DISCUSSION PAPER SERIES

No. 4623

DESIGNING DEMOCRACIES FOR SUSTAINABILITY

Hans Gersbach and Tobias Kleinschmidt

PUBLIC POLICY

Centre for Economic Policy Research

www.cepr.org

Available online at: **www.cepr.org/pubs/dps/DP4623.asp**

ISSN 0265-8003

DESIGNING DEMOCRACIES FOR SUSTAINABILITY

Hans Gersbach, Universität Heidelberg and CEPR
Tobias Kleinschmidt, Universität Heidelberg

Discussion Paper No. 4623
September 2004

Centre for Economic Policy Research
90–98 Goswell Rd, London EC1V 7RR, UK
Tel: (44 20) 7878 2900, Fax: (44 20) 7878 2999
Email: cepr@cepr.org, Website: www.cepr.org

CEPR Discussion Paper No. 4623

September 2004

ABSTRACT

Designing Democracies for Sustainability*

Democratic processes may not take the welfare of future generations sufficiently into account and thus may not achieve sustainability. We suggest that the dual democratic mechanism – rejection/support rewards (RSRs) for politicians and elections – can achieve sustainability. RSRs stipulate that incumbents who are not re-elected, but obtain the majority support among younger voters receive a particular monetary or non-monetary reward. Such rejection/support rewards induce politicians to undertake long-term beneficial policies, but may invite excessive reward-seeking. We identify optimal RSRs under different informational circumstances.

JEL Classification: D72, D82, H55 and Q56
Keywords: democracy, elections, incentive contracts, rejection/support rewards and sustainability

Hans Gersbach
Alfred-Weber-Institut
Universität Heidelberg
Grabengasse 14
69117 Heidelberg
GERMANY
Tel: 543 173
Fax: 543 578
Email: gersbach@uni-hd.de

For further Discussion Papers by this author see:
www.cepr.org/pubs/new-dps/dplist.asp?authorid=119061

Tobias Kleinschmidt
Department of Economics
Universität Heidelberg
Grabengasse 14
69117 Heidelberg
GERMANY
Email: t.kleinschmidt@thphys.uni-heidelberg.de

For further Discussion Papers by this author see:
www.cepr.org/pubs/new-dps/dplist.asp?authorid=161322

*We would like to thank Peter Bernholz, Verena Liessem and seminar participants in Heidelberg for valuable suggestions and comments. Financial support from the Deutsche Forschungsgemeinschaft (DFG) is gratefully acknowledged.

Submitted 31 August 2004

1 Introduction

Democracies may have difficulties in pursuing policies that mainly benefit future generations. If the beneficiaries of such long-term policies only form a minority today, politicians may not undertake them, since this would reduce their chances of getting reelected.

The problem of socially desirable policy projects that require investment expenditure first and only pay off later has been extensively discussed in connection with social security and global warming.

Starting with Browning 1975, a strand of literature (see Myles 1995 for a survey) has shown that voting equilibria regarding social security benefits and contribution rates leads to an excessive social security budget[1]. When a society experiences a slow-down or even a decline in population growth, adjustment and/or change of the pay-as-you-go system becomes inevitable to lower the burden on the young generation and to sustain incentives for growth (see e.g. Börsch-Supan 2000). Such changes, however, may make a majority of voters - retirees and individuals close to retirement age - worse off, as their expected net benefits would decline. Hence, pension reforms may be not politically feasible although, from a welfare perspective accounting for future generations, they are in fact desirable.

A similar intergenerational investment problem, coupled this time with more uncertainty about the returns, is global warming. Most predictions suggest that the temperature associated with thermal equilibrium on earth will increase as a result of rapidly rising emissions of greenhouse gases (IPCC 2001). Such temperature changes may have a sizable impact on the well-being of future generations (see e.g. Nordhaus 1991, Cline 1992 and Fankhauser 1995), while a large part of the costs for reducing emissions is borne by the older generations. Hence, more dramatic measures than e.g. those in the

[1]The political economy of social security has been further developed by Tabellini 2000, Casamatta, Cremer and Pestieau 2000 and Wagner 2002.

