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Median voting and intergenerational sustainability under intragenerational inequality

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Abstract

Intergenerational sustainability (IS) and inequality problems have been significant over time, encompassing climate change, income disparity and fiscal sustainability. While there have been several studies that deal with IS problems, such as people's selfishness under inequality, little is known about the mechanisms and/or institutions that contribute to their solution. This paper investigates how a median-voting institution impacts people's behaviors towards IS under intragenerational inequality, hypothesizing that median voting by Hauser et al. (2014) induces people to behave sustainably toward future generations. An online Intergenerational Common Goods Game (IGG) experiment is conducted with 210 subjects under two treatments with and without the median voting under the inequality that is approximated by heterogeneous initial endowments to subjects in a generation. In IGG, five subjects in one generation are asked to decide how much to harvest for themselves from an intergenerational common good. If the generation's extraction does not exceed (exceeds) a certain threshold, the good is replenished (depleted) and is (not) transferred to the next generation. Under median voting, the extraction by each member in a generation is determined by the median value of members' intended harvests. We find that median voting mitigates people's intended harvests, contributing to IS even under intragenerational inequality. This suggests that introducing median-voting mechanism may prove sustainable in intergenerational decisions, even though the actual application in an unequal modern-day capitalist society remains on the agenda.

Key Words: Intragenerational inequality; Intergenerational sustainability; Intergenerational goods game; Common-pool resources

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Nomenclature

HI High Inequality Treatment

IGG Intergenerational Goods Game

IS Intergenerational Sustainability

JPY Japanese Yen

MVHI Median Voting High Inequality treatment

SVO Social Value Orientation

1 Introduction

The main engine of a capitalist society is, by definition, technological innovation. On one hand, it has benefited humanity by ameliorating absolute poverty (Aguilar et al., 2024) and increasing average life expectancy (Richter, 2023). On the other hand, international race for economic superiority has caused serious collateral damage. Among the most visible negative consequences is global warming and its devastating ramifications that impact every new generation more severely than the previous one, failing to ensure intergenerational sustainability (IS). Notably, U.S. – the largest economy and per capita emitter of CO_2 in the world – has recently withdrawn from the Paris Agreement, followed by its first ever increase in carbon emissions over the past 15 years (Storrow, 2025). Overall, despite comprising just 16% of the global population, high-income countries produce 31% of world's greenhouse gas emissions (Li et al., 2023). This warrants legitimate concerns about the issues of global inequality and free-riding, whereby rich countries consistently exploit resources at others' expense.

Similar processes can be observed on a micro-level. When wealth management is decided individually, it is predominantly a small group of rich people who use resources far beyond sustainable limits, depriving future generations of their equitable stakes (Padilla, 2002). The root of the problem is intragenerational inequality that poses a serious challenge to IS. First, inequality tends to be reproduced and exacerbated: Piketty (2017) and Christophers (2018) show that a situation of uneven wealth distribution between members of a current generation tends to be reflected among their offspring. Second, relative wealth matters: Ferrer-i-Carbonell (2005) establish that well-being suffers for those individuals who realize that their income lags behind the income of their close social circle, discouraging them from contributing to the common good. To tackle this problem, Hauser et al. (2014) suggest setting the rules of exploitation through binding voting, whereby, as the evidence shows, resources are consistently preserved. This study aims to examine the relationship between IS and the introduction of a binding voting system (median voting) under the conditions of intragenerational inequality.

As most of IS problems stem from the individual selfishness, one of the common ways of measuring the latter is by estimating subjects' Social Value Orientation (SVO). SVO gauges the extent to which individuals consider the benefits accruing to others in their decision-making. In the early study establishing SVO measurement methods and their behavioral impacts Van Lange et al. (1997) identify three primary SVO orientations: self-oriented, cooperative and competitive. According to this classification, individuals with strong cooperative orientation consider the benefits of others, including future generations, from a long-term perspective. In Shahrier et al. (2017) study on the relationship between SVO and sustainability, urban subjects are shown to have a strong tendency toward competitive behavior, while rural dwellers clearly exhibit cooperative orientation, leading to sustainable decisions.

Whereas SVO measures the degree of individual prosociality in a static way, the Intergenerational Goods Game (IGG) dynamically tests subjects' cooperative behavior in a group setting. Players in each generation are responsible for deciding whether to benefit from shared resources for themselves or to transfer them to next generations. This game reveals decision-making processes and behavioral patterns related to IS. While in the absence of a regulation a small group of selfish individuals tends to exhaust available resources, implementing a binding voting mechanism can avert this adverse outcome (Hauser et al., 2014). Lohse and Waichman (2020) find that against subjects being normally hesitant to voluntarily contribute to the public good, introducing punishment as a potential disciplinary measure partially succeeds in maintaining pro-social cooperation when multiple generations are involved. Balmford et al. (2024) show that democratic institutions can promote cooperation even in the face of ambiguous thresholds, as indicated by the IGG results. These studies highlight the significance of representative systems and regulatory frameworks in fostering informed decision-making.

One of such frameworks that can potentially be incorporated into existing democratic institutions is "median voting." The "median voter model (theorem/rule)" is widely known in political science since its inception by Black (1948). According to it, under a majoritarian voting system, a candidate catering to the interests of a median voter is the one who wins elections (Congleton, 2004). In a strict sense, this theorem only holds for homogeneous population (i.e. the one with normally distributed range of preferences), which is rarely the case in a real world (Gerber and Lewis, 2004). Moreover, candidates inevitably run with complex agendas that encompass multiple issues, thus making the identification of a "median" a multidimensional task. In this regard, Nehring and Pivato (2022) operationalize the median rule as the one that "minimizes the average distance to the views of the voters (where the 'distance' between two views is measured by the number of issues on which they differ).” As the “winner-takes-all” system often neglects minorities’ interests, leading to civil conflicts, supporting a candidate associating herself with median values of a given society would enhance intragenerational well-being (Renault and Trannoy, 2005). At the same time, since elections are normally held several times within a lifespan of a single generation (with an exception of referendums on pivotal issues pertaining to national security etc.), benefits of catering to a “median voter” are unlikely to enhance intergenerational sustainability. Simply put, since social values and preferences inevitably change over time, a current-day “median value” may no longer stand for a next generation. Overall, the “median voter rule” is an inductive concept, rather than an actual legally-binding mechanism from real-world electoral systems. In this respect, IGG allows us to test the appropriateness of a hypothetical “median voting” institution in the context of intergenerational sustainability (Hauser et al., 2014), potentially providing an equitable addition to an existing majoritarian system.

