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ABSTRACT

Although future generations are affected by on-going economic, social, and environmental conditions, the current political process allows present-day voters to ignore future generations' needs. This paper investigates a new voting rule wherein some people are given extra votes to serve as proxies for future generations (or individuals close to future generations). We predict that this voting scheme affects the voting behavior of those who do not receive an extra vote (i.e., single-ballot voters) because they are less likely to become a pivot, while proxy voters are expected to behave in support of the future generation. To test this prediction, we compare three scenarios wherein single-ballot voters would cast a vote: (a) one-voter-one-vote scenario wherein all voters cast only a single ballot; (b) a standard proxy-voting scenario wherein other voters cast two ballots, and the second vote is to cast for the benefit of a future generation; and (c) a non-proxy-voting scenario wherein other voters cast two ballots with no explanation for the second vote. Single-ballot voters are less inclined to vote for the future-oriented option in the non-proxy-voting scenario than in the one-voter-one-vote scenario. However, the results show that this reaction can be mitigated if the second vote is explained as being cast on behalf of the future generation.

Keywords: Voting rule, proxy vote, Demeny voting, future generation, intergenerational equity, voting behavior

1. Introduction

Democratic countries with aging populations suffer a common political problem—an increase in the age of voters. When a country's population advances in age, the intergenerational allocation of the country's resources becomes biased in favor of the elderly, and policies that may increase the country's birth rate are given less importance (Preston 1984; MacManus 1995; Poterba 1998; McDonald and Budge 2005; Disney 2007). Noted demographer Paul Demeny proposed a radical approach to deal with this issue—a new voting system wherein parents are allowed to vote as proxies for their children (Demeny 1986). The system, called Demeny voting (Sanderson and Scherbov 2007), has been the subject of great debate in several European countries, including Germany, Hungary, and Austria. In these debates, Demeny voting is offered as a potential electoral rule that could enable the current generation to make future-friendly decisions, thereby reducing inequality between the current and future generations. Discussions related to the Demeny voting system are now pervasive in other countries, including Japan (Aoki and Vaithianathan 2009; Vaithianathan et al. 2013) and Canada (Corak 2013).

The purpose of this study is to investigate possible flaws in the proxy-voting system proposed by Demeny (1986) in order to provide further insight to current discussions on it. Past research on the proxy-voting scheme has generally focused on its legitimacy (Van Parijs 1998; Wolf et al. 2015); however, this study investigates whether it accomplishes the benefits of future generations as intended.

To clarify the focus of this paper, let us consider a voter who prefers to vote for a candidate that emphasizes issues salient to future generations (e.g., environmental protection, education, or technological progress) over benefits to the current generation (e.g., tax reduction). Would such a voter cast his or her ballot for the future-oriented candidate if other voters were expected to cast a proxy vote on behalf of a future generation? This is a critical

question, as the contention that proxy-voting schemes benefit future generations and correct intergenerational inequality hinges on the assumption that they do not affect the voting behaviors of other people. However, as is often the case with economic policies and institutions, the new voting scheme may change voting behavior, resulting in unexpected and unintended outcomes.

In this study, we are concerned with whether people who *do not* have a proxy vote change their voting behavior. We focus on the behavior of single-ballot voters because current discussions of the proxy-voting scheme overlook this crucial point. Even after the introduction of this new voting system, the majority of voters still cast only a single ballot. Their behavior still has a substantial influence on election outcomes.

To evaluate single-ballot voters' behavior in the proxy-voting scheme, we utilize a laboratory-based experiment. Although such experiments (using university student participants) are not suitable for testing how parents cast their proxy votes on behalf of their children, they are suitable for testing the behavior of single-ballot voters in different voting systems. By evaluating voter behavior in different voting systems (and therefore, with different voting incentives), this study can provide useful information to consider when introducing this scheme for future generations.

There are two key reasons why single-ballot voters may behave differently in the proxy-voting scheme relative to a traditional voting system. First, their influence on an election is weakened in the proxy-voting scheme because it empowers another voting block (i.e., parents voting on behalf of their children). Second, voters allowed to cast two ballots are expected to cast their second ballot on behalf of a future generation; this expectation can affect the voting preferences of other voters. Taken together, these two factors can influence the behavior of single-ballot voters in different ways.

In our experimental task, two participants act as representatives of the present generation,

and one participant acts as a representative of a future generation. The two members of the present generation determine how resources should be allocated between the two generations. We then compare the voting decisions of present-generation participants between two voting rules—a traditional voting system (i.e., each participant casts one ballot) and the proxy-voting scheme (i.e., one of the two present-generation participants casts two ballots). To independently test the effects of the proxy-voting scheme on the voting behavior of single-ballot voter, we compare voting behavior between two slightly different voting schemes—proxy-voting (PV) and non-proxy-voting (NPV) schemes. These two are asymmetric voting schemes. However, in PV, the rationale for the two-ballot voter receiving the second vote is explained; in NPV, it is not. Thus, we compare the voting decision of single-ballot voters in the traditional voting system, PV and NPV. Comparing voting decisions in the traditional voting system and in NPV, we test the effect of the decreasing influence of single-ballot voters. The comparison of single-ballot voters' decisions in NPV and PV tests how the rationale of the second vote affects their voting behavior.

