Referee Report for *The Demand for Bad Policy when Voters Underappreciate Equilibrium Effects*

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1 Research Question

The paper by E. Dal Bó, P. Dal Bó, and Eyster 2018 tries to analyze whether the bad policy is chosen because voters underappreciate equilibrium effects. To understand the research question well, we need to grasp the definitions of "bad policy", "equilibrium effects" and "underappreciate" in this paper, which are as follows:

- Bad Policy: a policy that cannot maximize voters' total utility, i.e. there must exist at least one policy that can bring higher utility to voters.
- Equilibrium Effect: the total effect of the policy on voters when nobody wants to change their behaviors. It consists of two parts: the direct effect from the policy and the indirect effect from the change of voters' behavior.
- Underappreciate: voters cannot take full indirect effect into account when computing their own utility.

2 Contribution

2.1 New explanation of bad policies

In the field of political economy, most of literature blame bad policies on politicians or institutions. Some blame on politicians for their limited electoral accountability (e.g., Barro 1973, Ferejohn 1986) and their ineptitude (e.g., Caselli and Morelli 2004), some blame on institutions for status quo bias (e.g., Romer and Rosenthal 1978), delay to reform (e.g., Alesina and Drazen 1989, Fernandez and Rodrik 1991) and dynamic inefficiency due to the threat of losing political control (e.g., De Figueiredo 2002, Besley and Coate 1998).

However, most studies view politicians as panderers rather than educators (Harrington Jr 1993, Canes-Wrone, Herron, and Shotts 2001, Maskin and Tirole 2004). Therefore, this paper focuses on the potential problems in voters' demand for policies. Specifically, this paper finds the relationship between voters' limitation on estimating policies and their policy choice, implying evidence for a new explanation of bad policies.

2.2 Demonstration the causal relationship between underappreciation of equilibrium effects and bad policies

Although a few papers have studied the reasons related to voters for bad policies, such as inefficient extraction rules proposed by some voters affects policy efficiency (Walker et al. 2000), voters heterogeneity exacerbates policy inefficiency (Margreiter, Sutter, and Dittrich 2005), and understanding of the strategic situation affects policy efficiency (E. Dal Bó and P. Dal Bó 2014), none of none focuses on voters' understanding of equilibrium effects.

Moreover, while a few papers have studied voters' understanding of equilibrium effects, such as people's attitudes towards taxes in laboratory experiments (Sausgruber and Tyran 2005, Sausgruber and Tyran 2011) and people's preference for Prisoners' Dilemma rather than coordination game (E. Dal Bó and P. Dal Bó 2014), none of them demonstrates the causal relationship between underappreciation of equilibrium effects and bad policies.

This paper, however, formalizes and empirically demonstrates the causal relationship between them, which is missing in the prior papers.

3 Research Method

The authors conducted an experiment to investigate the causal relationship between the extent to which voters understand the indirect effect and the choice of policy. In this experiment, each game represents one of the policy, and the indirect effect comes from the other player's behavioral change (from cooperation to defection, or vice versa) in different games. Specifically, participants had to choose one of the two 2×2 games they wanted to participate (shown in Table 1) and then would be asked about their beliefs on the probabilities of others' cooperation rates.

Table 1: The Prisoners' Dilemma and Harmony Games

	C	D
C	$b-c, b-c$	$-c, b$
D	$b, -c$	$0, 0$

Prisoners' Dilemma (PD)

	C	D
C	$b-c-t_C, b-c-t_C$	$-c-t_C, b-t_D$
D	$b-t_D, -c-t_C$	$-t_D, -t_D$

Harmony Games (HG)

In these two games, benefit (b) should be larger than cost (c), that is, $b > c > 0$. Tax on defection (t_D) should be less than benefit but larger than sum of cost plus tax on cooperation (t_C) so people will choose to cooperate in Harmony Game, that is, $b > t_D > t_C + c$.

In this case, a rational person would choose to defect (D) in Prisoner's Dilemma (PD) and cooperate (C) in Harmony Game (HG) because D is the dominant strategy in PD while C is the dominant strategy in HG. If both participants in the two games are rational, then the games fall into a Nash Equilibrium (NE).

Specifically, the authors set a particular choice of parameters: $b = 6, c = 2, t_C = 1, t_D = 4$ over a baseline payoff of 5 (see Table 2). In this setting, $NE_{PD} = (5,5)$, $NE_{HG} = (8,8)$, suggesting that the tax game (HG) players can get a higher gain than no tax game (PD) players.