According to the World Bank, modern-day capitalist economies are characterized by uneven levels of income distribution, with 49 countries falling under “highly-” or “extremely unequal” categories, having Gini coefficient above 40 (Fleck, 2024). We therefore find it important to account for intragenerational inequality when conducting IGG. Hauser et al. (2019) explore the influence of inequality on cooperation by implementing a public goods game in an online setting. Their study introduces a model with different initial endowments, productivities and benefits accruing from the public good. The authors find that extreme inequality significantly undermines cooperation, whereas moderate inequality, when appropriately aligned with productivity, may facilitate the maintenance of cooperative behavior. Markussen et al. (2021) conducted a field experiment in rural Vietnam to investigate the relationship between economic inequality, voluntary contributions and institutional quality. Their results demonstrate that perceptions of corruption further exacerbate the adverse effects of inequality on contributions. Melamed et al. (2022) carried out an online experiment to assess the impact of wealth inequality on cooperation and the formation of social networks. Their findings reveal that individuals are more likely to cooperate with wealthier counterparts for deriving personal benefits. Such dynamic leads to a concentration of wealth and social connections within a small subset of individuals, further increasing inequality within the network over time. These studies highlight that intragenerational inequality exerts a detrimental effect on cooperative behavior within and across generations.

Previous literature demonstrates that, in the absence of regulation, a minority of selfish players consistently deplete available resources. Moreover, intragenerational inequality negatively affects IS in the IGG. At the same time, some evidence confirms that introducing median voting can prevent such negative outcomes. In this study, we investigate how a median-voting institution affects people's behavior toward future generations under intragenerational inequality. We hypothesize that median voting by Hauser et al. (2014) induces people to behave sustainably toward future generations. To test this hypothesis, we conduct an online IGG experiment with 210 subjects. In the IGG, each generation's members decide how much to harvest for themselves from the intergenerational common good, based on the endowment (initial allocation) they are provided. Under median voting, the extraction by each member in a generation is determined by the median value of members' intended harvests. For example, if the subjects intend to harvest 6, 10, 17, 8 and 20 points respectively, the median point is 10. If the total harvest of the intergenerational common good is depleted, the resources cannot be transferred to the next generation.

2 Experimental procedures

The experiments were carried out online through the oTree platform (Chen et al., 2016) across nine sessions involving 210 subjects, with monitoring and supervision conducted via Zoom. Each subject attended only one session. Subjects were recruited from the student pools of Kochi University of Technology, University of Kochi, Kochi University and Musashi University. Each session involved 20 to 30 subjects and was divided into three parts. The first part is the Social Value Orientation (SVO) game, the second part is the Intergenerational Goods Game (IGG) and the third part is a questionnaire survey on sustainable behavior.

An SVO game classifies each subject's social preference into one of the following types: altruistic, prosocial, individualistic or competitive (Van Lange et al., 1997, 2007, Brosig et al., 2011, Carlsson et al., 2014, Sutters et al., 2018). This study employs the "slider method" to evaluate how subjects prioritize their own benefits relative to others (Borghans et al., 2008, Murphy et al., 2011). Figure 1 illustrates the design of the SVO game. Each of the six items presents nine choices for distributing points between themselves and an anonymous partner. Subjects select one option for each item by marking a point on a line that represents their most preferred distribution.

Subsequently, the mean allocations for the subjects themselves (A_s) and their partners (A_p) are calculated across all six items. Then, 50 is subtracted from both A_s and A_p to shift the reference point of the resulting angle to the center of the circle (50, 50). The SVO index for each subject is determined using the following formula: SVO $=$ arctan [(A_p $-$ 50) / (A_s $-$ 50)]. Based on the SVO index, social preferences are classified as follows: Altruistic (SVO $> 57.15°$), Prosocial ($22.45°$ $<$ SVO $< 57.15°$), Individualistic ($- 12.04°$ $<$ SVO $< 22.45°$), Competitive (SVO $< - 12.04°$). In this study, "altruistic" and "prosocial" types are categorized as "prosocial" subjects, while "individualistic" and "competitive" types are classified as "proself" subjects (Murphy et al., 2011).