We derive predictions from two different strands of literature on voting. In the first, a voting model wherein voters express their preferences through voting behavior in a manner similar to fans cheering for their favorite sports teams is considered (Brennan and Lomsky 1993; Brennan and Hamlin 1998). The expressive voting model predicts that the decreasing pivotal probability promotes voting for a future-friendly option because the cost of behaving ethically becomes low when the voters' decision does not influence the voting outcome. The second strand is related to the conformity of decisions. In literature, it is known as the bandwagon effect (Leibenstein 1950; Zech 1975). The bandwagon model predicts that explaining the rationale for the two-ballot voter's proxy vote increases the single-ballot voter's expectation that the likely winner is a future-friendly option, and thus, promotes the ethical voting of single-ballot voters.

The experiment's results provide evidence against our first prediction of expressive voting model; the NPV scheme did not induce single-ballot voters to vote for future-oriented issues possibly because asymmetric voting power between single- and two-ballot voters in this scheme produces unfair perception of the single-ballot voters. This perception may induce them to vote more egoistically. However, we did find support for the bandwagon model prediction—single-ballot voters will vote in favor of the future in the PV scheme relative to the NPV scheme. It is likely that the combined effect of decreasing pivot probability and the explained rationale of the two-ballot voters' second vote guaranteed the neutrality of single-ballot voters' behavior before and after the introduction of the proxy-voting scheme. These results suggest that the success of the new voting scheme suggested by Demeny should depend on whether the rationale behind giving some voters a second ballot is explained and understood.

Our results have implications not only for the current discussions on voting reform, but also for the academic literatures on experimental economics and political science. First, our use of an experimental design (and the results derived from it) is relatively novel in this domain. Past experimental research on weighted voting is based on cooperative game theory (Montero et al. 2008, Guerci et al. 2014); however, our study focuses on how asymmetric voting power affects the decision between self-interest and fairness. Second, this study adds to the literature on the expressive voting model by showing a negative relationship between pivot probability and fair voting (Feddersen 2009; Shayo and Harel 2012; Kamenica and Brad 2014). Our results indicate that voters' behavior is affected by whether voting power is symmetrical or asymmetrical. Third, our research design is related to a dictator game experiment wherein a group of multiple participants plays the role of a dictator. Past literature on group decision-making has suggested that, relative to individuals, groups tend to show greater self-interest because of in-group favoritism and the group discussion process

(Wildschut and Insko 2007; Charness and Sutter 2012). In this study, we demonstrate how the manner wherein each group member's opinion is aggregated affects each group member's voting preferences.

To address these issues, we have organized the remainder of the paper in a series of interrelated sections. In the next section, we describe our experimental design. We then present the results of our experiment in section 3. Finally, in section 4, we summarize our results, discuss their implications, and outline their limitations.

2. Design, hypotheses, and procedures

2.1 General setup

We divide participants into groups of three to represent individual "societies." Two of the three group members represent the present generation, and the remaining member represents the future generation. The two members of the present generation determine the way wherein resources are allocated between the present and future generations. The member of the future generation cannot participate in decision-making related to resource allocation, but receives a payoff determined by the present generation. Given this setup, the future generation can be considered a stakeholder, but is excluded from the political process.[1]

Members of the present generation are asked to choose one of the following two alternatives (see Table 1): an allocation scheme wherein all individuals receive 500 JPY (Choice A, a future-oriented option), or a setup wherein the members of the current generation receive 600 JPY and the member of the future generation receives 300 JPY (Choice B, a present-oriented option). We assume the future-oriented choice to be the fair

[1] In this sense, our experimental findings can be extrapolated to not only intergenerational resource allocation problems, but also to more general situations wherein some stakeholders are excluded from the decision-making process.

option because the present political decision is biased toward the present (Thompson, 2010; Kamijo et al., 2017).

<Insert Table 1 here>

Members of the present generation vote on the choices, and the option that receives the most votes is declared the winner (with resources allocated accordingly). In the ordinary voting (OV) scheme, each member in the present generation casts a vote for only one of the options. Voters are not allowed to abstain. In case of a tie between choices, one option is randomly selected.

In the proxy-voting (PV) scheme, one of the two members in the present generation is provided with an additional vote that represents a proxy ballot for a future generation. Although the person provided with the additional vote is recommended to use it on behalf of the future generation, he or she is not required to do so. We consider the PV scheme to be asymmetric in terms of voting power because one of the two present-generation members is provided with two votes relative to the other member's one vote. The member with one vote is called a "single-ballot voter," and the member with two votes, a "two-ballot voter."

We use this binary-option experimental design to eliminate strategic considerations from the voting decision as much as possible. This design allows us to determine that differences in voting behavior across conditions reflect changes in voting preferences because of the voting scheme.