Kyoto protocol[2] are difficult to implement in the political process.

In this paper, we suggest that rejection/support rewards (RSRs) may enhance the sustainability of economies governed by democracies. RSRs work as follows. If an incumbent is rejected in his bid for reelection but receives the majority of votes of the younger generation, say individuals below the age of 40, he is entitled to a special reward. Such a reward is a pecuniary or non-pecuniary utility transfer for the rejected politician. The idea is that RSRs should induce politicians to act on behalf of the young generation even if this is against the interests of the majority in the current electorate. In a simple two-generation model, we identify the benefits and disadvantages of RSRs. RSRs induce socially desirable long-term policies, but may invite excessive investment at the expense of the current generation in the course of attempts by politicians to obtain an RSR. We show that optimally designed RSRs balance the benefits and costs of the instrument so that it is universally welfare-improving.

The current paper follows recent literature on how incentive contracts can be combined with elections in democracies without affecting voter sovereignty. Incentive contracts for politicians were introduced by Gersbach 2003 as a means of solving the underinvestment problem for projects with long-term beneficial consequences. There, politicians are forced to accept an incentive contract that makes their future utility (income or reelection) dependent on future developments if they want to stand for reelection. Both in Gersbach 2003 and in subsequent papers (see e.g. Gersbach and Liessem 2004), contracts politicians adopt are meant to increase the expected utility of the median voter. In this paper, we introduce specific incentive elements that may lower the utility of the median voter while increasing the well-being of future generations. We note that incentive contracts for politicians are not used in modern democracies. Thus, our proposal calls for new institutions[3].

The current paper is related to the literature on electoral accountability, which was

[2] In some countries such as the US, the Kyoto protocol itself has not gained enough political support to be adopted.

[3] There are, however, historical parallels. For example officials in ancient Athens were liable for their actions with their entire assets (see e.g. Bleicken 1991).

initiated by Barro 1973 and Ferejohn 1986, and recently extended by Persson, Roland and Tabellini 1997. Politicians and voters are assumed to have divergent interests and elections are a means by which voters control political misbehavior, since the possibility of reelection induces self-interested politicians to act in the interests of the electorate. In this paper, we show that adding a mechanism that rewards a rejected politician if he obtains the support of the younger generation increases the long-term well-being of societies.

The paper is organized as follows. In the next section, we introduce the model. In the third section, we examine the effects of the reelection mechanism. In section 4, we extend our analysis to the case of incomplete information regarding the preferences of the politician in office. In section 5, we explore the robustness of our results with respect to several extensions of the basic model. Section 6 concludes.

2 The Model

We consider a simple OLG model spanning two periods with two generations. The older generation only lives in the first period, whereas the younger generation will live in periods 1 and 2. At a point E in period 1, government elections take place. We assume that the older generation has a majority at this point in time.

The welfare of the two generations is indicated by $W^o = W_1^o$ for the older generation in period 1 and W_1^y and W_2^y for the younger generation in periods 1 and 2, respectively. Overall welfare is given by

$$W = W_1^o + (W_1^y + \delta W_2^y), \tag{1}$$

where δ is a discount factor.

The politician in office can invest in a given project, denoted by **I**. The case of the politician not investing is indicated by **NI**. The investment project yields returns for the young generation in period 2. The quality of the investment is uncertain. Two types are possible. The project may be good (**G**) and increase overall welfare compared to **NI**. However, it may also reduce aggregate welfare (**B**).

We assume that the type of the project at hand is only known to the politician. The society only knows the probability g of the occurrence of a project **G**. Investment in a good project increases the welfare W_2^y of the younger generation in period 2. The investment costs will be borne by the two generations in period 1. Thus, the welfare of the older generation will be lowered compared to the **NI** case, since the returns from the investment will come into effect in period 2. Hence, our assumptions can be summarized as follows:

$$W_2^y(I,G) > W_2^y(NI) > W_2^y(I,B) \tag{2}$$

$$W_1^o(I) < W_1^o(NI) \tag{3}$$

$$W_B < W_0 < W_G \tag{4}$$

Here, W_0 represents the overall welfare of the two generations in the **NI** case. W_B and W_G represent the aggregate welfare in cases (**I,G**) and (**I,B**), respectively.