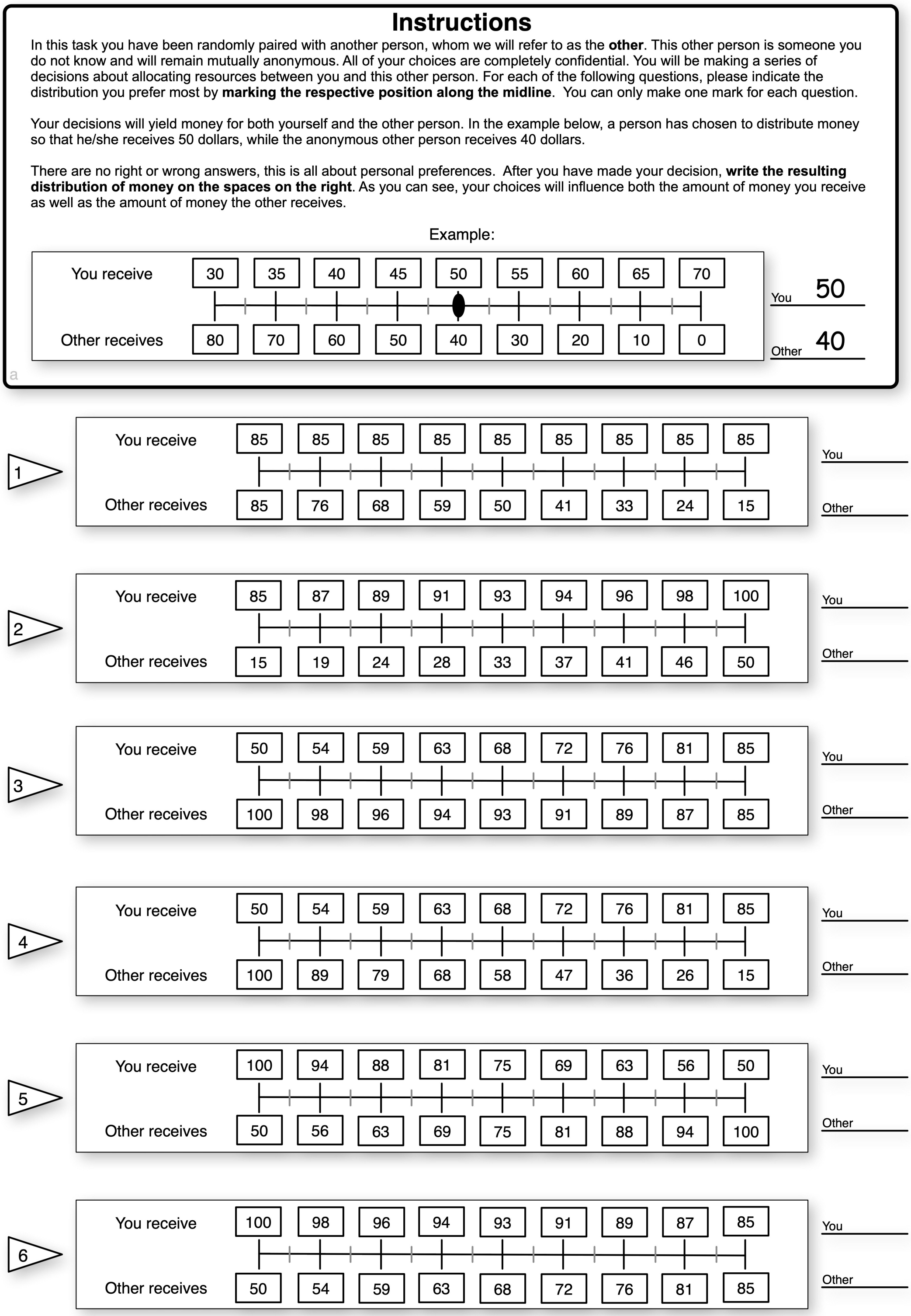


Figure 1: Instructions to measure social value orientation by the slider method

In the IGG, we adopt the core design and methodology outlined by Hauser et al. (2014) to simulate IS problems. The game integrates essential features of a public goods game, including group resources and threshold limits. Figure 2 explains the experimental design of the IGG under inequality. The initial group account starts with 100 points for the first generation in each sequence. In each session, multiple sequences are formed, each consisting of five group members who are selected randomly. Each subject's endowment is allocated as endowment points, with two members receiving 0 points, one member receiving 10 points and two remaining members receiving 20 points. They independently decide how many points to harvest from the group account, within a range of 0 to 20 points. If the total harvest of the five members within a generation (group harvest) is 50 points or less, and a white chip is drawn with 80 % probability, the shared resource is replenished to 100 points for the next genelation (Case 1, see figure 2). On the other hand, if the group harvest exceeds 50 points, even if a white chip is drawn, the shared resources are depleted, leaving no points for the next generation (Case 2, see figure 2). Furthermore, if a red chip is drawn with a 20 % probability, regardless of the group harvest, the IGG sequence terminates, and the process does not proceed to the next generation (Case 3, see figure 2).

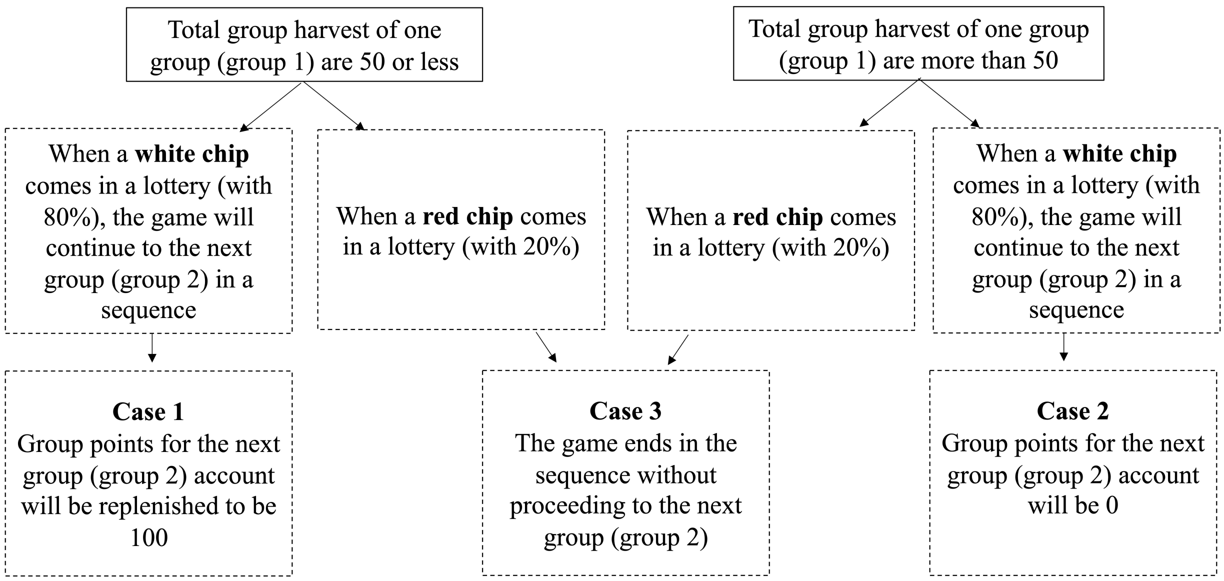
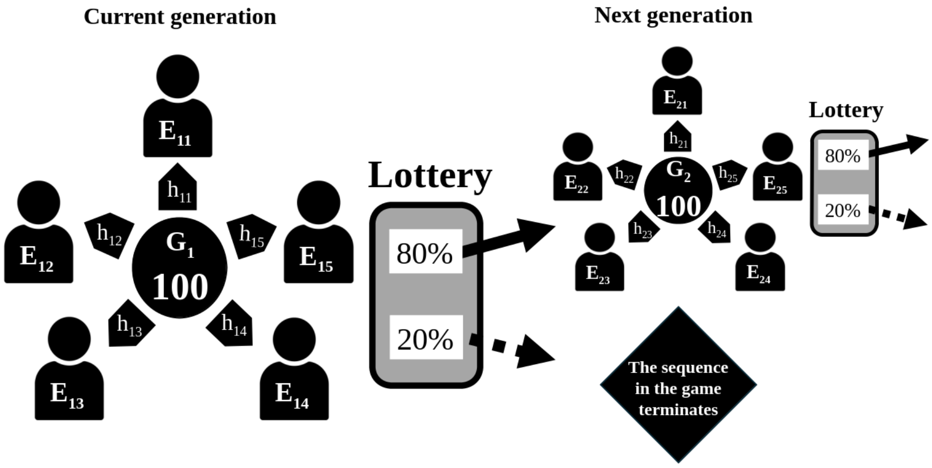
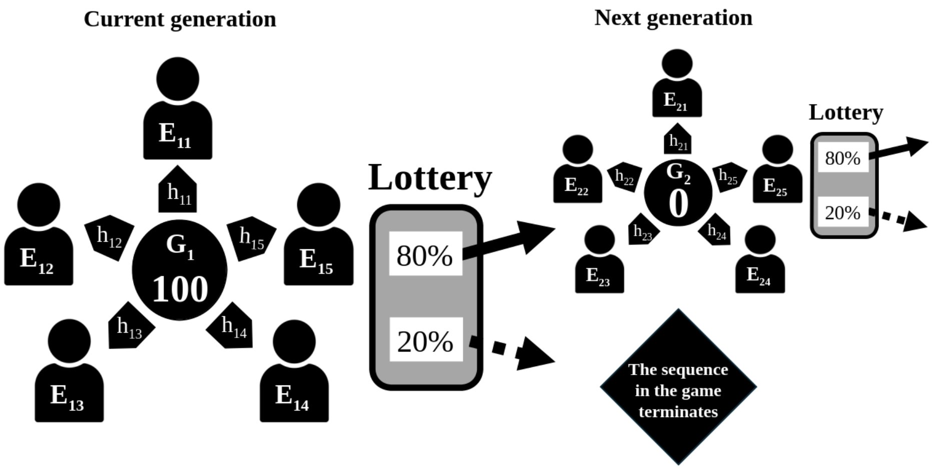