Table 2: The Prisoners' Dilemma and Harmony Games with specific values

	C	D
C	9,9	3,$\underline{11}$
D	$\underline{11}$,3	$\underline{5}$,$\underline{5}$

Prisoners' Dilemma (PD)

	C	D
C	$\underline{8}$,$\underline{8}$	$\underline{2}$,7
D	7,$\underline{2}$	1,1

Harmony Games (HG)

According to Expected Utility Theory (EU) Theory, a person will choose HG to maximize her utility, if she believes the cooperation rate between HG and PD is larger than 50% (see below).

The expected gain (G) can be decomposed into three terms: direct effect of game change (DE), indirect effect due to the adjustment in behavior by self (IS), indirect effect due to the adjustment in behavior by the other player (IO), that is, $G = DE + IS + IO$. Specifically, in this game,

$$DE = EU(HG|\alpha,\beta) - EU(PD|\alpha,\beta) = -(\alpha t_C + (1-\alpha)t_D) = 3\alpha - 4 \tag{1}$$

$$IS = EU(HG|\alpha',\beta) - EU(HG|\alpha,\beta) = (\alpha' - \alpha)(t_D - c - t_C) = \alpha' - \alpha \tag{2}$$

$$IO = EU(HG|\alpha',\beta') - EU(HG|\alpha',\beta) = (\beta' - \beta)b = 6(\beta' - \beta) \tag{3}$$

$$G = DE + IS + IO = -4 + 2\alpha + \alpha' + 6(\beta' - \beta) \tag{4}$$

Assume a person chooses D in PD and C in HG, that is, $\alpha = 0, \alpha' = 1$. If a person chooses HG, then $G > 0$, then

$$\beta' - \beta > \frac{4 - 2\alpha - \alpha'}{6} = \frac{1}{2} \tag{5}$$

This inequality indicates that a person will choose PD if she underestimates the cooperation rate in HG. To demonstrate this causality, the authors designed the following experiment:

First, participants are divided into three treatment types: Control, Random Dictator, Majority Once, each with many groups of 6 participants. Then, the authors designed a two-stage experiment: in each stage, each player is asked to play games for 5 periods with different players. In the first stage, the players are requested to play PD all the time. In the second stage, the players need to play one of the games all the time but the way the games are chosen is different in the three treatment types. In particular, players of Control type are assigned one of the two games randomly, while those of Random Dictator type choose game by themselves and those of Majority Once type play the game chosen by the majority in the group.

To avoid the unobserved effect of the game played in the first stage (PD), the authors added 2 reversed types for Control and Random Dictator, i.e., the players of Reverse Control and Reverse RD types had to play HG in the first stage, while keeping other settings constant. Moreover, in order to the learn the evolution of the choice in a group, the authors add the Majority Repeated type, the only difference between which and Majority

Once is that the players of Majority Repeated type need to choose a game in each period of second stage.

Table 3: Experiment Design - Treatments

Treatment	Extension
Control	Reverse Control
Random Dictator (RD)	Reverse RD
Majority Once	Majority Repeated

4 Hypotheses and Experiment Results

The authors recruited 384 student subjects from UC Berkeley and 384 from Brown University to participate in the experiment. The results of the experiment are as follows.

4.1 The payoffs in Harmony Game is higher than those in Prisoners' Dilemma

Hypothesis 1 *The payoffs in Harmony Game is higher than in Prisoners' Dilemma.*

The cooperation rate (CR) in HG is higher than that in PD, which results in higher payoffs in HG than in PD (see Table 4). In particular, across all Stage 2 periods, the average CR of Control type is 16% in PD and 92% in HG, while the one of Reverse Control type is 30% in PD and 93% in HG. Taking all treatment types together, there is 23% CR in PD and 95% in HG in Stage 2, resulting in average payoffs of 5.91 and 7.66, respectively. Furthermore, in the 5th period of Stage 1, when people have gained experience, the CR is 15.5% CR in PD and 95% in HG, leading to average payoffs of 5.62 and 7.65, respectively.

In summary, the average payoffs in Harmony Game is higher than those in Prisoners' Dilemma, supporting Hypothesis 1.