It is obvious that the set of first-best allocations is given by (**I,G**) and (**NI,B**). If and only if the politician observes **G**, then he should invest.

Our final assumption implies that the investment project is welfare-reducing from an ex ante point of view. Hence,

$$gW_G + (1-g)W_B < W_0 \tag{5}$$

We impose a simple utility function of the politician to model his preferences. He is motivated by private benefits P, such as getting reelected at E, as well as by the overall welfare W of the society. Utility is denoted by U and given as follows:

$$U = \alpha W + (1-\alpha)P. \tag{6}$$

The variable α is the weight social welfare has in the utility of the politician. The higher the weight α, the more the agent will be interested in the social welfare. The polar cases where α is equal to unity or zero represent the cases of a pure statesman or a purely selfish politician, respectively.

We assume that the politician can be reelected once at date E. If he is reelected, the private benefits P are assumed to be H, which represents the value of holding office. If the politician is rejected, the private benefits are normalized to zero. If the politician receives an extra compensation in the case of rejection, denoted by C, P will be equal to C.

To break ties, we assume that the agent prefers **NI** to investment in a bad project **B** and **G** to **NI** if he is indifferent.

We work with prospective voting behavior as stipulated in the following assumption:

Assumption 1

*The older generation has a majority at E. The politician is reelected if he does not invest (**NI**) and is rejected in the case of **I**.*

If the agent makes the investment, the older generation will not vote for him at E, since the investment will lower their welfare. This justifies the assumed rejection of the politician in the case of an investment. Of course, assumption 1 is a polar case, which highlights the tradeoffs the politician faces. Later we will discuss how stochastic reelection chances impact on our results. If the politician does not invest (**NI**), we assume the agent's policy is welfare-improving for the older generation and he will be reelected.

Since a positive investment decision will automatically lead to the rejection of the politician, it is hardly imaginable that the agent will choose **I** in the case of **G** unless he values welfare much more highly than his own personal benefits from holding office. This would be the case if the weight α is higher than a certain threshold $\overline{\alpha}$, given by $\overline{\alpha}W_0 + (1-\overline{\alpha})H = \overline{\alpha}W_G$. Hence,

$$\overline{\alpha} = \frac{H}{W_G - W_0 + H}. \tag{7}$$

To induce the politician to undertake the investment in the case where $\alpha < \overline{\alpha}$, we suggest a monetary payment C in the case of the agent's rejection at E. However, this bonus is coupled with the amount of votes he gets from the younger generation at E.

In particular, payment C is designed as an RSR. The politician receives C if and only if he is rejected in the reelection at date E and he obtains the majority of votes of the younger generation. The essential idea is that, first, politicians should be motivated to undertake socially valuable projects even if they will be rejected by a majority of voters. Second, politicians should still be accountable to the younger generation to avoid the compensation of politicians for bad policies.

We say that a democracy with RSRs achieves sustainability if compensation C induces politicians to choose **I**(**NI**) when **G**(**B**) occurs.

Since a good investment **I** increases the expected overall utility of the younger generation, we assume that they will favor this agent at E, if they expect the investment to be a good one **G**. More generally, we also assume prospective voting behavior on the part of the younger generation.

Assumption 2

In the case of investment, the young generation votes for the politician holding the office, if the expected welfare $W^y = W_1^y + \delta W_2^y$ of this generation is higher than its welfare in the case ***NI****.*

In equation (5) we assumed that investment is welfare-reducing from an ex ante point of view. However, this is not necessarily the case for the younger generation. In the case of investment, the total welfare and the welfare of the younger generation differ by the cost $W_1^o(I)$ of the project borne by the older generation in period 1. Thus, we might encounter situations in which the younger generation will vote for the politician even if the expected aggregate welfare in the case of **I** is less than W_0.

We do not need to consider the voting decision of the younger generation in the case of no investment **NI**, since owing to assumption 1, the politician will be reelected anyway by the majority of the older generation and will not receive a rejection reward.