Figure 2: Instructions for the intergenerational goods game (IGG) per sequence in a session



(a) Group harvest, $H_i \leq 50$ where $H_i = \sum_{j=1}^{5} h_{ij}$



(b) Group harvest, $H_i > 50$ where $H_i = \sum_{j=1}^{5} h_{ij}$

Figure 3: The intergenerational goods game (IGG) design

Figure 3 illustrates the design of the online IGG experiment. Here, the initial endowments and harvests of each individual are denoted by E_{ij} and H_{ij}, respectively, where $i = 1, \ldots, n$ represents the generation, and $j = 1, \ldots, 5$ show the unique identification number of subjects within a sequence. The intergenerational common good and the group harvest are represented by G_i and $H_i = \sum_{j=1}^{5} h_{ij}$, respectively. As shown in figure 3a, if the median of the group harvest for a generation is 50 points or less (for example, if each member harvests 7, 18, 6, 20 and 10 points, and the median is 10 points, making $H_{ij} \leq 50$), and a white chip is drawn, then Case 1 is realized. Consequently, the common good is replenished, and the next generation within the sequence proceeds with 100 points of the common good, as with the previous generation. On the other hand, if the median of the group's harvest exceeds 50 points (for example, if each member harvests 15, 12, 19, 6 and 20 points, and the median is 15 points, making $H_{ij} > 50$), and a white chip is drawn, then Case 2 is realized. In this case, the common good is depleted, and the next generation within the sequence cannot use the common good. If neither Case 1 or Case 2 is realized (a red chip is drawn), then Case 3 takes place, and the IGG sequence terminates without advancing to the next generation.

In this game, the dominant strategy (or Nash equilibrium strategy) for each subject is to harvest 20 points (Indh20), as this maximaizes their individual payoff regardless of the harvests of other group members. On the other hand, a Pareto-optimal allocation is achieved when each subject in a generation harvests an amount that allows the common good to be replenished and maximizes the total payoffs for both the current and the next generations. Therefore, for a fair and sustainable allocation in both intragenerational and intergenerational contexts, it is desirable for each subject in a generation to harvest 10 points (Indh10). This value is regarded as the benchmark for individual harvests (see tables 1 and 2 for the definitions of Indh10 and Indh20).

While the first treatment (baseline) corresponds to the IGG under inequality, the second treatment incorporates a median voting institution on top of inequality. For each of these treatments, initial heterogeneous endowments approximating inequality are randomly allocated to members within a generation in a following way. Two members in a generation receive 0 points (E0), one member gets 10 points (E10), and the remaining two members receive 20 points (E20). The total endowment for each generation is therefore fixed at 50 points. Under these conditions, the average and median endowments are both 10 points, and the Gini coefficient, which indicates the level of inequality, is 0.48.[1]

Upon joining the online meeting, subjects are given an overview of the session procedures and are asked to provide their consent to participate. Following this, they access the experiment through a unique URL, beginning with the SVO game and proceeding to the IGG. Before starting the IGG, subjects must complete a series of quizzes to ensure their understanding of experimental procedures. The session concludes with subjects providing sociodemographic details and responding to questions about their sustainable behaviors. Each session lasts approximately 45 minutes, with 10 minutes allocated for the SVO game, 25 minutes for the IGG, and 10 minutes for the questionnaire. Throughout it, subjects are supervised via original links to ensure their active, real-time

[1] This level of inequality is comparable to that in Honduras or Panama (World Bank, 2024).

engagements. In the SVO game, the average earnings are 200 JPY (Japanese Yen), calculated at an exchange rate of 0.20 JPY per point. In the IGG, each point is worth 100 JPY, resulting in an average payout of approximately 2500 JPY. On average, subjects earn a total of around 3000 JPY, which is distributed in the form of Amazon gift vouchers.

