



Consideration of keys to solving problems in long-term fiscal policy through laboratory research

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Abstract

People tend to think only about their immediate benefits, as well as to be extremely optimistic. Coupled with changes of generations due to limited lifespan, this becomes a source of problems in long-term fiscal policy. The hypothesis of “silver democracy”, based on the rational voter hypothesis, argues that elderly voters prevent sustainable policy choices. It is therefore urgent to discuss how to design a policy decision framework which ensures that sustainable policies can be socially selected. In a democracy, as well as voting, the role of deliberation is emphasized. Assessing the effectiveness of deliberation in promoting sustainable policy decisions, which is called the hypothesis of “deliberative democracy”, is necessary. Through the use of questionnaires on the selection of hypothetical fiscal policies, the validity of hypotheses and keys to designing a decision framework to solve the problems are considered. Options of hypothetical fiscal policy are discussed among participants. The relationship between participants’ personal attributes and selection is examined. The role of an imaginary future generation (IFG) (Saijo in *Future design: Incorporating preferences of future generations for sustainability*, Springer, New York, 2018), a virtual representative of a future generation, is randomly assigned to some of the participants, and the nature of collective decision making is elucidated. There are several findings. Public judgment based on altruism works together with personal interests in the selection of policy. As the age of the participants increases, support for sustainable policies is weakened. However the older generation make their choices more on the basis of public judgement than personal interests. Hence the simple hypothesis of “silver democracy” seems exaggerated. Furthermore, providing information on the personal burdens imposed by policies to the participants reduces support for sustainable policies through “privatization” of policies.

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Moreover, attitudes toward uncertainty; prospects of the future economy and values of future generations, affect choices. The effect of introducing an IFG toward sustainable choice is confirmed; however the results also suggest that the evidence for promoting sustainable decision by deliberation is not necessarily certain. A randomly allocated role of IFG would not be able to complete the role of representing voices of the future. Finally, based on these findings, some keys to solving problems in long-term fiscal policy are presented.

Keywords “Silver democracy” · Public judgment · Deliberative democracy · Imaginary future generation · Ricardian equivalence

JEL Classification C90 · H30 · H60 · J18

Introduction

Hypotheses of “silver democracy” and “deliberative democracy”

People tend to think only about their immediate benefits as well as to be extremely optimistic. Humans have only limited capacities and thus they concentrate on the challenges they are facing. They do not consume their abilities by worrying about the distant future. Such behavioral tendencies must have worked for their survival in the long run. Both myopia and optimism-bias are thus a part of human nature.

However, owing to technological advances, as human activities increase in scale, the need for careful consideration of long-term interests increases. Focusing on fiscal policy, through the development of capital markets such as issuing long-term bonds, which enables inter-temporal resource allocation between generations, we must not leave myopia and optimism-bias intact. Changes of generations due to our limited lifespan make the problems more difficult. Fiscal policies affect future generations as well as present generations, but only present generations are allowed to participate in decisions on policies. The hypothesis of “silver democracy”, based on the rational voter hypothesis [5], argues that elderly voters prevent sustainable policy choices. It is therefore urgent to discuss how to design a policy decision framework which ensures that sustainable policies are socially selected. In a democracy, as well as voting, the role of deliberation is emphasized. A representative democracy provides the opportunity to reach some reasonable judgment, away from the mere accumulation of interests of voters, through deliberation among the representatives. This is called the hypothesis of “deliberative democracy” in this paper. Assessing the effectiveness of deliberation in promoting sustainable policy decisions is necessary.

Approach of this paper and previous works

In order to consider the validity of the hypotheses and to obtain keys to designing a decision framework to solve long-term fiscal problems, this paper describes

“laboratory research” conducted on decisions about fiscal policy. In the research, participants were asked to choose from options of hypothetical fiscal policies.

Among previous experimental work on fiscal policy, Cadsby and Frank [3] were the first to examine Ricardian equivalence. The Ricardian view comes from Barro [2], who argues that shifting the burden of debt from present to future generations will not happen. Knowing that debt will have to be repaid by their children, an altruistic present generation will not regard debt as net wealth, and so will not increase their consumption through the use of debt. Cadsby and Frank [3] introduced the following altruistic utility function of generation 1 (U_1) and asked the subjects to act upon the function:

$$U_1 = (C_1^A) \times (C_1^B) \times U_2 \quad (1)$$

$$U_2 = (C_2^B) \times (C_2^C). \quad (2)$$

C_1^A is the spending on consumption by generation 1 at period A. U_2 is the utility function of generation 2. The results of their experiment favor Ricardian equivalence. Following their study, Slate et al. [24] tested the equivalence under uncertainty, Ricciuti and Di Laurea [17] under liquidity constraints, and Adjil et al. [1] under distortionary taxes.

In these studies, altruistic intergenerational utility functions were assumed, however in the present paper, the specific form of utility function is not given, because the altruism of the participants and the form of their utility functions, is the subject of investigation here. Under the hypothesis of “silver democracy”, the utility function of generation 1 would take U_2 away from Eq. (1).

Since fees were not paid to the participants¹, the research in this paper is not an experiment in the sense of Smith [25]. However the use of questionnaires which ask subjects to formulate responses to hypothetical situations for the studies of fiscal policy is known in Kotlikoff et al. [12]. Like the research in this paper, their study did not give a specific form of utility function in advance and found an undervaluation of future resources relative to current resources, which suggested that Ricardian policies would not be neutral. In a broader context, economic valuation using stated preference information is known as the Contingent Valuation Method (CVM)², which contains a scenario of the hypothetical policy the respondent is being asked to evaluate or vote upon.

In this paper, judgment based upon altruism is called public judgment. Sen [21], using Edgeworth’s words, pointed out that when we depart from the “unsympathetic isolation which is abstractly assumed in Economics”, we adopt sympathy and commitment. Through sympathy, humans leave their own limited interests and participate in other people’s happiness/unhappiness and joy/sorrow. And commitment means that “if it does not make you feel personally worse off, but you think it is

¹ In this paper, policy choices with a time horizon of 30 years and more were tested. In the selection of fiscal policies, a person in 2046 could be both the person herself in 2046 and another person in 2046. The ambiguity of the identity of people in the future, which would influence policy selection, is one of the issues to be investigated in the study. Assuming specific utility functions would not be useful to investigate the issue.

² Hoyos and Mariei [9] reviews the history and the methodology of the CVM.

wrong, you are ready to do something to stop it” [21]. In this way humans begin to act based on public judgment, which is clearly distinguished from judgment based upon personal interests.

As an empirical analysis of “silver democracy”, Shimasawa et al. [23] found that per capita geriatric welfare expenses in Japan’s 47 prefectures increase along with median age. Different from their study, this paper investigates the issue in controlled laboratory-like conditions, which enables more precise assessment of the hypothesis.

In this paper, consideration is not limited to analysis focusing on individuals, but covers the nature of collective decision making: what is discussed among participants, and how valid the hypothesis of deliberative democracy is. Opinions are exchanged among participants on hypothetical fiscal policy options, and in turn they choose one. On some occasions, a mechanism to artificially create “representatives of future generations” among participants is used.