Table 4: Cooperation Rates in the Two Games

Stage	Type	CR_{PD}	CR_{HG}	$Payoff_{PD}$	$Payoff_{HG}$
	Control	16%	92%		
Stage 2	Reverse Control	30%	93%		
	All	23%	95%	5.91	7.66
Stage 1	All (Period 5)	15.5%	95%	5.62	7.65

4.2 The majority prefers Prisoners' Dilemma

Hypothesis 2 *The majority prefers Prisoners' Dilemma.*

Although choosing HG leads to higher average payoffs, a slight majority (53.60%) voted for PD across all treatments for Stage 2, while the minimum vote rate is 50.00% and maximum is 60.83%.

Thus, the majority prefers Prisoners' Dilemma to Harmony Game, even though choosing Harmony Game brings higher average payoffs, supporting Hypothesis 2.

Table 5: Prisoners' Dilemma Vote Share

	Average	Min	Max
Vote Share	53.60%	50.00%	60.83%

4.3 The majority underestimates the change of others' behavior

Hypothesis 3 *The majority underestimates the change of others' behavior.*

First, on average, participants underestimate the difference in cooperation rate between HG and PD (half of the real difference). More specifically, their average belief difference is 35% in Random Dictator treatment and Majority Once treatment, and 30% in Reverse RD treatment, while the real difference is 76% in Control treatment and 63% in Reverse Control treatment (see Table 6).

Table 6: Average Difference of Cooperation between HG and PD

	Real Difference		Believed Difference		
	Control	Reverse Control	Random Dictator	Majority Once	Reverse RD
Difference	76%	63%	35%	35%	30%

Second, participants who underestimate more the change of others' behavior (the lower the change, the smaller the believed difference) are more likely to vote for PD because the results are significant at 1% level and robust to controlling for personal characteristics (see Table 7).

To summarize, the majority underestimates change of others' behavior. The more underestimated they are, the more likely they are to choose Prisoners' Dilemma, supporting Hypothesis 3.

Table 7: Beliefs and Voting for Prisoners' Dilemma

	(1)	(2)
	No Control Var.	Control Personal Characteristics
Belief Difference	-0.005***	-0.005***
	(0.001)	(0.001)

Note: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

4.4 Causality between underestimation and preference of Prisoners' Dilemma

Hypothesis 4 *Subjects who underestimate the change of others' behavior are more likely to choose Prisoners' Dilemma.*

From Table 7, we can only conclude correlation between voting and belief rather causality. To determine the causality, the authors designed an additional experiment, which differs from Random Dictator treatment in that the participants receive information about the cooperation rate of past participants and can only choose D in PD and C in HG.

Specifically, in stage 1, the participants need to play PD. Then, they are divided into two groups, the first group is informed that the cooperation rate was 50% for both games, while the second is told 17% for PD and 83% for HG; in stage 2, they are required to play with computers (rather than real people) with the same cooperation rate as the actual rate in one of the treatments of the main experiment. To avoid unobserved effects, the authors added two more groups to play HG in first stage, while keeping other settings constant (see Table 8).

Table 8: Beliefs and Voting for Prisoners' Dilemma

	50%-50%	17%-83%
Prisoners' Dilemma	PD-1	PD-2
Harmony Game	HG-1	HG-2

The results of the additional experiment show that the majority underestimates the change of others' behavior (belief difference of 28%) and prefers to vote for Prisoners' Dilemma (59%).

$$\text{Saw High Difference} = \begin{cases} 1 & i = \text{informed cooperation rate of 17\% and 83\%} \\ 0 & i = \text{informed cooperation rate of 50\%} \end{cases} \tag{6}$$

Then the authors used the variable *Saw High Difference* as the exogenous instrument variable to estimate the causal relationship (see Table 9). The first-stage result shows that *Saw High Difference* affected Belief Difference by 16% points (significant at 1% level). The second-stage results indicate that 1% point change in Belief Difference leads to a fall in preference to vote for PD of 2% points (significant at 1% level).

In short, underestimating the change of others' behavior causes a higher probability of participants choosing the Prisoners' Dilemma, supporting Hypothesis 4.

4.5 Ruling out alternative causes

Some other potential causes for choosing PD exist, but have been ruled out. Firstly, participants chosen PD may because of a status quo bias, but the settings of Reverse treatments can rule out this possibility. Secondly, participants may be averse to the word "tax". However, the word "tax" was barely mentioned in the experiment, nor was it mentioned in the Reverse Randomized Dictator treatment, whose results do not differ from the other treatments. Thirdly, social preference may affect the results, which can be ruled out in the additional experiment (opponents are computers). Finally, one may choose PD to avoid risk based on EU theory, which has been shown to be impossible if one does not underestimate the behavioral changes of others, even if she is completely risk averse.