To maintain consistency and eliminate bias, the procedural flow chart depicted in figure 4 is strictly adhered during all sessions. According to it, the key difference between the HI and the MVHI treatments is as follows. On one hand, decisions on individual harvests in the HI treatment directly translate in harvesting actions, whereby a group harvest is a simple sum of individual harvests. On the other hand, for the MVHI treatment, individual harvesting decisions are additionally followed by the determination of the *median value*, whereby intended individual harvests for all five players are ranked from the smallest to the largest, and the third one is unequivocally determined as an actual harvested value for each participant. As a result, a group harvest for the MVHI treatment is calculated as the median value multiplied by five.

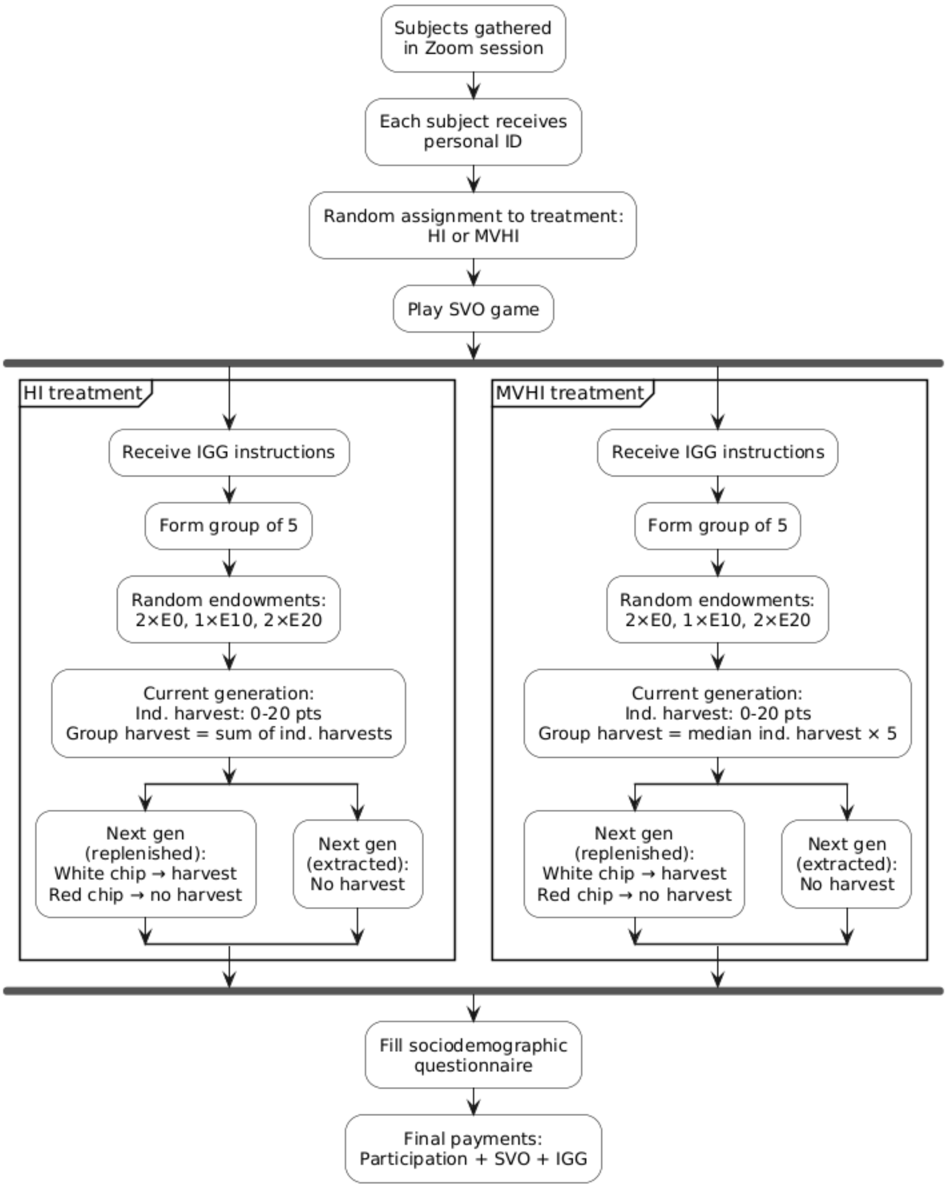


Figure 4: A flow chart of experimental procedures for subjects to participate in one session

3 Results

Tables 1 and 2 present the definitions of variables and summarize the statistics based on 210 subjects distributed across two treatments: the baseline "high-inequality" (HI) treatment with 110 subjects and the "median voting high inequality" (MVHI) treatment with 100 subjects. Regarding subjects' characteristics, 58 % of individuals in the HI treatment are male, and 31 % are classified as exhibiting prosocial behavior. As for the MVHI treatment, 52 % of subjects are male, and 41 % demonstrate prosocial tendencies. Next, we discuss subjects' harvesting behavior. The average individual harvests (Indhs) are 14.03 points for the HI treatment and 11.78 points for the MVHI treatment respectively. Under the baseline treatment, subjects with endowments of E0, E10 and E20 have average Indhs of 16.14, 11.95 and 12.95 points respectively. Meanwhile, in the MVHI treatment, subjects with endowments of E0, E10, and E20 have average Indhs of 12.67, 10.3 and 11.62 points respectively. This clearly shows that subjects under the MVHI intervention harvest less compared to those under the baseline HI condition. Moreover, while all subjects with low incomes tend to overharvest, this is especially evident for the HI treatment. It is also interesting to note that the most sustainable behavior across both treatments is demonstrated by middle-income subjects. Overall, it can be said that median voting helps to balance harvesting behavior and to promote sustainability under high inequality conditions. Furthermore, under the HI treatment, 40 % of subjects select Indh20, while this proportion drops to 21 % in the MVHI treatment, reflecting a 19-percentage-point decrease. Conversely, the share of subjects choosing Indh10 rises from 23 % in the HI treatment to 30 % in the MVHI treatment, indicating a 7-percentage-point increase. Overall, the groups under median voting treatment are characterized by more prosocial results than HI treatment.