2.2 Two types of asymmetric voting scheme: Proxy-voting and non-proxy-voting

The PV scheme differs from the OV scheme (i.e., one-voter-one-vote scheme) in two key ways. First, the PV is weighted such that some voters are allowed multiple votes, while

others are not. This creates asymmetric voting power between voters. Second, when the PV scheme is employed, two-ballot voters are instructed to use their second ballot on behalf of others (i.e., vote for Choice A). However, this instruction is non-binding, and therefore, has no influence on the structure of their voting power. Nevertheless, we expect the instruction to influence voters' moral preferences by increasing the perception that Choice A is socially desirable.

To differentiate the two effects that the PV scheme may induce, we also create a control condition wherein voters have asymmetric power (i.e., one voter has one vote and the other has two), but the single-ballot voter does not receive explanations for the two-ballot voter's second vote. In the control condition, the two-ballot voter's second vote was not framed as the voting right of members of the future generation. This control condition is called the NPV scheme. By comparing single-ballot voters' voting behavior in the OV scheme to their behavior in the NPV scheme, we can evaluate how asymmetric voting power affects voting behavior independent of context. By comparing the single-ballot voters' voting behavior in the NPV scheme to their behavior in the PV scheme, we can test the effect of "proxy-voting" on voting behavior of single-ballot voters.

2.3 Hypothesis

Experimental research on actual human subjects has shown that they are not simple economic agents that maximize their own tangible profit. Here, we assume that voters have behavioral preferences that are popular in the voting context, as well as concerns regarding their tangible outcome.

First, in addition to being motivated by tangible outcomes, people also have a tendency to behave in an ethical manner (Fehr and Schmidt 2006). Research on voting behavior has shown that voters obtain positive utility not only from the outcomes of the elections wherein

they participate, but also by using their voting behavior as an expression of their attitudes (Riker and Ordeshook 1968; Brennan and Buchanan 1984; Scheussler 2000).

Second, we assume that voters may prefer to vote for the likely winner. The bandwagon effect (Leibenstein 1950; Zech 1975; McAllister and Studlar 1991; Tyran 2004) will affect voting behavior because the prospects of the likely winner are different between the three situations, even though voters have the same belief on other voters' preference in the three different situations.

To derive a sharp hypothesis on voting behavior, we consider a rational decision model of voters incorporating the expressive and bandwagon preferences. In our model, in addition to the tangible utility from choices (i.e., 500 JPY if Choice A is realized and 600 JPY if Choice B is realized), voters are assumed to obtain utilities from other sources—their behavior itself (not the outcome), and victory or defeat of the choice for which they casted their ballots. We assume that voters construct subjective probability to the opponent's preferences on choices, and this probability is not affected by the voting scheme. Let p_A and p_B be the subjective probabilities that the opponent likes Choices A and B, respectively. Given this, voters cast their ballots in order to maximize their expected payoffs.[2]

2.3.1 Expressive Voting Preference

In the expressive voting model, voters are assumed to obtain positive utility U_E directly from

[2] Here, we consider a rational single agent's decision problem given the opponent's behavior. Thus, in this analysis, the agent does not rationally predict the opponent's behavior, but naïvely accepts the initial prediction without adjusting because of strategic consideration. We adopt this setting because of its simplicity and sufficiency for analyzing the difference in the two models. We also conduct the equilibrium analysis of the models, and prove that the same result holds. We will send the proof on request.

behaving in an ethical manner. Since Choice A is fairer, we assume that the voter obtains U_E by just voting for Choice A. The size of U_E depends on voter characteristics, but we assume that this is constant across voting schemes for that voter.

We now calculate the expected payoff of voting for A and B as follows. In the OV scheme, these expected payoffs are

$$EU^{E-OV}(A) = U_E + p_A \times 500 + p_B \times (0.5 \times 500 + 0.5 \times 600)$$

$$EU^{E-OV}(B) = p_A \times (0.5 \times 500 + 0.5 \times 600) + p_B \times 600$$

Thus, the payoff difference between voting for A and B is

$$D^{E-OV} = U_E + 0.5 \times (500 - 600)$$

The second term is interpreted as the pivot probability of this voter multiplied by the reduction in the tangible outcomes; this is considered the cost of acting in an ethical manner. Thus, the payoff difference is the direct utility by behaving ethically minus the cost of doing that. If voters are rational, they vote for Choice A if D^{E-OV} is greater than 0.[3]

Next, we consider how single-ballot voters vote in the NPV scheme. In this voting scheme, voters think that two-ballot voters cast their ballots for their preferred choices. Thus, single-ballot voters assume there is no voting split in two-ballot voters, and thus, his or her pivotal probability becomes zero. Thus, in NPV, the payoff difference is just the positive gain, and cost is negligible. Thus, we have

$$D^{E-NPV} = U_E.$$

In contrast to the NPV, single-ballot voters think that the two-ballot voters in the PV scheme use the second vote for the future generation, and vote for Choice A. In the first ballot, they use the vote for themselves. Thus, with probability p_A, the opponent casts their two

[3] If some noise terms are taken into account, they vote for Choice A more frequently as D^{E-OV} increases.

ballots for Choice A, but with probability p_B, they split their votes into two choices. Therefore, in the PV scheme, these expected payoffs are

$$EU^{E-PV}(A) = U_E + p_A \times 500 + p_B \times 500$$

$$EU^{E-PV}(B) = p_A \times 500 + p_B \times 600.$$

Thus, the payoff difference is

$$D^{E-PV} = U_E + p_B \times (500 - 600).$$

Since our behavioral model assumes that voters choose Choice A if the payoff difference is positive, we have the following predictions.