We summarize the structure of the game:

Stage 1: A RSR value of C is determined.

Stage 2: The politician can undertake a project that comes into effect in period 2. He observes a perfect signal about the quality of the project. He decides whether to invest (**I**) or not (**NI**).

Stage 3: The politician decides whether to stand for reelection at E. The older and younger generations cast their votes.

Stage 4: In the case of his rejection, the politician receives the compensation C determined in stage 1 if the younger generation voted for him.

We look at the Bayesian equilibria of this game.

The RSR C involves the risk that a politician may invest in a *bad* project **B**, which would lower overall welfare compared to the **NI** case, merely so as to receive the rejection reward, if this is higher than his benefits from holding the office. Therefore, the design of appropriate values for C becomes important. We first examine the pure reelection mechanism. Then we explore how RSRs can improve welfare. We then allow for uncertainties in the variables α and H.

3 The Reelection Mechanism

In this section, we explore the circumstances in which the reelection mechanism with and without RSRs is able to achieve first-best allocations and thus sustainability.

For a more transparent presentation of our results, we normalize all individual welfare in the case of **NI** to zero:

$$W_1^o(NI) = W_1^y(NI) = W_2^y(NI) = 0. \tag{8}$$

In particular, this implies $W_0 = 0$.[4]

[4]Normalizing utilities across generations is not problematic in our model as only aggregate welfare deviations matter when the politician chooses **I**.

3.1 The Pure Reelection Mechanism

If the agent decides not to invest (**NI**), he will be reelected at E according to assumption 1. His utility, denoted by U_{NI}, is then given by

$$U_{NI} = (1 - \alpha)H \tag{9}$$

In the case of investment the politician will be rejected at E, as the older generation has a majority in period 1 and votes prospectively. The votes of the younger generation are not relevant in the case of a pure reelection mechanism. We next observe that it is never beneficial for a politician to invest if the quality of the project is **B**. In such cases, he would be rejected and welfare would be lower. If the politician observes **G** and selects **I**, his utility, denoted by $U_{I,G}$ is given by:

$$U_{I,G} = \alpha W_G \tag{10}$$

The politician will invest upon observing **G**, if $U_{I,G} > U_{NI}$. This is fulfilled if his weight α is higher than the threshold $\overline{\alpha}$:

$$\alpha > \frac{H}{W_G + H} \equiv \overline{\alpha} \tag{11}$$

If the politician's weight α is lower than $\overline{\alpha}$, he will never invest when there is pure reelection without an RSR.

To induce the agent holding office to invest in case **G**, we next introduce RSRs at date E.

3.2 The Reelection Mechanism and RSRs

In the following we investigate the reelection mechanism in the presence of an RSR with value C, where all variables except the quality of the investment project are publicly observable. In particular this means that the politician's type α is known to the public.

The extension to unknown α and uncertainty on the agent's interest in holding office H is given in section 4.

If an RSR $C > 0$ is present, we have to distinguish three cases: **NI**, where the politician is reelected and obtains benefits from holding office H and welfare is $W_0 = 0$. If the agent decides to invest, **I**, this may either be a good investment **G** or a bad investment **B**. In either case, **I** leads to the agent's rejection. He receives compensation C upon rejection if the younger generation cast their votes in his favor. We assume that a reward C amounts to a pure redistribution between the public and the politician without affecting any relevant welfare comparisons.

The voting decision is given by the following proposition.

Proposition 1

Suppose $C \in [\underline{C}, \overline{C}]$, with

$$\underline{C} = \max\left\{0, H - \frac{\alpha}{1-\alpha} W_G\right\}, \tag{12}$$

$$\overline{C} = H - \frac{\alpha}{1-\alpha} W_B. \tag{13}$$

*Then, there exists a Bayesian Equilibrium where the politician will choose **I** upon **G**, and **NI** otherwise. In the case of **I**, the younger generation will vote for the politician and he will receive C.*