Table 1: Definitions of the variables

Variables	Definitions of the variables included in regressions
Dependent variable	
Individual harvest (Indh)	A variable that represents the individual harvest from the intergenerational common good of 0 to 20 points.
Indh10	A dummy variable that takes 1 if a subject harvests 10 points from the intergenerational common good; otherwise, 0.
Indh20	A dummy variable that takes 1 if a subject harvests 20 points from the intergenerational common good; otherwise, 0.
Independent variables	
Treatments (Base group = HI)	
Median voting high inequality (MVHI)	A dummy variable that takes 1 if a subject is assigned to MVHI; otherwise, 0.
Endowments (Base group = Subjects with E0)	
E10	A dummy variable that takes 1 if a subject is endowed with 10; otherwise, 0.
E20	A dummy variable that takes 1 if a subject is endowed with 20; otherwise, 0.
Prosocial (Base group = Proself)	A dummy variable that takes 1 if a subject is identified as prosocial; otherwise, 0.
Gender (Base group = female)	A dummy variable that takes 1 if a subject is identified male; otherwise, 0.

Table 2: Summary statistics

Variables	Baseline (110)[a]			MVHI (100)		
	Mean	Median	SD	Mean	Median	SD
Indh (overall)	14.03	15	5.87	11.78	10	5.13
E0	16.14	20	4.69	12.67	10	4.57
E10	11.95	10	4.85	10.3	10	6.07
E20	12.95	11.50	6.78	11.62	10	5.09
Indh10	0.23	0	0.42	0.30	0	0.46
Indh20	0.40	0	0.49	0.21	0	0.41
Prosocial (Base group = Proself)	0.31	0	0.46	0.41	0	0.49
Gender (Base group = Female)	0.58	1	0.50	0.48	1	0.50

[a] The number of subjects per treatment in the bracket.
SD and Indh stand for Standard deviation and the individual harvest, respectively.
E10 and E20 present dummy variables that take 1 if a subject is endowed with 10 and 20, respectively, taking a base group of subjects with E0.
Indh10 (Indh20) stands for a dummy variable that takes 1 if a subject harvests 10 (20) points from the intergenerational common good; otherwise, 0.
Prosocial stands for a dummy variable that takes 1 if a subject is identified as prosocial; otherwise, 0.

Figure 5 presents the boxplots of individual harvests (Indhs) across treatments, indicating that the median Indh under HI (15 points) is 5 points higher than that under MVHI (10 points). We can therefore infer that the median voting treatment adjusts subjects' harvesting behavior and increases the concentration of the distribution, potentially promoting sustainable attitudes. Specifically, the decrease in the median and the reduction in variance point at the effectiveness of a median-voting institution. Figure 6 shows the histograms of Indhs' distribution as percentages under HI and MVHI treatments. This figure visually replicates the findings regarding Indh10 and Indh20 presented above in the context of table 2. In addition, it shows that the mode (most frequent value) of Indhs under HI is 20, whereas under MVHI, it shifts to 10, suggesting that the introduction of the median voting system helps to make subjects' harvesting behaviors equitable, inducing them to refrain from overharvesting the common good.

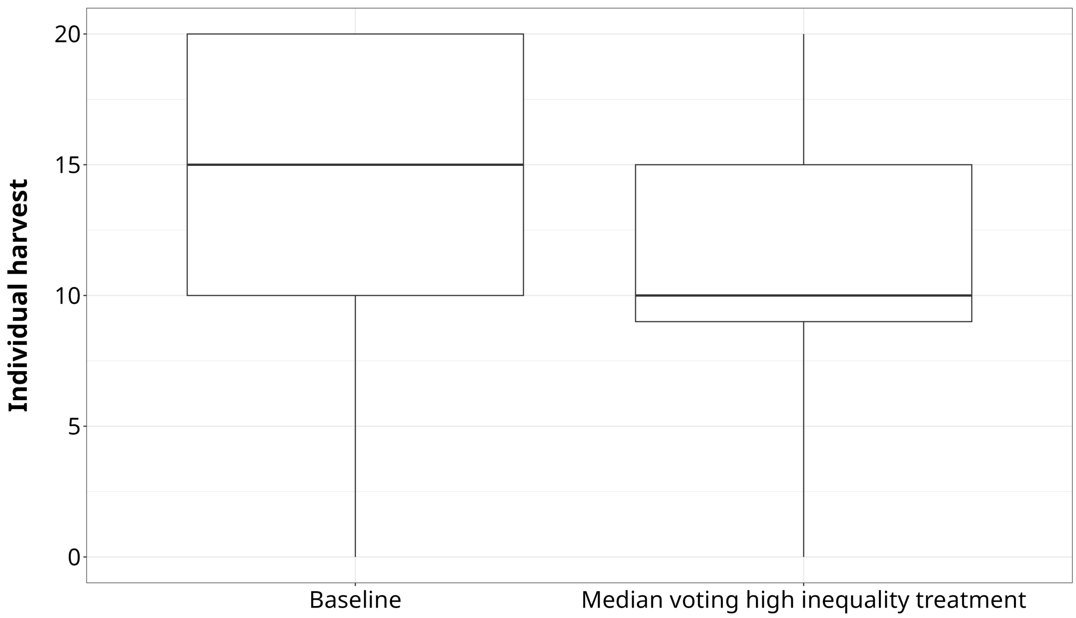


Figure 5: Boxplots of the individual harvests (Indhs) under high inequality (HI) and high inequality under median voting (MVHI) treatments