E1 (Asymmetric voting power) Single-ballot voters in the NPV scheme will vote for Choice A more frequently than single-ballot voters in the OV scheme will.

E2 (Proxy vote) Single-ballot voters in the NPV scheme will vote for Choice A more frequently than single-ballot voters in the PV scheme will.

Rationales of E1 and E2 are as follows. E1 is derived from the analytical result wherein $D^{E-NPV} > D^{E-OV}$, and thus, $D^{E-OV} > 0$ implies $D^{E-NPV} > 0$. Therefore, if some voter votes for Choice A in the OV scheme, the voter must vote for Choice A when he or she is a single-ballot voter in the NPV scheme. E2 is derived from the analytical result wherein $D^{E-NPV} > D^{E-PV}$, and thus, $D^{E-PV} > 0$ implies $D^{E-NPV} > 0$.

Our hypotheses, which are derived from expressive voting models, are consistent with extant literature. This suggests that voters tend to vote for fair and ethically sound alternatives as their pivot probability decreases and the cost of expressing the ethical behavior becomes

lower (Tyran 2004; Feddersen 2009; Shayo and Harel 2012). In our model, a single-ballot voter in NPV has negligible influence on the voting outcome, and thus, the cost of expressing an ethical attitude is small. This implies that they vote for Choice A more frequently than voters in the OV and the PV do.

2.3.2 Bandwagon Preference

Another relevant behavioral characteristic of voters in our voting context is the bandwagon effect (Leibenstein 1950; Zech 1975; McAllister and Studlar 1991; Tyran 2004). Voters may prefer to vote for the likely winner. Thus, we assume that voters obtain a positive utility U_B if they vote for the winner. For a person who has a strong bandwagon preference, it is important to follow the behavior of the majority member. In our context, the prospect of how the opponent votes in each voting scheme is important to determine the voting decision of the voter with a strong bandwagon preference.

We now calculate the expected payoff of voting for A and B as follows. In the OV scheme, these expected payoffs are

$$EU^{B-OV}(A) = p_A \times (U_B + 500) + p_B \times 0.5 \times (U_B + 500) + p_B \times 0.5 \times 600$$

$$EU^{B-OV}(B) = p_A \times 0.5 \times 500 + p_A \times 0.5 \times (U_B + 600) + p_B \times (U_B + 600).$$

Therefore, the payoff difference is

$$D^{B-OV} = 0.5 \times (p_A - p_B) \times U_B + 0.5 \times (500 - 600).$$

Next, we consider how a single-ballot voter votes in the NPV scheme. In this voting scheme, voters think that two-ballot voters cast their two ballots for their preferred choices. Thus, the single-ballot voters assume there is no voting split in two-ballot voters, and thus, their pivotal probability becomes zero. Thus, we have

$$EU^{B-NPV}(A) = p_A \times (U_B + 500) + p_B \times 600$$

$$EU^{B-NPV}(B) = p_A \times 500 + p_B \times (U_B + 600).$$

Thus, the payoff difference is

$$D^{B-NPV} = (p_A - p_B) \times U_B.$$

In contrast to NPV, single-ballot voters in the PV scheme think that two-ballot voters use their second vote for the future generation and vote for Choice A. However, they use their first ballots for themselves. Therefore, in the PV scheme, the expected payoffs are

$$EU^{B-PV}(A) = p_A \times (U_B + 500) + p_B \times (U_B + 500)$$

$$EU^{B-PV}(B) = p_A \times 500 + p_B \times (U_B + 600).$$

Thus, the payoff difference is

$$D^{B-PV} = p_A \times U_B + p_B \times (500 - 600).$$

The magnitude of the relationship between the three payoff differences is more complex because it depends on the subjective probability and the bandwagon utility. However, under a reasonable assumption on the subjective probability that the egoistic choice is more frequent (i.e., $p_B > 0.5$), D^{B-OV} and D^{B-NPV} must be negative. However, it is possible that D^{B-PV} is still positive (when $U_B > 100\frac{p_B}{p_A}$). Thus, from bandwagon preferences with some assumption on the subjective probability, we have the following predictions.

B1 (Asymmetric voting power) The frequency of voting for Choice A of single-ballot voters in the NPV scheme is not different from that in the OV scheme.

B2 (Proxy vote) Single-ballot voters in the PV scheme will vote for Choice A more frequently than single-ballot voters in the NPV scheme will.

The rationale for B1 and B2 is as follows. B1 comes from the analytical result wherein both

D^{B-OV} and D^{B-NPV} are negative when $p_B > 0.5$. B2 comes from the analytical result wherein, while D^{B-NPV} is negative when $p_B > 0.5$, D^{B-PV} can be positive.