The idea of “representative of future generations” is obtained from Saijo [19]. In this paper, following Saijo [19], the “representative of future generations” is called an “imaginary future generation”(IFG). Nakagawa et al. [15] and Kamijo et al. [10] are previous works involving the use of IFG. In these studies, it is reported that when IFG joins discussion in the laboratory, the groups including the IFGs tend to make a choice of higher sustainability. In these experiments, payoffs over multiple generations (i.e. if the present generation chooses high compensation, the next generation’s compensation decreases) are presented, and choices are made through the exchange of opinions among three participants. What were presented in these experiments were simple numerical values. In this paper, to learn about the functions of IFG, and to obtain keys for improving fiscal policy, concrete options of fiscal policy are presented and discussed. Shichijo and Hiromitsu [26] is a preparatory-stage study toward this paper. This paper extends participants of the survey, considers the hypotheses through statistical investigations, and assesses the results in the broader context of previous works.

The laboratory research

Setting

The organizer of this research, the author, prepared an imaginary fiscal scenario featuring different fiscal policy options³. Two hypothetical fiscal policy options, outlined below, are developed on the basis of the *Long-term Fiscal Sustainability*

³ Given the author’s affiliation (Ministry of Finance), it might be pointed out that the participants could be induced to select FP2. However, the participants are gathered on the basis of units such as schools and workplaces, and an instruction is given that there is no correct answer to the selection of fiscal policies. While the ratio of selecting FP2 is around 70%, this paper does not draw meanings from the absolute level of this ratio. The focuses of analysis are the deviations from the average by attributes of the participants and the collective decision-making. Even if the participants would have felt such pressure, the findings in this paper would still not be affected.

*Analysis in Japan*⁴ [7], published by the Fiscal System Council (Japan). The options could be seen under slightly different budget constraints; e.g. in 60 years (2016–2075), total disposable income in FP1 is 104,400,000 JPY, and in FP2 is 100,800,000 JPY. The analysis estimates fiscal gaps, which should be filled immediately, to stabilize the debt-to-GDP ratio after 2060. It includes estimates of “costs of delay”, which are additional fiscal gaps caused by delay in consolidation, and the policy options are developed by allocating the gaps to major items of revenue and expenditure. In this sense, the two options are under the same macroeconomic and demographic constraints.

	Fiscal policy 1 (FP1)		Fiscal policy 2 (FP2)
	2016–2045	2046–	2016–
VAT	10%	25%	20%
Income tax	20%	30%	25%
Social security premium (monthly)	40,000 JPY	60,000 JPY	50,000 JPY
Individual payment of medical expenses	30%	35%	35%
Pension benefits (monthly)	100,000 JPY	50,000 JPY	70,000 JPY
Example of personal burdens (monthly)			
VAT	15,000 JPY	37,500 JPY	30,000 JPY
Income tax	60,000 JPY	90,000 JPY	75,000 JPY
Social security premium	40,000 JPY	60,000 JPY	50,000 JPY
Medical expenses	3,000 JPY	3,500 JPY	3,500 JPY
Disposable income (monthly; nominal earnings 300,000 JPY)	180,000 JPY	110,000 JPY	140,000 JPY

Participants were instructed “please imagine that you are in an imaginary country different from Japan though similar” and given information that “in the country, at present (2016), the nation’s debt is about 1,000 trillion yen (eight million yen per person), the rate of aging is 26%, and the working-age population (15-year-old to 64-year-old) reduces by more than one million per year”. Participants answered by making their own choices. In some of the groups, participants made their choices without being shown the “Example of Personal Burdens” in order to see the influence of this information on their selections.

After making their individual choices, groups of three members⁵, randomly organized, try to decide the fiscal policies to be adopted. A 10-min exchange of opinions had taken place in the groups. It did not matter whether it was a majority decision or consensus; however, the group had to decide which policy to be adopted in the end. For some of the groups, one member randomly selected from the three

⁴ The methodology of this analysis comes from the [6], on which European Commission publishes an annual Fiscal Sustainability Report of member countries.

⁵ Because of rounding, there were groups having two or four persons. Members with similar occupations were grouped together in each venue of the research (i.e. an office worker was grouped with office workers).

Table 1 Descriptive statistics ($n=447$)

Gender		Personality			
Male	Female	Optimism		Pro-social	
272	175	220		273	
Occupation					
High school	University/graduate	Regular employment	Non-regular employment	Public service	Others/no answer
115	137	70	51	64	10

was asked to become a representative of a future generation; i.e. IFG⁶. They were instructed to pretend to be a future human in 2046, 30 years from now⁷. The person assigned the role of the IFG had to let the other two know this.

Questionnaires were given before and after the opinion exchange; age, occupation, personalities (optimism⁸ and sociability⁹) and free comments on the research were gathered. The majority of participants were asked what viewpoints they expressed in the opinion exchange after the discussion (hereinafter referred to as the “main questionnaire”). In some venues (three universities and two offices), in which 68 people participated, in the place of the main questionnaire the reasons for policy selection by individuals were gathered before entering the exchange of opinions, and the reasons for the change of opinion were asked after the discussion (hereinafter referred to as the “reason survey questionnaire”).

Summary of results

The research was conducted from December 2015 to April 2016 at ten venues¹⁰ with 447 participants from late teens to late 70s. At the time of the research, the consumption tax hike to 10% from April 2017 was being planned in Japan. In June 2016, however, Prime Minister Shinzo Abe postponed the hike to October 2019. In view of this circumstance, it can be understood that the period of the research was in a similar social environment regarding fiscal policies. The descriptive statistics are shown in Table 1.

⁶ In the research there were 148 groups in total. Among 148 groups, 65 groups contained one IFG. These 65 groups came from all ten venues.

⁷ The instructions suggested that the participants should become future humans away from their individual personalities. Other types of instructions are possible. Participants could be instructed to be themselves in 2046, or to pretend to go to 2046 by time machine.

⁸ The Optimism test used was the Life Orientation Test-Revised [[19]]. The following is a sample of the test. “Please put ○ on the closest to you from 1 (I disagree a lot) to 5 (I agree a lot). (A) In uncertain times, I usually expect the best. 1 2 3 4 5”.

⁹ The Sociability test used was the Social Value Orientation Test [27]. The following is a sample of the test.

“Please put ○ on the option (whether A or B or C) that you most prefer

	A	B	C
Points you get	500	500	550
Points other gets	100	500	300

¹⁰ The venues were a high school, four universities (including a student association) and five offices.

Table 2 Participants who select FP2 before the exchange of opinions (by age group)

Age	15–19	20–24	25–29	30–34	35–39	40–44	45–49
Percentage	80.4%	74.3%	66.7%	61.1%	80.0%	65.2%	62.5%
Person/total by group	140/174	55/74	12/18	11/18	8/10	15/23	25/40
	50–54	55–59	60–64	65–69	70–74	75–79	Total
	60.7%	58.8%	52.9%	60.0%	66.7%	100%	71.6%
	17/28	20/34	9/17	3/5	2/3	3/3	320/447

The fiscal policies selected before the opinion exchange are shown in Tables 2 and 3. Around 70% of the participants selected FP2. In regression analysis of the relationship between the selection of FP2 and variables, ages of the participants are significant: on average, with the addition of one year of age, the support of FP2 declines by 0.4%. With the provision of personal burden information to the participants, the support for FP2 was reduced by 13%. Neither optimism nor pro-sociality was significant, while occupation in non-regular employment and public service significantly affected the level of support for FP2.

Next, the reasons for selection before the exchange of opinions are shown in Tables 4 and 5. Table 4 shows that around 60% of people who selected FP1 chose “(4) Because the future (2046) is uncertain, present interests should be given priority.”, and around 60% of FP2 chose “(3) Interests of future generations should come before ours (present generation).” In Table 5, half of FP2 chose “(2) Not only my own interests but also interests of society as a whole, including those of future generations, should be considered.”