Table 9: Instrumenting for Beliefs

Panel A: First Stage		
	(1)	(2)
	No Control Var.	Control Personal Characteristics
Saw High Difference	15.549***	16.232***
	(5.444)	(5.467)

Panel B: Second Stage		
	(1)	(2)
	No Control Var.	Control Personal Characteristics
Belief Difference	-0.022***	-0.022***
	(0.008)	(0.008)

Note: $^{***}\,p < 0.001$; $^{**}\,p < 0.01$; $^{*}\,p < 0.05$

5 Conclusion

This paper experimentally demonstrates a causal relationship between underestimating the change of others' behavior and preference of Prisoners' Dilemma.

6 Assessment

Overall, this article is one of the academic masterpieces. It rigorously demonstrates experimentally that people's underestimation of changes in others' behavior under different policies can lead people to prefer policies that make their total utility lower. This research has produced a shock to the inherent perception that inefficient policies are implemented from the intervention of politicians or groups. It has also contributed to the study of political economy using behavioral and experimental economics.

However, several minor issues remain to be discussed, as described in Sections 6. Sections 6.1 - 6.3 discuss one noteworthy point in this paper, Sections 6.4 - 6.6 list three ideas for future research inspired by this paper, and Sections 6.7 - 6.8 state two supplementary points of this paper.

6.1 A noteworthy point: Prisoners' Dilemma is strongly preferred when knowing large difference in cooperation rates

From the additional experiments, we can indeed conclude that underestimating indirect effects leads to a higher preference for PD. However, one thing we need to note is that still 42% of the participants chose PD, even though they knew that the real difference in the cooperation rates was 66% (83% in HG and 17% in PD), which was higher than 50%.

In the additional experiment mentioned in 4.4, participants can only choose D in PD and C in HG, which means $\alpha = 0, \alpha' = 1$. Moreover, the information of the cooperation rates (83% in HG and 17% in PD) are reasonable and, most importantly, consistent with the cooperation rates they experienced in Stage 1, which means we have no reason to reject them as the real beliefs, then

$$\beta' - \beta = 83\% - 17\% = 66\% > 50\% \tag{7}$$

According to Equation (7), at least the vast majority of participants should have chosen HG, which contradicts the fact that nearly half of them chose PD.

6.2 A similar experiment conducted by myself

To explore the potential reasons for the contradiction, I did a similar experiment as the one in the paper, which are as follows.

First, I showed the two games (games in Table 2) to around 20 people and explained the rules of them. Then I asked each of them the following questions, without them knowing anyone else.

1. Which game will you choose?
2. Which action (Cooperation or Defection) will you choose in the two games?
3. What are the probabilities do you think the other player will choose in the two games?
4. After thinking of your and the other player's actions in the two games, which game will you choose?
5. Now I'd like to tell you the real cooperation rates in the two games (16% in PD and 92% in HG), which game will you choose?
6. If the unit of these payoffs change from dollars to thousands or millions, which game will you choose, respectively (base on the real cooperation rates in Q5)?
7. If the payoffs of the two games change (see payoffs in Table 10), which game will you choose (base on the real cooperation rates in Q5)?
8. Assume you and the other player are both playing PD and both choose D in PD. Now if you choose to play HG instead, the other player will still choose D for the first time, then the cooperation rate grows with the times you play HG and finally reach at 92%. Which game will you choose (base on the real cooperation rates in Q5)?

Table 10: The Prisoners' Dilemma and Harmony Games including losses

	C	D
C	$4,4$	$-2,\underline{6}$
D	$\underline{6},-2$	$\underline{0},\underline{0}$

Prisoners' Dilemma (PD)

	C	D
C	$\underline{3},\underline{3}$	$\underline{-3},2$
D	$2,\underline{-3}$	$-4,-4$

Harmony Games (HG)

The difference in selection rate between Q4 and Q1 supports the conclusion of this paper. In particular, there is only 25% participants choosing HG in Q1 and 45% choosing HG in Q4. The aim of Q2 and Q3 is to guide them think the two games deeply and make them gain experience in a short time. After gaining experience, their beliefs in the difference of cooperation rates increase, leading to a higher selection rate in HG.