2.3.3 Summary of the predictions and their presumptions

Table 2 summarizes our hypotheses and predictions. The predictions derived from the two different hypotheses are contrasting. While the highest frequency of ethical voting is predicted in NPV from the expressive voting preference model, it is the highest in PV from the bandwagon preference model. The three presumptions that are needed to derive these predictions should be emphasized. First, we assume that, in NPV, vote splits rarely occur. Second, the second votes of the two-ballot voters in PV are cast more frequently for Choice A. Third, the frequency of ethical vote is less than 50% in all situations except for proxy voting in PV.

<Insert Table 2 here>

2.4 Experimental design

We use a between-subjects experimental design to compare the voting behavior of single-ballot voters in the NPV and PV schemes. In contrast, we use a within-subjects experimental design to compare voting decisions of voters between the OV and the PV schemes and between the OV and the NPV schemes (see Figure 1).

We adopt the strategy method to collect meaningful data for this study as much as possible. Thus, before determining the voting scheme (OV or PV/NPV) and the role (present generation or future generation; OV voter, single-ballot voter, or two-ballot voter), the participants are asked to choose and vote for either Choice A or B if they play each of the roles. In the PV and NPV treatments, there are three roles (i.e., OV voter, single-ballot voter

in PV/NPV scheme, and two-ballot voter in PV/NPV scheme) of making decisions; thus, the three decisions are made in a random order to control the order effect (see Figure 1). Before each decision, we give three minutes to the participants for considering the decision.

Previous experimental studies have shown that concerns that are related to fairness and altruism are different across individuals. We measure these factors because they are of interest to our current study. After participating in the voting experiment, participants move on to a dictator game (DG), and then, a prisoner's dilemma (PD) (see Figure 1). In the DG, participants are paired; one of the two participants is randomly selected to act as the dictator. The dictator then allocates proportions of 1,000 JPY to the dictator and the opponent. Before being told whether they were assigned the role of dictator, participants answered how much they would allocate to their partners if they were assigned that role.

In the PD, each paired participant is initially allocated 300 JPY, and must decide whether to pass 200 JPY from it to the paired participants. If the participant passes 200 JPY of his or her 300 JPY, the opponent receives double the amount of the passed amount. In the context of the prisoner's dilemma, "pass" and "not pass" are respectively treated as cooperation and defection. We conduct both simultaneous and sequential PD experiments to evaluate participants' propensity for altruism, reciprocity, and beliefs in others' behavior.

<Insert Figure 1 here>

2.5 Procedure

We perform all experiments at the experimental laboratories of Kochi University of Technology and Kansai University in 2016 and 2017. Each research subject participates in only one session. In total, 162 participants are assigned to the PV treatment, and 159 participants, to the NPV treatment.

At the beginning of each session, participants are randomly assigned to laboratory booths. These booths separate participants to ensure their decisions are made independently and anonymously. Once participants are inside these booths, the experimenter provides them with instructions. Consistent with the common practice in experimental economics, we use neutral wording in the instructions to the extent possible. For example, we avoid words like “fair,” “pity,” “election,” “democracy,” and “Demeny voting.”

In the order stated, participants engage in the voting experiments, the DG experiment, and the PD experiment. Participants are unaware of the nature of the experiments before they engage in them, and feedback for all experiments is provided at the conclusion of the final experiment (i.e., the PD experiment). In this way, we avoid confounding each result.

We used z-Tree software (Fischbacher 2007) to perform the experiment. On average, sessions took 90 minutes to complete. The participants’ earnings are based on the collective results of the three experiments, and the average payment per subject is 2,311 JPY (approximately 21 USD).

3. Results

3.1 Summary of experimental data

<Insert Table 3 here>

Table 3 reports the descriptive statistics associated with both the NPV and the PV treatments. Variables related to the voting and the PD experiments take the value of 1 if the ethically superior option is chosen (i.e., Choice A in the voting experiment and cooperation in the prisoner’s dilemma) and 0 otherwise. The value of the variable associated with the DG ranges from 0 JPY to 1,000 JPY (equal to the amount offered). As shown in Table 3, the

variables in the DG and PD show no significant differences between the two treatments. This result indicates that slightly different instructions in the voting experiment (i.e., revelation of the purpose of the second vote) between the two treatments did not influence participants' decisions in the DG and the PD experiments. Moreover, there is no significant difference in the choice under the OV scheme between the two treatments. This indicates that participants' voting behaviors in the OV scheme are not affected by the instructions for NPV and PV. We find the only difference in the behavior of single-ballot voters between PV scheme and the NPV scheme (though this difference is significant only at the 10% level), and the direction is much consistent with B2, rather than E2. We elaborate further on this finding in section 3.4, wherein we perform a regression analysis that controls for the effects of other variables.