Next, the outcomes of the opinion exchange, collective decision making, are shown in Table 6. The share of the individual selection of FP2 before opinion exchange was 71.6%. Discussion increased the support for FP2, and the increase came from the groups containing IFG.

Next, the influence of the opinion exchange on selections by individuals is shown in Table 7. Among those who selected FP1 before opinion exchange, around 35% changed their opinions to FP2, while less than 10% of those who selected FP2 changed to FP1.

Next, the detail of the process of collective decision-making is examined. Table 8 shows the relationship between individual selections and decisions as groups. Cases where policies which were not the majority in advance have been selected by groups were 9 groups to FP1 (4 + 1 + 3 + 1) and 7 groups to FP2 (2 + 2 + 1 + 1 + 1). Focusing on the groups which contained IFG, 4 groups (3 + 1) changed to FP1 and only one group to FP2. The major reason for the increasing share of support for FP2 by groups was found to be the direct effect of adding advocates of FP2 by assigning the role of IFG.

Furthermore, based on Table 7, opponents of those who changed their opinions through opinion exchange are examined in Table 9. Among the people who changed to FP2, nearly 80% [(15 + 12 + 4)/39] were adaptive opinion change, while only 33.3% (7/21) of people who changed to FP1 were adaptive opinion change. FP1, even when supported by a minority, tends to demonstrate stronger propagation.

Table 3 Relationship between selection of FP2 and variables (probit regression; coefficient [marginal effect]; “FP2” = 1)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Female			0.067 [0.022]		- 0.165 [0.062]	- 0.793** [- 0.308]
Age	- 0.013*** [- 0.004]	- 0.013*** [- 0.004]	- 0.013*** [- 0.004]		- 0.005 [- 0.002]	0.278 [0.101]
Optimism			- 0.137 [- 0.046]		- 0.327* [- 0.122]	- 0.155 [- 0.060]
Pro-sociality			0.125 [0.042]		0.370 [0.139]	0.438 [0.173]
Provision of personal burden information		- 0.439** [- 0.131]	- 0.434** [- 0.130]	- 0.493** [- 0.143]	- 0.364 [- 0.128]	- 0.782 [- 0.262]
High school				0.232 [0.074]	-	-
University/graduate				- 0.007 [- 0.002]	-	-
Non-regular employment				- 0.785*** [- 0.292]	- 0.594** [- 0.229]	
Public service				- 0.462** [- 0.166]	- 0.462** [- 0.166]	
Others/no answer				- 0.324 [- 0.116]	- 0.324 [- 0.116]	

***1% significance, **5% significance, *10% significance

Model 5 excludes high school and university/graduate students. Model 6 covers only people aged 55 and over

Correlation factor of age and optimism is 0.08, and that of age and pro-sociality is 0.26 (in all samples)

Table 4 From what perspectives did you express your opinion when discussing in your group? (multiple answers allowed) (main questionnaire)

Perspectives	Percentage of those who expressed their opinions from the perspective on the left (person who selected FP1)	Percentage of those who expressed their opinions from the perspective on the left (person who selected FP2)
(1) Interests of us (present generation) should come before those of future generations	20.9% (19 people)	1.7% (4 people)
(2) Both our (present generation) interests and the interests of the future generation should be fairly considered	29.7% (27 people)	64.8% (151 people)
(3) Interests of future generations should come before ours (present generation)	12.1% (11 people)	24.0% (56 people)
(4) Because the future (2046) is uncertain, present interests should be given priority	57.1% (52 people)	6.9% (16 people)
(5) We don't know what future generations will value, or what they will want	19.8% (18 people)	10.3% (24 people)
(6) Other (free comments)	2.2% (2 people)	9.0% (21 people)
Number of respondents	91 people	233 people

Participants who were assigned as IFG did not answer this question because they did not participate in the opinion exchange based on their individual opinions

Table 5 Please choose two from the following choices as the closest reasons why you selected FP1 or FP2” (reason survey questionnaire)

Reasons	Percentage of those who selected FP1 for the reason on the left	Percentage of those who selected FP2 for the reason on the left
(1) My own interests should come first	21.7% (5 people)	4.4% (2 people)
(2) Not only my own interests but also interests of society as a whole, including those of future generations, should be considered	8.7% (2 people)	51.1% (23 people)
(3) The state and communities are semi-permanent beings, which have values beyond individuals, and the survival of the state and communities should come before my own interests	8.7% (2 people)	11.1% (5 people)
(4) Considering my own life, the policy of immediate burden increase is too harsh	39.1% (9 people)	2.2% (1 people)
(5) Considering my own life, a significant increase of burden after 30 years would be a major blow	0.0% (0 people)	46.7% (21 people)
(6) Considering the lives of my children and grandchildren, a significant increase of burden after 30 years would be a major blow	8.7% (2 people)	42.2% (19 people)
(7) Depending on future population, economy, and science & technology, the future would be better than what is expected now	39.1% (9 people)	4.4% (2 people)
(8) Depending on future population, economy, and science & technology, the future would be worse than what is expected now	13.0% (3 people)	11.1% (5 people)
(9) The actual fiscal situation may not be very bad and an increase of burden may not be necessary	4.3% (1 people)	0.0% (0 people)
(10) Considering future generations is not productive, because it is not knowable what future generations will value nor what they will really want	30.4% (7 people)	4.4% (2 people)
(11) It is doubtful whether the funds will be properly used, even if we accept an increased burden	17.4% (4 people)	4.4% (2 people)
(12) I would like to leave as rich and healthy a society as possible to future generations	8.7% (2 people)	17.8% (8 people)
Number of respondents	23 people	45 people

Table 6 Policies selected as groups

Selected fiscal policy		Number of groups	Percentage
FP1		31	20.9
FP2		117	79.1
Group of the present generation only	Number (percentage)	Group containing IFG	Number (percentage)
FP1	23 (27.7)	FP1	8 (12.3)
FP2	60 (72.3)	FP2	57 (87.7)

Table 7 Participants who changed their opinions through opinion exchange

	Persons (①)	People who changed their opinions(②)	②/① (%)
Those who selected FP1 before opinion exchange	111 people	39 people (Changed FP1 → FP2)	35.1
Those who selected FP2 before opinion exchange	271 people	21 people (Changed FP2 → FP1)	7.7

Table 8 Relationship between individual selections and decisions as groups

Group of present generation only		Number of groups	Group that contains IFG		Number of groups
FP1		23 (27.7%)	FP1		8 (12.3%)
Individual selections →Group decision	1,1,1 → 1	6	Individual selections →Group decision	IFG (1), 1,1 → 1	3
	1,1,2 → 1	11		IFG (2), 1,1 → 1	1
	1,1,1,2 → 1	1		IFG (1), 1,2 → 1	3
	1,2,2 → 1	4		IFG (2), 1,2 → 1	1
	1,2,2,2 → 1	1			
FP2		60 (72.3%)	FP2		57 (87.7%)
Individual selections →Group decision	2, 2, 2 → 2	30	Individual selections →Group decision	IFG (1), 2,2 → 2	9
	1,2,2 → 2	22		IFG (2), 2,2 → 2	31
	2,2,2,2 → 2	1		IFG (1), 1, 2 → 2	1
	2,2 → 2	1		IFG (2), 1, 2 → 2	14
	1,1,2 → 2	2		IFG (1), IFG(2), 2,2 → 2	1
	1,1,2,2 → 2	2		IFG (2), 1,1 → 2	1
	1,2 → 2	1			
	1,1 → 2	1			

