stereotypes. *Quarterly Journal of Economics,* 131(4), 1753–1794.

[4] Bursztyn, L., Ferman, B., Fiorin, S., Kanz, M. and Rao, G. (2018). Status Goods: Experimental Evidence from Platinum Credit Cards. *Quarterly Journal of Economics,* 133(3), 1561–1595.

[5] Chen, Y. and Konstan, J. (2015). Online Field Experiments: a Selective Survey of Methods. *Journal of the Economic Science Association,* 1(1), 29–42.

[6] Chen, D. L., Schonger, M. and Wickens, C. (2016). oTree-An Open-source Platform for Laboratory, Online, and Field Experiments. *Journal of Behavioral and Experimental Finance,* 9, 88-97.

[7] DellaVigna, S. and Pope, D. (2017). What Motivates Effort? Evidence and Expert Forecasts. *Review of Economic Studies,* 85(2), 1029–1069.

[8] Dreber, A., Ellingsen, T., Johannesson, M. and Rand, D. G. (2013). Do People Care about Social Context? Framing Effects in Dictator Games. *Experimental Economics,* 16(3), 349– 371.

[9] Ehm, C., Laudenbach, C. and Weber, M. (2018). Focusing on Volatility Information Instead of Portfolio Weights as an Aid to Investor Decisions. *Experimental Economics,* 21(2), 447-480.

[10] Freeman, D. J. and Mayraz, G. (2018). Why Choice Lists Increase Risk Taking. *Experimental Economics,* 1–24.

[11] Gächter, S., Huang, L. and Sefton, M. (2016). Combining "Real Effort" with Induced Effort Costs: the Ball-Catching Task. *Experimental Economics,* 19(4), 687–712.

[12] Imas, A. (2016). The Realization Effect: Risk-Taking after Realized versus Paper Losses. *American Economic Review,* 106(8), 2086–2109.

[13] Jordan, J., McAuliffe, K. and Rand, D. (2016). The Effects of Endowment Size and Strategy Method on Third Party Punishment. *Experimental Economics,* 19(4), 741–763.

[14] Kuziemko, I., Norton, M. I., Saez, E. and Stantcheva, S. (2015). How Elastic Are Preferences for Redistribution? Evidence from Randomized Survey Experiments. *American Economic Review,* 105(4), 1478–1508.

[15] Montiel Olea, J. L. and Strzalecki, T. (2014). Axiomatization and Measurement of Quasi-Hyperbolic Discounting. *Quarterly Journal of Economics,* 129(3), 1449–1499.

[16] Spears, D. (2013). Poverty and Probability: Aspiration and Aversion to Compound Lotteries in El Salvador and India. *Experimental Economics,* 16(3), 263–284.