However, surprisingly, even though they know the real cooperation rates in Q5, they make little change to the selection rate in HG, similar to the results of the additional experiment in this paper. The reason why there is such a large rate of participants choosing PD in Q4 and Q5 is that they do not want to encounter risks even though the probability of the other player choosing D in HG is low.

Specifically, they will choose D in PD and C in HG, i.e., $\alpha = 0,\ \alpha^{'} = 1$. Then they think there is no difference between the games and the two lotteries (see below), so they think at least they can gain 5 in PD while there exists a risk of obtaining 2 in HG. In this case, we cannot rule out the explanation that a person will choose PD if she is fully risk averse.

$$L_{PD} = (5, 84\%; 11, 16\%)$$
$$L_{HG} = (8, 92\%;\ 2, 8\%)$$

6.3 An potential explanation to the high selection rate in Prisoners' Dilemma

One potential explanation is that the participants overweight small probabilities and underweight large probabilities, which is consistent with the data in the additional experiment. Even though the participants are informed the real cooperation rate (83% in HG and 17% in PD), they still believe the cooperation rate is 74% (underweight) in HG and 38.4% (overweight) in PD.

Based on the assumption, we can use Cumulative Prospect Theory (CPT) to analyze the utility of participants, while the authors use traditional EU Theory in this paper.

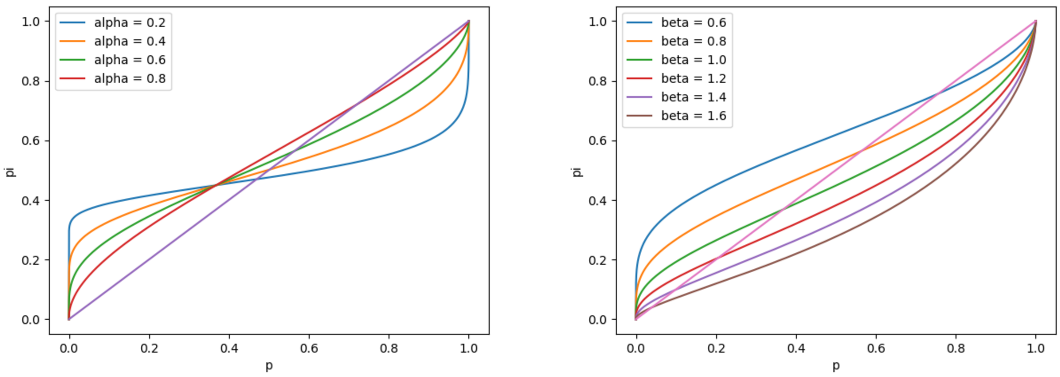
$$EU_{HG} = \exp(-\beta(-\ln p)^{\alpha} \times 8^{\alpha} + \exp(-\beta(-\ln(1-p))^{\alpha} \times 2^{\alpha} \tag{8}$$
$$EU_{PD} = \exp(-\beta(-\ln(1-q))^{\alpha} \times 5^{\alpha} + \exp(-\beta(-\ln q)^{\alpha} \times 11^{\alpha} \tag{9}$$

To determine the possible values of α and β, $\alpha = 0.6$, $\beta = 0.8$ are taken as the baseline values and two corresponding CPT curves are plotted. One figure describes the different values of α $(0 < \alpha < 1)$ at a fixed $\beta = 0.8$, and the other illustrates the different values of β $(\beta > 0)$ at a fixed $\alpha = 0.6$ (see Figure 1).

Based on Figure 1, I calculate the EU_{HG} when $p = 90\%$ and EU_{PD} when $q = 10\%$ with 5 sets of $(\alpha,\ \beta)$ (see Table 11). We can see at least in 4 of these 5 sets of $(\alpha,\ \beta)$, the payoffs of choosing PD with a 10% probability of others' cooperation are higher than HG with a 90% probability of others' cooperation.