“Individual selections → Group decision” column, for example, “1, 1, 2 → 1” means “two persons select FP1 and one person selects FP2 as individuals. After an exchange of opinions, their decision as a group is FP1”

“IFG (1)” means “one whose individual selection was FP1 is assigned the role of an imaginary future generation”

The shaded part indicates that the policy which was not in the majority in advance has been selected by a group after the exchange of opinions. Those who are given the role of IFG are assumed to support FP2

Table 9 Opponents of those who changed their opinions through opinion exchange

Composition of opponents	Adaptive opinion change			Others		
	2, 2	IFG, 2	2, 2, 1	2, 1	IFG, 1	1, 1
People who changed FP1 → FP2 (39 people)	15 people	12 people	4 people	5 people	2 people	1 person
Composition of opponents	Adaptive opinion change	Others				
	1, 1	1, 2	1, IFG	1, 2, 2	2, IFG	2
People who changed FP2 → FP1 (21 people)	7 people	6 people	3 people	2 people	2 people	1 person

“For example, “2, 1” means one supporter of FP2 and one supporter of FP1”

“Adaptive opinion change” means the adaptive opinion change to the majority of the group opponents

Next, the logic by which FP1 and FP2 have been lobbying the opponents respectively is examined. In this regard, it is useful to pay attention to the shaded part in Table 8 which indicates that the policy which was not in the majority in advance was selected by the group after the exchange of opinions. More specifically, persuasiveness of logic is marked through identifying the logic used by the supporters of policies which were not in the majority to successfully win the group decision¹¹. The results are shown in Table 10. The scores of the logic to support FP1 are higher. This is because the advocates of the logic refer to the logic in their free comments, and persuaded opponents also left comments of agreeing to the logic.

Interpretation of results

Preparation of interpretation

In preparation for the interpretation of the research, the utility function of generation 1 in Cadsby and Frank [3] is modified as follows:

$$U_1 = U_1^A(C_1^A) + U_1^B(C_1^B) + U_2. \quad (3)$$

¹¹ 1. In the list of “logic” in the reason survey questionnaire, the logic used by the winner (whose selection of policy becomes a final decision as a group) is marked.

1) In the case of the respondents to the reason survey questionnaire, add one point directly to the relevant logic.

2) In the case of the respondents to the main questionnaire, add one point to similar logic in the list.

3) If there are free comments, add one point to the relevant logic (even one point has been added in procedure 1), 2), add one more for taking seriously the fact that the winners make comments on the logic).

2. Add one point to the relevant logic if the loser left a free comment that they were persuaded by the logic.

Table 10 Persuasiveness of logic (logic that led to the final decisions by groups)

Logic	In groups of final decision FPI (point)	In groups of final decision FP2 (point)
(1) My own interests should come first	3 points	0 points
(2) Not only my own interests but also interests of society as a whole, including those of future generations, should be considered	3 points	4 points
(3) States and communities are semi-permanent beings, which have values beyond individuals, and the survival of the state and communities should come before my own interests	0 points	1 point
(4) Considering my own life, the policy of immediate burden increase is too harsh	5 points	3 points
(5) Considering my own life, a significant increase of burden after 30 years would be a major blow	0 points	4 points
(6) Considering the lives of my children and grandchildren, a significant increase of burden after 30 years would be a major blow	0 points	2 points
(7) Depending on future population growth, economy, and science & technology, the future would be better than is expected now	12 points	0 points
(8) Depending on future population growth, economy, and science & technology, the future would be worse than is expected now	0 points	0 points
(9) The actual fiscal situation may not be very bad and an increase of burden may not be necessary	0 points	0 points
(10) Considering future generations is not productive, because it is not knowable what future generations will value nor what they really want	7 points	0 points
(11) It is doubtful whether the funds will be properly used, even if we accept an increase in burden	0 points	2 points
(12) I would like to leave as rich and healthy a society as possible to future generations	0 points	3 points
(13) Discussion by IFG	4 points	1 point

$U_1^{A'} > 0$, $U_1^{A''} < 0$, $U_1^{B'} > 0$ and $U_1^{B''} < 0$. Period A is 2016–2045 and Period B is 2046–. When the participants in the research select FP1, there are several possible interpretations. First, they would miss U_2 or U_2 would have a smaller role in their function; i.e. they are less altruistic, namely public judgment has a smaller role in their choices. Second, they would be older. As they become older, U_1^B has a smaller role in their decision; i.e. they are myopic. Third, they would have greater economic prospects. As they expect higher growth, they intend to enjoy not only larger C_1^A but also larger C_1^B ; i.e. they are optimistic. Finally, they would not know what are future generations' values. As they have less information of the values of future generation, U_2 would have a smaller role in their function; i.e. they become agnostic on the values of the future.

In the following argument, these four interpretations are applied to the results. In the application, responses to the questionnaires in Tables 4 and 5 as well as the regression analysis in Table 3 are used to assist the application. It is necessary to note that the participants would not necessarily be motivated to show their true reasons in their responses to the questionnaires. However their answers may give us an initial window on the types of motivation behind their selections.

Packaging of policies

An unexpectedly high percentage, around 70% of participants, selected FP2, considering the political difficulties surrounding the consumption tax hike in Japan. As background of the strong support for FP2, it should be noted that the format of the question in the research makes the selection of FP2 easy. Participants were asked to select from policies packaging both present and future burdens. In Eq. (3), the hypothetical options, packaging C_1^A and C_1^B , do not allow participants to enjoy high C_1^B as well as high C_1^A .

Personal interests or public judgment?

Public judgment

Besides the packaging of the policies, another factor in the strong support for FP2 could be that participants make a choice not only based on personal interests but also based on public judgment. In Eq. (3), U_2 , the utility of generation 2 has a greater role. The responses to the questionnaires in Tables 4 and 5 also support the role of public judgment behind the selection of FP2. In Table 5, more than half of the participants who selected FP2 answered “Not only my own interests but also interests of society as a whole, including those of future generations, should be considered”.

Personal interests

On the contrary, evidence of participants making a choice based on personal interests can also be found. In Table 5, more than 20% chose “My own interests should

come first” and around 40% choose “Considering my own life, the policy of an immediate burden increase is too harsh”. Among the participants who selected FP2, some considered long-term personal interests. Table 5 tells us that 46.7% of participants who selected FP2 answered “Considering my own life, a significant increase of burden after 30 years would be a major blow”.

Coexistence of public judgment and personal interests

As Eq. (3) suggests, public judgment and personal interests can operate simultaneously. In Table 5, among 23 participants who chose FP2 and answered “Not only my own interests but also interests of society as a whole, including those of future generations, should be considered”, 6 selected “Considering my own life, a significant increase of burden after 30 years is a major blow”.

It is necessary to add an annotation to the results of the sociability test. Since pro-social persons placed values on fairness, they seemed likely to select FP2. According to Table 3, the signs of the selection and pro-sociality are consistently positive and there might be a tendency for pro-social participants to select FP2—however the tendency is not statistically confirmed. Kamijo et al. [10] used the same sociability test as this paper. Kamijo et al. [10] showed only the relationship between the decisions as groups and the sociability of participants. However it mentioned “when all members of the generation were prosocial, the generation was as likely to choose a sustainable option in the treatment condition as in the control condition (Kamijo et al. [10]: pp. 418), which suggests a positive relationship between the pro-sociality and sustainable selections.