<Insert Figure 2 here>

Figure 2 shows the proportion of votes for Choice A, depending on voting rules and the context. While Choice A receives the greatest proportion of votes in the PV scheme, it receives the smallest proportion of votes in the NPV scheme. The difference in the proportion of votes received by Choice A is likely attributable to appropriate usage of two-ballot voters' proxy votes for the future generation, coupled with a moderate increase in ethical voting practices among single-ballot voters (see Table 3). In contrast, the decrease of the share of Choice A in the NPV scheme is because of a decline in future-oriented voting among single-ballot voters. This result demonstrates that the manner wherein a voter interprets the presence of a second vote for two-ballot voters is critical.

3.2 Checking the presumptions

Here, we check the three presumptions that underscore the models (see Table 2). First, as

predicted, the ratio of vote-split is less in the NPV scheme than in the PV scheme. However, a non-negligible percentage of subjects in the NPV (18.24%) split their votes between Choices A and B. One interpretation of this behavior is that these voters are indifferent to Choices A and B. Another is responsibility-avoiding behavior on the outcomes. Second, about 70% of the second vote in the PV is cast to Choice A, much higher than the ratio of voting for A in other voting conditions. This is significantly higher than 0.5. Third, the frequency of the ethical vote is 0.35, 0.37, 0.30, 0.38, 0.31, and 0.31 in the OV scheme of the NPV treatment, the OV of the PV treatment, single-ballot voter in the NPV scheme, single-ballot voter in the NPV scheme, and two-ballot voter in the NPV scheme, and the first ballot of the two-ballot voter in the NPV scheme, respectively. All of them are significantly less than 0.5 (by conducting a chi-square goodness-of-fit test).

In sum, the presumptions behind the models hold, and we directly test the predictions from these models in the next subsections.

3.3 The effect of the asymmetric voting power: OV vs. NPV

In this subsection, we check whether Hypotheses B1 and E1 are supported by our data. Contrary to these two hypotheses, we note a five-point decline of voting for Choice A for a single-ballot voter in the NPV scheme compared with one for a voter in the OV scheme (0.30 in single-ballot voter in the NPV vs. 0.35 in the OV) (see Table 3), and this difference is statistically significant at the 10% level ($p = 0.059$; McNemar's test). Thus, at least, we confidently reject Hypothesis E1 that predicts the increase of voting for Choice A in the NPV. These data indicate that weighted voting procedures do not promote ethical voting among voters in a weak position. We offer some potential reasons for this result in section 4.

Result 1 The frequency of voting for Choice A of single-ballot voters in the NPV is

slightly less than that of voters in the OV. Thus, our data rejects Hypothesis E1.

3.4 The effect of the explanation about the second vote: NPV vs. PV

<Insert Table 4 here>

In this subsection, we test whether our data support Hypotheses B2 or E2. While B2 suggests that single-ballot voters in the PV scheme will vote for the future-oriented option more often than single-ballot voters in the NPV scheme will, the reverse relation is suggested by E2.

To perform this analysis, we ran a probit regression consisting of three models. In all models, the PV dummy (i.e., PV = 1 and NPV = 0) serves as the independent variable, and voting behavior (i.e., 1 for Choice A and 0 for Choice B) of the single-ballot voters in the PV and NPV conditions serves as the dependent variable. To account for participants' inherent preferences for altruism or fairness, we include voters' choices in the OV scheme and their offer provided in the DG in the model as control variables. We also control for the order wherein decisions are made in the voting experiment and the location of the lab (Kochi or Kansai). Models 2 and 3 add other control variables, including demographic factors and decisions made in the prisoner's dilemma games.

The three models show that single-ballot voters are more likely to vote for the future-oriented option in the PV scheme than in the NPV scheme (Models 1 and 2: $p < 0.05$; Model 3: $p < 0.10$). These results provide evidence that supports B2, but not E2. Furthermore, the results summarized in Table 4 show that, when single-ballot voters are provided with an explanation of the proxy vote, their probability of voting for the future-oriented option increases by 10–12%.

The coefficients associated with variables regarding preference for altruism or fairness in the allocation tasks (Choice in DG and Choice in Sequential PD as second mover after first chooses cooperation) are also positive and statistically significant. These results indicate that our data are robust across different distributional tasks. The coefficients associated with the other three choices in the prisoner's dilemma game (i.e., Choice in PD, Choice in Sequential PD as first mover and Choice in Sequential PD as second mover after first chooses defection) are not significant. This is reasonable in the sense that the three altruistic or fair choices are affected not only by participants' altruistic preferences, but by other factors as well (e.g., beliefs about opponents' choices and negative reciprocity). This is in line with the literature on social psychology, which shows that the prisoner's dilemma and dictator games measure different elements of an individual's propensity to behave prosocially (Bohnet and Frey 1999; Brosig 2002).

Result 2 Single-ballot voters in the PV vote for Choice A more frequently than single-ballot voters in the NPV condition do. Thus, our data support Hypothesis B2, but not E2.

From Results 1 and 2, we find that the predictions from the bandwagon preference model are much consistent with our data than the ones from the expressive preference model.