Expected overall welfare in equilibrium is

$$V = gW_G + (1-g)W_0 = gW_G. \tag{14}$$

Proof

We need to investigate the three different options for the politician:

$$\begin{aligned} U_G &= \alpha W_G + (1-\alpha)C \\ U_{NI} &= (1-\alpha)H \\ U_B &= \alpha W_B + (1-\alpha)C \end{aligned} \tag{15}$$

The compensation should be chosen so that it is high enough to compensate for the loss of holding office if (**I**,**G**) occurs. It should be low enough to ensure that agents are not induced to invest merely to receive the reward. This yields the following inequality:

$$U_{I,B} < U_{NI} < U_{I,G}. \tag{16}$$

$U_B < U_G$ is given by construction, since $W_G > W_B$. The remaining two inequalities yield the boundaries $\underline{C}$ and $\overline{C}$, given above.

If $C \in [\underline{C}, \overline{C}]$ and given the voting behavior of the younger generation, the politician only invests if he observes **G**. If **B** occurs, the agent is better off selecting **NI**, even if he is paid C in the case of **I**. Hence, the voting behavior of the younger generation is a best response and we obtain the separating equilibrium where politicians choose **I** if and only if they observe **G**.

■

If $\alpha < \overline{\alpha}$ and $C < \underline{C}$, the agent holding the office would prefer **NI** to (**I**,**G**) and no politician would invest in a project, even if the reward C were given to him in the case of rejection. For $\alpha \geq \overline{\alpha}$, the compensation cannot be set lower than $\underline{C} = 0$, since we are only considering positive RSRs.

If the compensation is higher than the upper limit $\overline{C}$, the politicians would prefer a bad investment to no investment at all. In this case, no equilibrium in pure strategies exists that would support sustainability. If $C > \overline{C}$ and $\alpha < \overline{\alpha}$, investment in **G** and **B** is only profitable to the politician if he receives compensation C. This is achievable if the expected welfare for the younger generation $W^y(I) = gW^y_G + (1-g)W^y_B$ is positive. However, since in this case the investment decision does not depend on the quality of the project, the expected total welfare is negative in the case of **I** owing to our assumption (5). Thus, there exist equilibria in which the younger generation rejects(votes for) any politician choosing **I**. Politicians choose **NI**(**I**). If $C > \overline{C}$ and $\alpha > \overline{\alpha}$, agents benefit from choosing **I** if **G** occurs, even if the RSR is not given to them. In this case, no equilibrium in pure strategies exists. Suppose that the younger generation votes for the agent if he chooses **I**. Then the politician would also invest in the event of **B**, and the voting behavior of the younger generation is not a best response. Suppose that the younger generation rejects politicians who have chosen **I**. If a politician observes **G**, he will chose **I** nevertheless. Hence, the voting behavior of the younger generation is not a best response either.

The boundaries $\underline{C}$ and $\overline{C}$ depend on the value of α. As an immediate consequence, we obtain

Corollary 1

$$\begin{aligned} If \quad \alpha = \overline{\alpha}, \qquad & \underline{C} = 0,\, \overline{C} = H\left(1 - \frac{W_B}{W_G}\right). \\ If \quad \alpha = 0, \qquad & \underline{C} = \overline{C} = H. \end{aligned}$$

Note that for $\alpha \geq \overline{\alpha}$ a positive RSR is not required to induce sustainability.

Up to now we have considered the variables H, W_G, W_B and α as observable. Accordingly, the public can obtain precise values for the boundaries $\underline{C}$ and $\overline{C}$, and the reward C can be chosen to lie in $[\underline{C}, \overline{C}]$. We relax these conditions in the following section.

4 Uncertainty of Type α and Benefit H

In the analysis so far, the knowledge of the politician's preference parameter α and the value H the politician attaches to the benefit of holding office were publicly observable. In the next section, we analyze the cases of unknown type α and unknown benefit of holding office H.

4.1 Random Type α of the Politician

We investigate the level at which compensation C should be set, if the weight α of the politician holding office is not known to the public.