Therefore, based on CPT, it's reasonable for a risk averse person to choose PD even when knowing the real cooperation rate of the two games. Assuming $\alpha = 0.6$, $\beta = 0.8$, if we recalculate the conceptual framework by replacing EU with CPT, we can obtain

Figure 1: CPT curves for different values of α and β



(a) different values of α at a fixed $\beta = 0.8$ (b) different values of β at a fixed $\alpha = 0.6$

Table 11: CPT Expected Utility

	Cooperation Rate	
	90% in HG	10% in PD
$\alpha = 0.6,\ \beta = 0.8$	3.24	3.26
$\alpha = 0.4,\ \beta = 0.8$	1.68	1.81
$\alpha = 0.2,\ \beta = 0.8$	1.37	1.46
$\alpha = 0.6,\ \beta = 0.6$	3.54	3.81
$\alpha = 0.6,\ \beta = 1.0$	2.98	2.84

equation (10), which is different from equation (5).

$$\begin{aligned} G &= EU_{HG} - EU_{PD} \\ &= \exp(-0.8(-\ln\beta')^{0.6} \times 8^{0.6} + \exp(-0.8(-\ln(1-\beta'))^{0.6} \times 2^{0.6} \\ &\quad - \exp(-0.8(-\ln(1-\beta))^{0.6} \times 5^{0.6} - \exp(-0.8(-\ln\beta)^{0.6} \times 11^{0.6} > 0 \end{aligned} \tag{10}$$

However, it is not easy to determine the specific values of α and β, and the computational utility is too complicated, so it is reasonable to use the traditional EU theory to design the conceptual framework part. Moreover, if we want to rule out this potential explanation (overweight small probability and underweight large probability), we can add more groups in the additional experiment to measure the percentages people over and underweight.

6.4 Extension 1: The loss is greater in absolute value than the utility of the gain

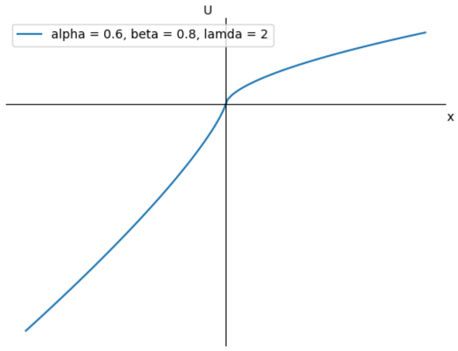
In Q7, surprisingly, all the participants (100%) in my experiment choose PD between the two games in Table 10 no matter no matter what the cooperation rate is. The only difference between these games and the original games is that the payoffs in Table 10 are the payoffs in Table 2 minus 5, which introduce potential loss to the game.

If the participants choose D in PD and C in HG, they face new expected utility according to CPT Theory. Given $\lambda > 0$, we assume $\alpha = 0.6,\ \beta = 0.8,\ 0 < p < 1,\ 0 < q < 1$, and can obtain $EU_{HG} < 0$ and $EU_{PD} > 0$ (see equations (11) and (12)).

$$EU_{HG} = \exp(-\beta(-\ln p)^{\alpha} \times 3^{\alpha} + \exp(-\beta(-\ln(1-p))^{\alpha} \times (-\lambda)(-3)^{\beta} < 0 \tag{11}$$
$$EU_{PD} = \exp(-\beta(-\ln q)^{\alpha} \times 6^{\alpha} > 0 \tag{12}$$

This result is consistent with CPT in that people are more sensitive to losses given the same value of losses and gains (We can see this conclusion from Figure 2: the utility curve is steeper for losses than for gains).

Figure 2: Utility Corresponding to Losses and Gains



In reality, people see their status as a reference point, so a new policy brings them the possibility of loss, not just gain. According to CPT, this situation makes more people prefer PD, even if they have real beliefs about changes in others' behavior.

To explore to what extent different causes of choosing Prisoners' Dilemma, we could design an additional experiment identical to the game in Table 10 and give each participant 5 dollars before they take part in the game. This design is closer to reality. Most importantly, we can compare the results of the additional experiment with the original experiment to understand the extent to which different causes have an impact.

6.5 Extension 2: People have different levels of risk aversion to different units of payoffs

In Q6, when the unit of the payoffs change from dollars to thousands or millions, people are more likely to choose PD. Two potential reasons for the change (mathematical form is shown in equations (13) and (14)):

1) β becomes larger: When the unit becomes larger, people are more risk averse and overweight small probabilities more.

2) The difference between EU_{HG} and EU_{PD} grows larger: If the unit is changed to thousands, the difference is 1000^{α} times the previous value.

$$1000^{\alpha} \times EU_{HG} = \exp(-\beta(-\ln p)^{\alpha} \times 8000^{\alpha} + \exp(-\beta(-\ln(1-p))^{\alpha} \times 2000^{\alpha} \tag{13}$$
$$1000^{\alpha} \times EU_{PD} = \exp(-\beta(-\ln(1-q))^{\alpha} \times 5000^{\alpha} + \exp(-\beta(-\ln q)^{\alpha} \times 11000^{\alpha} \tag{14}$$

In reality, the payoff between different choices of policy can bring people at least thousands of dollars instead of dollars. To make experiment design closer to reality, perhaps we could add one more question after they choose one game to play, which is whether they would change their mind if the unit of payoffs is in thousands. Depending on the additional question, maybe we can calculate different α and β in different units and measure people's utility more precisely.