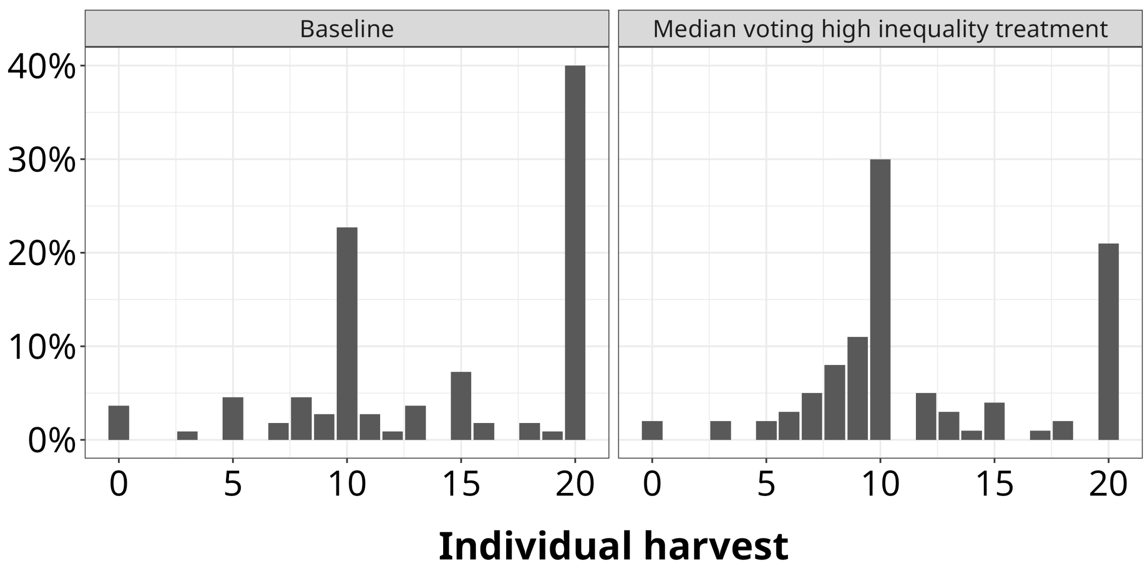


Figure 6: Histograms of individual harvests (Indhs) by percentages across two treatments

To quantitatively analyze individual harvests (Indhs), two regression models are employed: the logit regression and the Poisson regression. The logit regression model utilizes "Indh10 or less" as the dependent variable to estimate the coefficients and marginal effects associated with the likelihood of subjects harvesting 10 *points or less*. Table 3 provides a summary of the estimation results and the corresponding marginal effects derived from the logit regression models. The marginal effect (ME) quantifies the change in the probability of a subject harvesting 10 points or less, holding other predictors constant at their sample means. Model 3 indicates that subjects under the MVHI treatment are 22-percentage-point more likely to harvest 10 points or less compared to those under the HI treatment at the 1 % level of statistical significance. This finding suggests that median voting can effectively promote Intergenerational Sustainability (IS) in the situation of high income inequality. Harvesting behavior also differs substantially based on the levels of income, instrumentalized in IGG as "endowments." According to Model 3, as compared to subjects without endowment ("E0"), those with endowments of E10 (E20) are 23-(17-) percentage-point more likely to harvest 10 points or less at the 5 % level of statistical significance. In other words, compared to low-income subjects, high- and especially middle-income ones choose the harvesting strategy that reinforces IS. Finally, in line with our expectations, compared to "Proself" subjects, "Prosocial" ones are 16-percentage-point more likely to harvest 10 points or less at the 5 % level of statistical significance. All in all, the above findings paint a picture of a "Prosocial" subject with a decent endowment who is inclined to harvest resources by upholding IS. Importantly, this inclination becomes stronger when the "median voting" institution is adopted, as compared to a situation when individual harvesting is uncontrolled.

Table 3: Regression coefficients and marginal effects of the independent variables on "Indh10 or less" before MV in logit regressions

	Model 1		Model 2		Model 3	
	Coefficient	ME	Coefficient	ME	Coefficient	ME
MVHI (Base group = HI)	0.90^{***}	0.22^{***}	0.86^{***}	0.21^{***}	0.89^{***}	0.22^{***}
	(0.28)	(0.07)	(0.29)	(0.07)	(0.29)	(0.07)
Endowment (base = "E0")						
E10					0.96^{**}	$0.23^{**,a}$
					(0.41)	(0.09)
E20					0.70^{**}	$0.17^{**,a}$
					(0.33)	(0.08)
SVO (Base group = Proself)			0.65^{**}	0.16^{**}	0.63^{**}	0.16^{**}
			(0.30)	(0.07)	(0.31)	(0.08)
Gender (Base group = Female)					-0.00	-0.00
					(0.29)	(0.07)
(Intercept)	-0.37^{*}		-0.57^{***}		-1.05^{***}	
	(0.19)		(0.22)		(0.35)	
AIC	284.63	284.63	281.95	281.95	280.47	280.47
BIC	291.32	291.32	291.99	291.99	300.55	300.55
Log Likelihood	-140.31	-140.31	-137.98	-137.98	-134.23	-134.23
Deviance	280.63	280.63	275.95	275.95	268.47	268.47
Num. obs.	210	210	210	210	210	210

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$
Robust standard errors are reported in the parenthesis.
ME stands for marginal effect to indicate a change in a probability of a subject harvesting 10 points or less when one independent variable increases by one unit, holding other factors fixed.
HI, MVHI and SVO stand for high inequality treatment, median voting high inequality treatment and social value orientation, respectively.
E10 and E20 represent dummy variables that take 1 if a subject is assigned to have endowment 10 and 20, respectively.
[a] The numbers show that subjects with E10 (E20) are 23-(17-) percentage-point more likely to harvest 10 points or less than those with E0.

Table 4 presents the results of Poisson regression models, showing the estimated coefficients and marginal effects of MVHI compared to HI as the baseline treatment. The marginal effect (ME) represents the change in Indhs when an independent variable increases by one unit, holding other factors constant at their sample means. The results further support the findings presented in table 3. In particular, Model 3 demonstrates that, under MVHI, subjects tend to harvest 2.02 units less than those under HI at the 1 % level of statistical significance. It also indicates that, compared to the subjects with no endowment ("E0"), those with an endowment of E10 (E20) are likely to harvest 2.85 (2.14) points less. In other words, high- and especially middle-income subjects tend to exhibit more sustainable decision-making behaviors than those with low incomes. Lastly, in agreement with logit regression analysis, the results of Poisson regression demonstrate that prosocial subjects are estimated to harvest 2.15 units less compared to proself subjects (1 % level of statistical significance), indicating that altruistically incorporating others' viewpoints is instrumental for mitigating intergenerational problems. Overall, the findings presented in tables 3 and 4 strongly suggest that median-voting institution brings about an improved IS in the presence of intragenerational inequality.