Two points should be noted as reasons why the relationship between the policy selections and sociability was not confirmed, in comparison with Kamijo et al. [10]. First, the relationship would have been diluted, because the choices of FP2 were based not only on public judgment but also on personal interests. Second, the options presented to participants were concrete fiscal policies with some complexities, whereas the options in Kamijo et al. [10] were simple payoffs. The sociability test used for this paper is appropriate to judge psychological characteristics; however the selection of fiscal policies was based on attitudes cultivated through social experiences, even though psychological personalities would have some influence on policy selections.

These two points, for the purpose of solving long-term fiscal problems, are encouraging findings. If public judgment is the attitude cultivated by social experiences, it may become possible to intervene through education so as to strengthen the role of public judgment.

Information provided to the participants

Table 3 shows that the support for FP2 is reduced considerably, when personal burden information is provided to the participants. Those who would have selected FP2 only on such abstract information as tax rates would select FP1, the postponement of the burden to the future, once they are informed of their personal burden.

This result becomes more interesting when the coexistence of personal interests and public judgment is considered. “Privatization” of policies by providing personal burden information leads to difficulties of public determination of policies. In the reality of policy-making, the more important policies are, the more detailed information will be provided through Diet deliberations and media coverage. The concept of “privatization” of policies is a contribution to filling the gap between the 70% support of FP2 in the research and strong resistance to the increase of burdens in the real world.

Age and selection of fiscal policy

The author, prior to this research, expected that support of FP2 would decrease with age. As expected, Table 3 shows that the support of FP2 decreases with the progress of age. However, the decrease is so slow, 0.4% in every advance of one year, that adding 30 years would reduce the support only by 12%.

The background of this slow shift is also that participants select not only based on personal interests but also based on public judgment. The support of FP2 in the elderly is increased by public judgment. As Table 3, model 6, suggests, the relationship between policy selections and age seems to be weaker in the aged. Considering the reason of the loss hypothetically, the support for FP2 might no longer decrease due to personal interests, because events of 30 years in the future would be events after their death. Their ages do not matter whether they are 60 or 70-year-old. On the other hand, support for FP2 by the young may be suppressed because they make their choices from personal interests. Even the young in their late teens and 20s would probably select lighter burdens for the next 30 years, considering that these 30 years cover most of their employment. Time preference, which discounts future events, will facilitate this choice by the young. Figure 1 is presented to show this discussion.

From the average life expectancy and proportion of male/female participants, the average life expectancy at age 55 is just 30 years. If policies are selected only from personal interests, support for FP2 at the age of 55 would be zero. There are two estimates of the age at which support for FP2 will become 100%: minus 30 or minus 10-year-old. Support at other ages is on “line A” or “line B” which is drawn from the 100% point to the 0% point. “Line A” or “line B” represents support based on personal interests. “Line C” and “line D” are drawn based on Eq. (2) of the probit regression. The difference between “line C” and “line D” is the presence/absence of personal burden information. By including personal burden information, “line D” shows a downward shift relative to “line C”. The gap between “line A” (“line B”) and “line C” (“Line D”) represents the increase of support for FP2 by public judgment. “Line E” corresponds to Model 6 of Table 3, which covers only those aged 55 and over.

Figure 1 illustrates that greater support for FP2 is backed up by public judgment as age increases. The hypothesis of “silver democracy” argues that the elderly prevent sustainable policy choices. However, this research indicates that the elderly, unlike what the argument assumes, make their selections based on public judgment to an unexpectedly

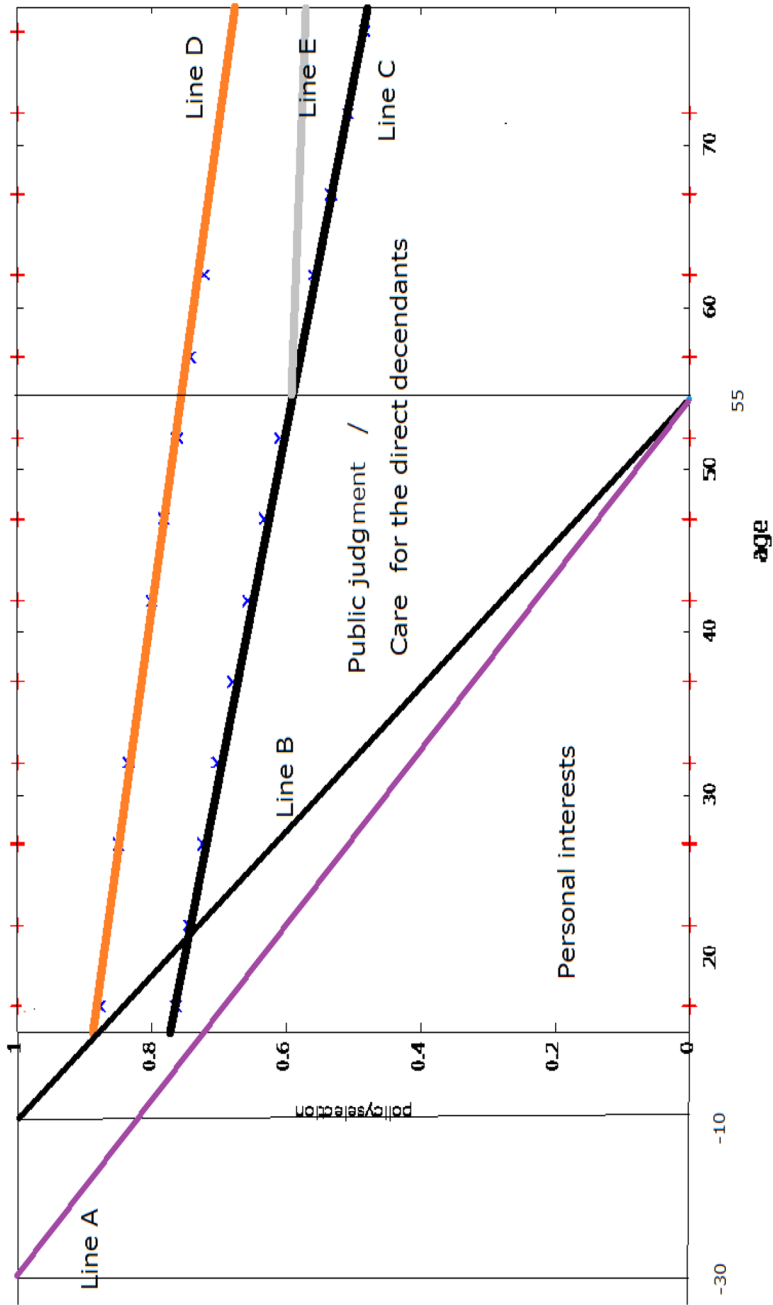


Fig. 1 Relationship between support of FP2 and age

high extent. With the progress of age, more people may come to see things from the point of view of the *nirvana*, which is the public or impartial point of view. The hypothesis seems exaggerated¹². On the other hand, it should be noted that the support of FP2 based on public judgment, compared with that based on personal interests, would be vulnerable. Hence the support for FP2 by the elderly might be unstable.

Occupation and selection of fiscal policy

Table 3 shows that support for FP2 by those in non-regular employment and public service is significantly weakened, and the relationship is statistically significant¹³. The hypothesis of the unpopularity of FP2 among those in non-regular employment is that their income and future prospects would be lower than those of regular employment. Non-regular employment may contain varieties of people from the so-called “working poor” to housewives in part-time jobs. However it is likely that the disadvantaged wish to avoid an immediate burden increase. According to Table 5, about 40% of the participants selecting FP1 answered “Considering my own life, the policy of immediate burden increase is too harsh”. The disadvantaged would express their dissatisfaction with the setting of the research. This dissatisfaction would appear as a force for downward shifts of “line C” (or “line D”).