6.6 Extension 3: Present-biased preference makes people prefer direct effects

In Q8, people prefer PD more if they know the indirect effects take time to realize. we can analyze this situation in terms of present-biased preferences. In particular, we can use a quasi-hyperbolic discounting model to describe a person's intertemporal preferences. In equation (15), people set a discount factor ($0 < \delta < 1$) for future utility while holding present utility constant. In this case, people overweight direct effects and underweight indirect effects.

$$U_t(u) = u_t + \beta \sum_{\tau=t+1}^{T} \delta^{\tau-t} u_\tau \tag{15}$$

In practice, similar to the dynamic model, the indirect effect occurs after $tau = t$, while the direct effect occurs at $tau = t$, which leads people to prefer PD even if they know the real probability of others' choices.

In this case, we can design a new experiment that includes a pair of dynamic games to measure the effect of presence bias. In this new experiment, people face the same games as in Table 2. Regardless of which game they choose, they need to play this game for 6 periods. If they choose HG, they need to choose D in the first period and then make their own decision in the following periods. In contrast, there is no restriction for PD.

6.7 Supplement 1: Explanation of payoffs values

One thing we need to note that there are many possibilities for the specific values of payoffs in these two games. However, I did not find any explanation why these values in Table 2 were chosen.

To explore more possibilities, I have designed two new pair of games based on the original game with $t_c = 0$. One pair of games minimizes the difference between the payoffs of two games (see Table 12). One pair of games maximizes the difference between the payoffs of the two games' NE (see Table 13).

Table 12: The Prisoners' Dilemma and Harmony Games (Alternative 1)

	C	D
C	9,9	7,$\underline{10}$
D	$\underline{10}$,7	$\underline{8}$,$\underline{8}$

Prisoners' Dilemma (PD)

	C	D
C	$\underline{9}$,$\underline{9}$	$\underline{7}$,8
D	8,$\underline{7}$	6,6

Harmony Games (HG)

Table 13: The Prisoners' Dilemma and Harmony Games (Alternative 2)

	C	D
C	$9,9$	$2,\underline{10}$
D	$\underline{10},2$	$\underline{3},\underline{3}$

Prisoners' Dilemma (PD)

	C	D
C	$\underline{9},\underline{9}$	$\underline{2},8$
D	$8,\underline{2}$	$1,1$

Harmony Games (HG)

In Table 12, both of the payoffs of the two games' NE and the payoffs with low probability are similar with each other. The expected payoffs in Table 12 are higher, which means people should prefer PD more in this setting. However, in Table 13, there exists a significant difference between payoffs of the two games' NE while the payoffs with low probability are similar, which means people should prefer HG more in this setting.

These two alternative experimental setups may differ significantly in results, while both are consistent with the concepts in Table 1. A solution to this problem is that perhaps we can conduct several experiments in different settings to eliminate potential explanations.

6.8 Supplement 2: Consistency of experiments with Pigouvian tax

According to the setting of the two experiments, the purpose of this tax is to reduce negative externalities, which is called Pigouvian tax mentioned in the paper. For example, if some companies emit pollution into rivers or the air, they will reduce the welfare of society, which is called a negative externality. The tax that the government imposes to improve this situation is the Pigouvian tax.

In this case, the direct effect is a reduction in revenue from taxes, while the indirect effect is a healthy living environment from fresher air or water. It is true that taxes increase the total welfare of society by reducing pollution. However, the firms that receive the taxes enjoy only a small fraction of the fresh air or water, and bear the full burden of the pollution they emit. So how can we ensure that the revenue from improved living conditions is greater than the cost of the tax to these firms? Why should they vote for the tax if the net profit from it is negative for them? For the rest of society who have the right to vote and can only enjoy a better life without bearing more of the tax burden, why shouldn't they vote for tax policies, but what is their role in the game? If these questions cannot be answered well, what is the realistic foundation of this experiment?

Unfortunately, I can't give specific answers to these questions, but they are worth thinking about.

References

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