Table 4: Regression coefficients and marginal effects of the independent variables on the individual harvest before MV in Poisson regressions

	Model 1		Model 2		Model 3	
	Coefficient	ME	Coefficient	ME	Coefficient	ME
MVHI (Base group = HI)	-0.17^{***}	-2.25^{***}	-0.16^{***}	-2.01^{***}	-0.16^{***}	-2.02^{***}
	(0.04)	(0.50)	(0.04)	(0.50)	(0.04)	(0.49)
Endowment (base = "E0")						
E10					-0.24^{***}	$-2.85^{***,}$ [a]
					(0.05)	(0.61)
E20					-0.17^{***}	$-2.14^{***,}$ [a]
					(0.04)	(0.52)
SVO (Base group = Proself)			-0.18^{***}	-2.29^{***}	-0.17^{***}	-2.15^{***}
			(0.04)	(0.51)	(0.04)	(0.51)
Gender (Base group = Female)					0.03	0.37
					(0.04)	(0.50)
(Intercept)	2.64^{***}		2.69^{***}		2.79^{***}	
	(0.03)		(0.03)		(0.04)	
AIC	1461.00	1461.00	1443.34	1443.34	1422.60	1422.60
BIC	1467.70	1473.04	1453.38	1458.73	1442.68	1448.03
Log Likelihood	−728.50	−728.50	−718.67	−718.67	−705.30	−705.30
Deviance	568.20	568.20	548.54	548.54	521.80	521.80
Num. obs.	210	210	210	210	210	210

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$
Robust standard errors are reported in the parenthesis.
ME stands for marginal effect to indicate a change in the individual harvest when one independent variable increases by one unit, holding other factors fixed.
HI, MVHI and SVO stand for high inequality treatment, median voting high inequality treatment and social value orientation, respectively.
E10 and E20 represent dummy variables that take 1 if a subject is assigned to have endowment 10 and 20, respectively.
[a] The numbers show that subjects with E10 (E20) are estimated to harvest 2.85 (2.14) points less than those with E0.

Lastly, table 5 reports the bootstrapping results to simulate 100 000 sequences by randomly sampling five subjects' observations per generation in a sequence out of the samples we have for the 1st and non-1st generations in our experiments. Each simulation generates one observation of how many generations per sequence sustain the common good. The results show that more than 90 % of sequences in baseline HI treatment terminate the game during the 1st generation, while more than 50 % of sequences in MVHI treatment continue up to the 2nd generation. Moreover, under MVHI, the probabilities to continue up to the 2nd, 3rd, . . ., 7th generation do not converge to zero either. Overall, bootstrapping presents yet another corroboration that median voting has a reassuring potential for sustainably maintaining IS under intragenerational inequality.

Table 5: The simulation results by bootstrapping: Baseline HI vs MVHI

	Treatment	
Generation	Baseline	MVHI
1	93.81	47.69
2	6.19	16.19
3	0.00	11.31
4	0.00	7.79
5	0.00	5.37
6	0.00	3.64
7	0.00	2.44

The median-voting institution used in our experiments has not yet been applied in the real-world collective decisions, although a deliberative institution called "majority judgment" utilizing a "median value" as a binding decision-making mechanism was suggested by Balinski and Laraki (2011). The absence of median voting from a political scene is likely due to the fact that this mechanism requires a one-dimensional agenda, which is rarely the case, as political candidates encapsulate whole range of issues that are often impossible to quantify and to turn into a unified scale. Had the method of transforming political agendas into numeric equivalents been practically implemented (e.g., following the suggestions of Baujard et al. (2018) or Nehring and Pivato (2022)), median voting and its antecedents could be empirically tested under natural circumstances. For now, based on the results of IGG, we find that the effectiveness of the median voting stems from the realization by every member in a generation that she/he has to obey the median-voting rule, or else her/his intended harvest will not be materialized. In other words, subjects are likely to self-impose an altruistic mindset toward future generations through prior realization of a focal "median" point for deciding their intended harvests. In a similar fashion, it is our belief that a median-voting institution can be customized for being implementable in a society, thereby maintaining and improving IS. While at this point we do not have a clear vision of such mechanism, conceptualizing a median-voting institution shall be a common agenda among social scientists worldwide for the betterment of IS. Although median voting appears to be effective in promoting IS under inequality, heterogeneous endowments do influence harvesting behavior. In line with

FERRER (2005), we find that subjects who realize that their personal income is inferior to others display less consideration for future generations. Notably, the opposite – sustainable – behavior is observed not among the "richest" but among the "middle-income" subjects. This finding fits the narrative about intergenerational benefits stemming from equitable society where, by definition, middle class plays a dominant role.

4 Conclusion

This article explores the research question "How does a median-voting institution influence people's behaviors towards future generations under intragenerational inequality?" We hypothesize that median voting, as proposed by Hauser et al. (2014), encourages people to adopt sustainable practices for the benefit of future generations. An online Intergenerational Goods Game (IGG) experiment was conducted with 210 subjects across two treatments: one with median voting and one without. The inequality was simulated through heterogeneous initial endowments assigned to participants within each generation. Developing the framework of Hauser et al. (2014) who implemented median voting under intragenerational equality, our findings indicate that median voting reduces subjects' intended harvests, thereby enhancing intergenerational sustainability even in the context of intragenerational inequality. This suggests that the binding "median-voting" rule motivates individuals to act altruistically rather than selfishly towards future generations, ensuring the realization of their intended harvests. Overall, our results highlight the potential for a sustainable framework that could be fostered through the adoption of a median-voting mechanism in intergenerational decision-making for a real society characterized by high levels of inequality.

At the same time, we acknowledge several limitations of this article and outline potential directions for future research. First, our study employs an online experiment to assess the effectiveness of median voting. This approach raises questions about the external validity of our findings, as they may not fully translate to real-world scenarios that encompass historical, economic, environmental and intrinsic factors. To generalize our conclusions, future research should replicate these experiments in real-world contexts or diverse societies. Second, our study operates under the assumption that the "median value" is mandatory, requiring all members to accept it in the context of median voting. However, in practice, enforcing an adherence to the median value among all members without a strong authoritative presence, such as law enforcement, may be unfeasible. Future research could explore alternative institutional governance mechanisms by allowing participants the option to deviate from the median value under certain conditions, facilitating a comparison with binding median voting outcomes. Despite these limitations, we believe that our research represents a crucial initial step in demonstrating the potential effectiveness of a median-voting institution in promoting IS in the presence of intragenerational inequality.

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