Optimism bias

Although uncertainty contains the possibility of being both better than and worse than expected, according to Table 4, 51.7% answered “because the future (2046) is uncertain, present interests should be given priority”. It deserves attention that participants’ views of the economy are contained in this valuation of uncertainty. Table 5 shows that around 40% of participants who select FP1 choose “Depending on future population, economy, and science and technology, the future would be better than what is expected now” as the reason for their choices. In the format of the research, we asked respondents to select either FP1 or FP2; however, if someone doubts the validity of the packages with reference to her own economic theory, she will make a choice considering her immediate interests, which are more certain. In Eq. (3), she intends to enjoy high C_1^B as well as high C_1^A .

¹² Risk aversion and time discounting are not covered in this research; however these two factors could influence the selections. As the participants become risk averse, they could prefer FP2. As the participants have higher time discounting, they could prefer FP1. Ohtake and Tsutsui [16], from their experiment, suggested that age did not have a significant influence on risk aversion. Chao et al. [4], by surveying a sample of individuals, found that age was not significantly related to time discounting. If so, risk aversion and time discounting would not affect the relationship between age and the selections in the research. However, empirical evidence regarding age differences in risk aversion and time discounting has not necessarily converged definitively. Furthermore, time discounting of the distant future could be related to life expectancy, which is an issue left for further study.

¹³ The weak support of FP2 in the civil service could come from their understanding of political difficulties of fiscal consolidation.

In Fig. 1, optimistic economic views also work as a force for a downward shift of “line C” (or “line D”). It should be noted that, as Table 10 suggests, these optimistic economic views not only work in the minds of individual participants but also have strong persuasiveness to others. While logic for intergenerational fairness wins only passive assent from opponents, optimistic economic views evoke strong support in groups.

It is necessary to add a note on the results of the optimism test. According to Table 3, it seems that optimistic participants tend to select FP1, although the statistical significance of the tendency is not clear. The optimism test is intended to assess degrees of optimism with regard to personal circumstances. However the economic views may rather be cultivated through social experiences. As has been discussed in the interpretation of the sociability test, the finding that the correlation between psychological personality and policy selection seems limited is convenient to discover keys for solving problems of long-term fiscal policy.

Excuse of “agnosticism” on values

“Optimism bias” is optimism which does not necessarily have a sound basis toward an uncertain future. “agnosticism” on values is similar to optimism bias in the sense that it is an attitude towards uncertainty, however it is a way of thinking that it is unproductive to consider the far future because it is not possible to know what future people want.

According to Table 4, around 20% of the participants who chose FP1 answered “We don’t know what future generations will value, or what they will want”. Table 5 shows that about 30% of those selecting FP1 chose “Considering future generations is not productive, because it is not knowable what future generations will value and what they will really want” as the reason for choosing FP1.

These choices are given in the questionnaires, on the suggestion by Glover [8]. Glover argues that we cannot determine the adoption of such technologies as genetic engineering and even brain control (control of the states of brains by psychotropic drugs or information technology) due to our discomfort with the application of these technologies to human beings, because these technologies could create people completely different from us in values.

To be honest, the author expected that few people would make these choices. It seems surprising that many participants chose them. Kato ([11]: pp. 329), at the commentary in the Japanese edition of Glover [8], points out “Because so-called environmental problems are problems of “choices left to future generations would be narrower than those for the present generation”, the relativity of values like “present and future generations have different values” does not hold”¹⁴. Long-term fiscal problems are also problems of options for future generations becoming narrower,

¹⁴ Contrary to Kato [11] and Suzumura and Tadenuma [27] take the relativity of values in environmental problems more seriously. Referring to the non-identity problem, they argue “the preferences of future generations depend crucially upon the policies to be implemented” (Suzumura and Tadenuma [27]: pp. 326).

i.e. issues of resources, not only issues of values. “Agnosticism” on values functions as a false reason, an excuse, for selecting FP1 not FP2. In Eq. (1), as participants have less information about the values of future generations, U_2 would have a smaller role in the function. Moreover, as Table 10 suggests, this excuse is strongly contagious to others. In Fig. 1, “agnosticism” on values also shifts “line C” (or “line D”) downward. Figure 2 shows the downward shift of support of FP2.

Sympathy, deliberation and IFG

Next, exchange of opinions in the collective decision-making is discussed. As Table 6 shows, the proportion selecting FP2 as a group increases after the exchange of opinions. The major cause of the increase is the high percentage of selecting FP2 in groups containing IFG. In deciding fiscal policy as a group, majority voting was allowed, so group-decisions could shift to FP2 without changes of opinions in individual participants. However, Table 7 shows that the exchange of opinions really changed individual opinions. The results suggest the possibility of opinion changes through discussion. In this regard, the hypothesis of deliberative democracy seems supported.

As discussed above, Sen [21] describes two cases departing from personal interests; (1) sympathy and (2) commitment. By listening to opinions, people become sympathetic to the positions of others; reflect on their own claims; and have the opportunity to commit to broader public judgment. The participation of IFG could activate sympathy towards future generations, through visualizing future people who do not have concrete existence. Furthermore, it could promote commitment to better resource allocation between present and future generations through deliberation with imagined future generations.

However, Tables 8, 9 and 10, which reports the details of the process of decision-making, show the necessity of considerable modifications of this understanding. According to Table 8, in groups of present generation only, the choices of FP2 as groups do not increase, and it is suggested that simple deliberation would not promote public judgment to be dominant. The major reason for the increase of selecting FP2 as groups seems to be the direct effect of increasing supporters of FP2 by imposing the role of IFG among the participants. As Table 9 suggests, adaptive opinion changes are dominant with regard to the impact on individual opinions of the discussions, and it is difficult to put greater weight on opinion changes by reasonable deliberation. Table 10 shows that FP2 does not have convincing logic, which rather belongs to FP1, which takes account of uncertainties like optimism and “agnosticism” on values.

Different from Kamijo et al. [10], this paper discusses the research of fiscal policies containing complex options. To understand policies and to advocate their adoption, sufficient abilities are required. Randomly allocated role of IFG would not be able to complete the role of representing voices of the future and it could be easily overwhelmed by optimistic economic views and “agnosticism” on values.