4. Discussion and Conclusion

In this study, we performed an experiment to evaluate the effects of introducing a new voting scheme intended to correct intergenerational inequality. Specifically, this study was designed to test whether this new voting scheme maintains the neutrality of voters' behavior. Our experimental design distinguished two different effects of the proxy-voting scheme on

single-ballot voters. We found that, although the asymmetric voting power caused by the proxy vote induced a negative reaction on the part of single-ballot voters, explaining why other voters had two votes mitigated their negative responses.

This result has significant implications for policymakers. It shows that the manner wherein two-ballot voters' second vote is explained to single-ballot voters is critical to ensure the neutrality of single-ballot voters' behavior. If single-ballot voters interpret the proxy vote as an undue amplification of two-ballot voters' interests and opinions, their voting behavior may be reversed to the direction in accordance with the interest of the present generation. In contrast, when single-ballot voters interpret the proxy vote as an inherent right of the people to make decisions for future generations, this negative reaction can be mitigated.

Furthermore, we added new evidence to the literature on voting, especially concerning the bandwagon effect and expressive voting. We found that the prediction derived from the former is more consistent with the data than that from the latter. Similar findings are observed in Tyran (2004) wherein experimental participants voted for approving or disapproving donations. It was hypothesized that expressive voters approved donations more as the probability of being a pivotal player became smaller. However, experimental data reject the hypothesis derived from the expressive voting model, being more consistent with the bandwagon model prediction, that is, the subjects vote for approving the donation if they expect other voters to do so.

Although the prediction from the bandwagon model is consistent with our experimental data, we can be still beset by misconceptions regarding why single-ballot voters in the NPV scheme move toward a relatively egoistic direction. One possible explanation is the weaker voting power of single-ballot voters relative to two-ballot voters. Prior experimental research has shown that individuals behave in their own self-interest if they have less power than others have. For instance, asymmetric prisoner's dilemma experiments show that players at a

disadvantage tend to defect against group interests more frequently (Steposh and Gallo 1973; Beckenkamp et al. 2007). A similar result is observed in asymmetric coordination games (Mifune et al. 2016).

Although this paper provides a number of insights, some points should be discussed. First, although our experiment was based on decisions related to resource allocation between the present generation and a future generation (see Kamijo et al. 2017), we believe that this result is not context-specific. Certainly, using the term “future generation” may have primed altruistic preferences among experimental participants, but this is not problematic because we compare the two treatments using the same framework. In addition, we found that a voter’s propensity to vote for a future-oriented alternative positively correlates with the offer amount in a dictator game or the benefit associated with cooperation in the prisoner’s dilemma. This suggests that, in this study, future-oriented voting measures one aspect of social preference that experimental economists and social psychologists have studied for decades.

Second, we should be careful not to overestimate the experimental results with respect to voting outcomes. Our focus was on the voting behavior of single-ballot voters; however, we did not replicate the current voting standards of our society. To gain further insight into voting outcomes, it would be useful to perform simulation analyses using actual demographic data combined with experimental observations. Such an analysis would be necessary to explore whether and how parents use their proxy votes on behalf of their children, a potentially valuable topic for future research.

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Table 1. Two distribution plans between present and future generations

	Present generation 1	Present generation 2	Future generation
Choice A (future-oriented)	500 JPY	500 JPY	500 JPY
Choice B (present-oriented)	600 JPY	600 JPY	300 JPY

Table 2. Summary of hypotheses, predictions, and presumptions

	Frequency of the future-oriented voting (i.e., voting for Choice A)	
	Asymmetric voting power	Proxy vote
	OV vs. NPV	PV vs. NPV
Expressive voting preference model	E1. NPV > OV	E2. NPV > PV
Bandwagon preference model	B1. OV = NPV	B2. PV > NPV
Presumptions of the predictions	1. In NPV, the vote splits rarely occurrs 2. In PV, the second vote is cast more for Choice A 3. The frequency of the future-oriented voting is less than 50% in all situations except for the second vote in PV	

Table 3. Descriptive statistics

	All		PV treatment		NPV treatment		PV v.s. NPV	
Variables	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	p-value	
1. Voting								
(1) Choice in OV	0.36	0.48	0.37	0.48	0.35	0.48	0.648	
(2) Choice of one-ballot voter in PV and NPV	0.34	0.47	0.38	0.49	0.30	0.46	0.099	*
(3) Choice of two-ballot voter in PV (self)	-	-	0.31	0.47	-	-	-	
(3) Choice of two-ballot voter in PV (proxy-vote)	-	-	0.73	0.45	-	-	-	
(3) Choice of two-ballot voter in NPV	-	-	-	-	0.31	0.46	-	
(3) Split vote of two-ballot voter in PV and NPV	0.31	0.46	0.43	0.50	0.18	0.39		
Order 1 [(1)=>(2)=>(3)]	0.16	0.37	0.16	0.37	0.16	0.37	0.936	
Order 2 [(1)=>(3)=>(2)]	0.15	0.36	0.12	0.33	0.18	0.38	0.186	
Order 3 [(2)=>(1)=>(3)]	0.13	0.34	0.15	0.36	0.11	0.32	0.280	
Order 4 [(2)=>(3)=>(1)]	0.15	0.36	0.16	0.37	0.14	0.35	0.578	
Order 5 [(3)=>(1)=>(2)]	0.25	0.43	0.24	0.43	0.26	0.44	0.723	
Order 6 [(3)=>(2)=>(1)]	0.16	0.37	0.16	0.37	0.16	0.37	0.936	
2. Dictator Game								
Choice in DG	185.0	214.0	185.2	216.8	184.9	211.7	0.937	
3. Prisoner's Dilemma								
Choice in Simultaneous PD	0.19	0.39	0.20	0.40	0.18	0.39	0.730	
Choice in Sequential PD (First)	0.29	0.46	0.30	0.46	0.29	0.45	0.891	
Choice in Sequential PD (Second after First Choose Cooperation)	0.33	0.47	0.36	0.48	0.31	0.46	0.344	