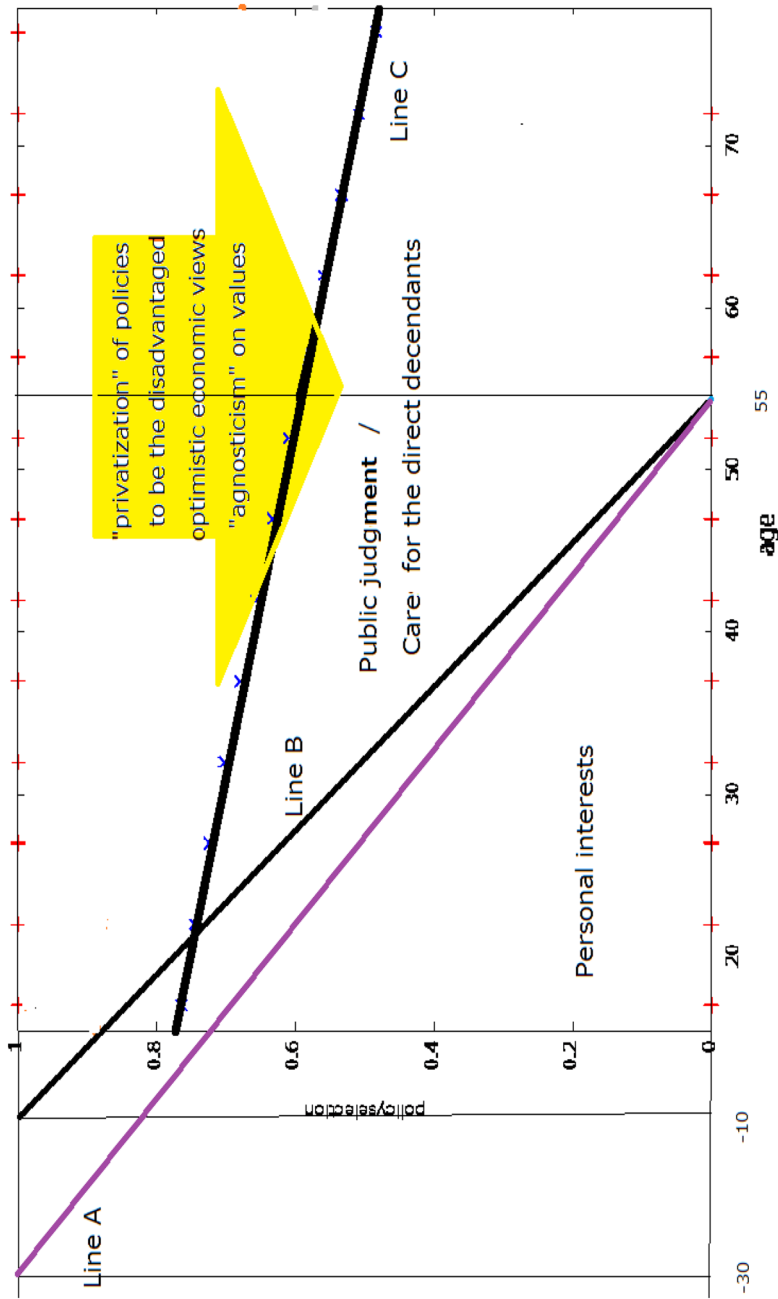


Fig. 2 Downward shift of support of FP2

Seven keys to solving long-term fiscal problems

Based on the findings discussed above, we provisionally present the following seven points as keys for solving problems in long-term fiscal policy.

Basing the discussion on the trade-off between benefits and burdens is crucial

First, the setting of the discussion is crucial. In this research, both benefits and burdens 30 years and more in the future are presented as a package.

A system that leads to a greater role of public judgment is necessary; however introducing simple deliberation would not be enough to ensure sustainable selection

Second, it is necessary to develop measures founded on the understanding that personal interests and public judgment compete in individuals' decision making. It would be useful to design social systems in which those involved in policy decisions are led to judge not on personal interests but on public interests.

The problem is old and new *aporia* since the idea of the *general will* (*volonté générale*) of Rousseau, which is distinct from *special will*, and from its aggregation *total will*. “When a law is proposed to the assembled people, what they are being asked is not (1) Do you approve or reject this proposal? But rather (2) Is this proposal in conformity with the general will?—the general will being their will. Each man's vote gives his opinion on that point, .i.e. his answer to question (2)” (Rousseau [18]; trans. Bennett 2017: pp. 56). However, we can not necessarily say that the *general will* is found by counting votes¹⁵.

In the hypothesis of deliberative democracy, a representative democracy has a chance to reach public judgment. Allowing IFG to join the discussion would be a part of measures to promote a better outcome. Even if deliberation with future generations is imaginary, we may be able to move our generation closer to public judgments. Deliberation will heighten sympathy for future generations and give us opportunities to ask ourselves if the policies we, the present generation, are going to select are truly reasonable. The finding that the elderly are closer to public judgment as they are coming nearer to the point of view of *nirvana* deserves attention. We could come up with systems to encourage the elderly to make their selections on public judgment, with which they are naturally familiar, and it is too early to give up to the pessimistic view about “silver democracy”.

On the other hand, as the research suggests, there is no guarantee that simple deliberation leads to public judgment. It is necessary to protect and guide the deliberation by good institutions. In complex problems, such as fiscal policies, IFG need to be assisted by sufficient knowledge and ability.

¹⁵ Following the quotation, Rousseau [18]; trans. Bennett 2017: pp. 56), Rousseau wrote as follows: “and the general will be found by counting votes”. Rousseau considered votes not as a process in which personal preferences are gathered, but as a process in which truth is found.

If reasonable changes of opinions through deliberation are rare, the alternative is a Madisonian style balance of power among factions. Pushing further the idea of Demeny voting, in which parents vote on behalf of their children, it could be an option to give votes to the representatives of future generations, which would directly change the balance of power between present and future generations. Madison [14]: pp. 268), one of the Founding Fathers of the United States, is known to have written “Ambition must be made to counteract ambition”. In contrast to advocates of consensus-making through deliberation, some point out that deliberation faces the risk of worsening confrontation among parties, and look to Madisonian power struggles and their management¹⁶.

Persuading to support sustainable policies based on personal interests is effective

The third key is that, while promoting public judgment, it is also useful to skillfully convince people based on their personal interests. In the research, policies of the present and 30 years in the future are packaged together. When considering the timescale of a few tens of years, there is a chance to prevent the postponement of burdens by encouraging people to pay attention to their long-term personal interests, especially for the younger generation.

Understanding the “privatization” of policies as a dilemma in democracy is critically important, and it is necessary to come up with measures to mitigate its influence

The fourth key is the possibility that giving information of individual burdens would lead to “privatization” of policies and discouragement of public judgment. Under democracy, disclosure of policy information to voters is a founding principle. However, upon determination of problems related to the interests of future generations as well as the present generation, it is not necessarily balanced to allow the “privatization” of policies by the present generation without involvement of future generations. At least, it is necessary to grasp the “privatization” as a dilemma.

As a measure for tackling this dilemma, limiting opportunities of policy decision is suggested here. By incorporating long-term policy actions in legislation, the execution of policies is automated. Sufficient information is provided during the discussion of bills. On the other hand, if laws go into effect, policies will be implemented automatically along with the incorporated program. Looking for similar measures in Japan, incorporating the 2004 “macro-economic slide” in the public pension system is an example. In the macro-economic slide, the insurance rate is automatically raised, while the pension benefit is also automatically adjusted in accordance with population dynamics.

¹⁶ See Shapiro [22].

It should be noted that the younger generation does not necessarily represent the voices of future generations

The fifth key is that even the young may not sufficiently represent the views of future generations. To mitigate this problem, ideas such as lowering the voting age and Demeny voting have been proposed; however, they have inevitable limitations in representing the interests of unborn generations.

Considering problems which the disadvantaged face is important

Concerning the sixth key, in this paper the relationship between the disadvantaged and fiscal policy selections is hypothetically presented. It is understandable that impending needs in lives push aside decisions based on longer-term considerations. It might be possible to increase support for long-term policies by strengthening the ability to pay principle, which would improve the conditions of the disadvantaged.

Sharing appropriate economic views is necessary to justify calling for sustainable choices. It is necessary to understand that fiscal policies are not problems of values but resources

The seventh and final key is the importance of sharing appropriate economic views among interested parties. Even if the setting of the discussion includes a trade-off between the benefits and burdens, those who have unique views or theories of economy, such as the ways in which the economy works, and prospects of economic growth, population, and technological innovations, may try to challenge the setting itself. To solve this problem, it may be necessary to design multilayered frameworks such as setting up opportunities for deliberation about the setting of the discussion itself. When IFGs decide the setting of the discussion, it is hoped that they do not attempt to make optimistic future expectations, and try to look at it safely.

Sharing appropriate economic views is also important in measures relating to “agnosticism” on values. The appropriate economic view to cope with “agnosticism” is re-confirmation of the basic facts. In other words, in the future line-of-sight, future generations as well as the present generation need clean air, water, food, a safe house and companionship with others, and the more resources are available to ensure these the better. There are surely those who disagree with “the more resources the better”, however no one has the right to unilaterally impose the idea of “honorable poverty” on future generations.

Conclusion

Several findings were reported in this paper. Public judgment works together with personal interests in the selection of policy. As participants age, their support for sustainable policy is weakened; however the older generation make their choices

more on public judgement than on personal interests. The simple pessimistic hypothesis of “silver democracy” seems exaggerated. Furthermore, providing information on the personal burden of policies to participants reduces support for sustainable policies through “privatization” of policies. Moreover, attitudes towards uncertainty; prospects of future economy and values of future generations, affect participants’ choices. The effect of introducing an IFG toward sustainable choice is confirmed, however it is also suggested that the evidence of promoting sustainable decision by deliberation is not necessarily certain. A randomly allocated role of IFG would not be able to fully represent voices of future generations. Finally, based on these findings, some keys to solving problems in long-term fiscal policy are presented.

Finally, some issues for further study are identified. First of all, in the future, it would be useful to organize formal experiments with fees, and compare their results with those of this study. Second, one of the important findings of this paper is the influence of attitudes toward uncertainty upon policy selection. “Sharing appropriate economic views is necessary to justify calling for sustainable choices. It is necessary to understand that fiscal policies are not problems of values but resources” discussed how to treat the problem; however, the attitudes are rooted in human nature and they may have become stronger through our experience of radical changes of life since the beginning of modernization. More comprehensive consideration, therefore, may be necessary to mitigate the problem. Third, one of the focuses of this paper is the nature of collective decision making. In reality, policies are discussed among a number of people. The processes and ways of resolution could change conclusions. It would be necessary to study the details of the nature of collective decision making. The last point is also an issue of collective decision making. This paper maintains an expectation that deliberation leads to public judgment; however it leaves room for the adjustment of interests between generations through balance of power. Further study is required to know which of the two should play a greater role.

References

1. Adji, A., Alm, J., & Ferraro, P. (2009). Experimental tests of Ricardian equivalence with distortionary versus nondistortionary taxes. *Economic Bulletin*, 29(4), 2556–2572.
2. Barro, R. J. (1974). Are government bonds net wealth? *Journal of Political Economy*, 82(6), 1095–1117.
3. Cadsby, B. C., & Frank, M. (1991). Experimental tests of Ricardian equivalence. *Economic Inquiry*, 29(4), 645–664.
4. Chao, L.-W., Szrek, H., & Sousa, N. (2009). Time preference and its relationship with age, health and survival probability. *Judgment and Decision Making*, 4(1), 1–19.
5. Downs, A. (1957). *An economic theory of democracy*. New York: Harper.
6. European Commission. (2006). *The long-term sustainability of public finance in the European Union*. Brussels: Office of Official Publications of the European Commission.
7. Fiscal System Council, Ministry of Finance, Japan, (2015). Long-term fiscal sustainability analysis in Japan (Updated Edition). https://www.mof.go.jp/about_mof/councils/fiscal_system_council/sub-of_fiscal_system/proceedings/material/zaiseia271009/01.pdf. Final Accessed 14 Aug 2018.
8. Glover, J. (1984). *What sort of people should there be? Genetic engineering, brain control and their impact on our future world*. London: Penguin Books.
9. Hoyos, D., & Mariei, P. (2010). Contingent valuation: Past, present and future. *Prague Economic Papers*, 19(4), 329–343.

10. Kamijo, Y., Komiya, A., Mifune, N., & Saijo, T. (2017). Negotiating with the future: Incorporating imaginary future generations into negotiations. *Sustainability Science*, 12(3), 409–420.
11. Kato, N. (1996). “Remarks. (In Japanese),” In the Japanese edition of *Glover (1984)* (pp. 313–332). Tokyo: Sangyotosyo.
12. Kotlikoff, L. J., Samuelson, W., & Johnson, S. (1988). Consumption, Computation Mistakes and Fiscal Policy. *American Economic Review*, 78(2), 408–412.
13. Madison, J. (1788). No.10. The same subject continued, In Hamilton, A., Jay, J., and Madison, J. (1788). In G. W. Carey & J. McClellan (Eds.), *The Federalist* (pp. 42–48). Indianapolis: Liberty Fund.
14. Madison, J. (1788). No.51. The same subject continued, with the same view, and concluded, In Hamilton, A., Jay, J., and Madison, J. (1788). In G. W. Carey & J. McClellan (Eds.), *The Federalist* (pp. 267–272). Indianapolis: Liberty Fund.
15. Nakagawa, Y., Kotani, K., Kamiya, Y., Saijo, T. (2017). *Solving the intergenerational sustainability dilemma through imaginary future generations: A qualitative-deliberative approach*. SDES-2016-14. Kochitec.
16. Ohtake, F., & Tsutsui, Y. (2012). An analysis of risk a version from an economic experiment. *Behavior Economics*, 5, 26–44. (in Japanese).
17. Ricciuti, R., & Di Laurea, D. (2003). An experimental analysis of two departures from Ricardian equivalence. *Economic Bulletin*, 8(11), 1–11.
18. Rousseau, J. (1762). *The social contract*. (trans. Bennett, Jonathan. 2017). <https://www.earlymoderntax.com/assets/pdfs/rousseau1762book1.pdf>. Accessed 29 Nov 2018.
19. Saijo, T. (2018). *Future design: Incorporating preferences of future generations for sustainability*. New York: Springer. (forthcoming).
20. Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism. *Journal of Personality and Social Psychology*, 67, 1063–1078.
21. Sen, A. (1977). Rational fools: A critique of the behavioral foundation of economic theory. *Philosophy & Public Affairs*, 6(4), 317–344.
22. Shapiro, Ian. (2003). *The state of democratic theory*. Princeton: Princeton University Press.
23. Shimasawa, M., Oguro, K., Toyoda, N. (2014). Does Japan have a Gray Democracy? An Empirical Analysis of Prefectural Data. Technical Report. Hitotsubashi University Repository.
24. Slate, S., McKee, M., Beck, W., & Alm, J. (1995). Testing Ricardian under uncertainty. *Public Choice*, 85(1), 11–29.
25. Smith, V. L. (1976). Experimental economics: Induced value theory. *American Economic Review*, 66(2), 274–279.
26. Shichijo, T., & Hiromitsu, T. (2018). Compassion for future generation is not only for others. In T. Saijo (Ed.), *Future design: Incorporating preferences of future generations for sustainability*. New York: Springer. (forthcoming).
27. Suzumura, K., & Tadenuma, K. (2007). Normative approaches to the issues of global warming: Responsibility and compensation. In J. Romer & K. Suzumura (Eds.), *Intergenerational equity and sustainability* (pp. 320–336). New York: Palgrave MacMillan.
28. Van Lange, P. A. M., De Bruin, E., Otten, W., & Joireman, J. A. (1997). Development of pro-social, individualistic, and competitive orientations: Theory and preliminary evidence. *Journal of Personality and Social Psychology*, 73(4), 733–746.

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