Choice in Sequential PD (Second after First Choose Defection)	0.02	0.14	0.02	0.16	0.01	0.11	0.423
4. Others							
Male	0.56	0.50	0.59	0.49	0.53	0.50	0.350
Location (Take value 1 for Kansai and 0 for Kochi)	0.43	0.50	0.43	0.50	0.43	0.50	0.884

Note. Significance level: ***p < 0.01, **p < 0.05, *p < 0.1; we conducted chi-square tests of independence to examine the difference between the PV and the NPV treatments for all variables except “Choice in DG” (range = 0 – 1000; we performed a non-parametric Mann–Whitney U-test)

Table 4. Results of probit regression analysis of single-ballot voters

Choice of single-ballot voter in PV and NPV	Model 1		Model 2		Model 3	
	ME	Std. err.	ME	Std. err.	ME	Std. err.
PV Dummy	0.122**	0.060	0.120**	0.060	0.103*	0.059
Choice in OV	0.655**	0.050	0.654***	0.050	0.650***	0.052
Choice in DG	0.0004***	0.0002	0.0004***	0.0002	0.0003*	0.0002
Choice in PD	-	-	-	-	0.097	0.085
Choice in Sequential PD (First mover)	-	-	-	-	-0.075	0.072
Choice in Sequential PD (Second mover after first choose cooperation)	-	-	-	-	0.242***	0.077
Choice in Sequential PD (Second mover after first choose defection)	-	-	-	-	0.100	0.131
Male	-	-	0.021	0.060	0.009	0.063
Order 2	-0.013	0.117	-0.015	0.116	-0.047	0.118
Order 3	0.181	0.136	0.179	0.135	0.192	0.132
Order 4	0.055	0.110	0.054	0.111	0.029	0.110
Order 5	0.125	0.109	0.122	0.109	0.147	0.107
Order 6	0.015	0.108	0.015	0.108	0.038	0.112
Location	0.039	0.062	0.042	0.064	0.018	0.063
Log pseudo-likelihood	-118.1		-118.1		-111.8	
Pseudo R^2	0.426		0.426		0.457	
Sample Size	321		321		321	

Notes: Robust standard errors are used; significance level: ***p < 0.01, **p < 0.05, *p < 0.1; we estimated marginal effects (ME) in a probit regression model on the probability of single-ballot voters voting for Choice A

Figure 1. Experimental design

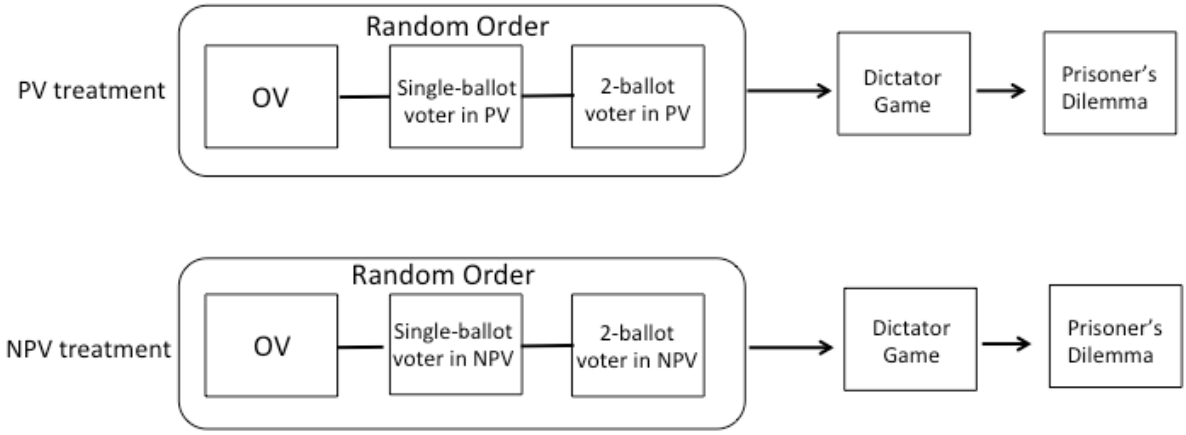

Figure 2. Proportion of votes for Choice A (future-oriented option) by voting schemes and experimental conditions