We assume that the politician's type α is totally unobservable to the public, which means α is randomly drawn from the interval $[0,1]$. The probability that the agent's type α is higher than a value x is then given by

$$p(\alpha > x) = (1 - x). \tag{17}$$

To discuss equilibria, we use $p_G(I)$ and $p_B(I)$ to denote the probabilities that a politician will choose **I** if he has observed **G** or **B**, respectively. Obviously

$$p_G(NI) = 1 - p_G(I), \tag{18}$$

$$p_B(NI) = 1 - p_B(I). \tag{19}$$

Similarly, we use $\mu_I(G)$ and $\mu_I(B) = 1 - \mu_I(G)$ to denote the beliefs of voters that the project is good or bad, respectively, if they observe **I**. Bayes' rule implies:

$$\mu_I(G) = \frac{g p_G(I)}{g p_G(I) + (1-g) p_B(I)}. \tag{20}$$

We distinguish two regions for the compensation, namely $C < H$ and $C > H$, and analyze them separately.

If the reward C is lower than the benefit of holding office H, the agent will always choose not to invest in the case of a bad project **B**. Even if the younger generation would vote for him at the elections E, the rejection reward would not compensate for the loss of his office. Setting $C < H$ amounts to a conservative solution, where bad projects are always avoided. However, in general the conservative solution is not welfare-maximizing.

In the case of a good project in period 2, the politician has the choice between making a good investment (**I,G**) and no investment **NI**. Since no politician would invest in a bad project if $C < H$, the younger generation will vote for the agent if he invests in a project because it is definitely good. The comparison of the two utility functions U_G and U_{NI} in equation (15) leads to a threshold for the weight α of the politician:

$$\alpha_G = \frac{1}{1 + \frac{W_G}{H-C}} \tag{21}$$

If α is higher than α_G, the politician will decide to make an investment (**I,G**) - if it is lower, he will not invest, (**NI**).

The expected welfare as a function of C in the case of $C < H$, $V(C < H)$ is given by:

$$V(C < H) = g\left[p(\alpha > \alpha_G)W_G + (1 - p(\alpha > \alpha_G))W_0\right] + (1 - g)W_0 = gp(\alpha > \alpha_G)W_G, \tag{22}$$

where g is the probability of a good project the politician can invest in. With the definitions above we get:

$$V(C < H) = g\frac{W_G^2}{H - C + W_G} \tag{23}$$

This function is monotonously increasing in C. The maximum value gW_G is reached at $C = H$.

If $C > H$ and the politician can be certain of getting the reward, he would always invest in the case of a good project **G**:

$$p_G(I) = 1, \qquad p_G(NI) = 0 \tag{24}$$

If **B** occurs, the probabilities for investment in the case of an assured rejection reward are:

$$p_B(I) = p(\alpha < \alpha_B), \qquad p_B(NI) = 1 - p(\alpha < \alpha_B), \tag{25}$$

where α_B is given by

$$\alpha_B = \frac{1}{1 - \frac{W_B}{C-H}}. \tag{26}$$

If the actual weight α of the politician is higher than α_B, he will choose **NI** upon **B**. If α is lower, he will make a bad investment (**I,B**).

With the definitions given above, we can find the expected overall welfare in the case of **I**. This is given by:

$$\begin{aligned} \overline{V}_I(C) &= \mu_I(G)W_G + \mu_I(B)W_B \\ &= \frac{gW_G}{g + (1-g)\alpha_B} + \frac{(1-g)\alpha_B W_B}{g + (1-g)\alpha_B} \end{aligned} \tag{27}$$

This is a rather complicated function of compensation C. However, examining its limits, we see that $\overline{V}_I(C)$ is the expected welfare in the case where all politicians invest in **G** and **B**, if C is taken to infinity:

$$\lim_{C\to\infty} \overline{V}_I(C) = gW_G + (1-g)W_B. \tag{28}$$

At $C = H$, the expression for the expected welfare in the case of investment reduces to

$$\overline{V}_I(H) = W_G, \tag{29}$$

since a bad project would never be undertaken at $C = H$. Thus, the expected welfare decreases from (29) to (28) if C rises from H to infinity.

The expected welfare of the younger generation in case **I** is given by:

$$\overline{V}_I^y(C) = \overline{V}_I(C) + K^o, \tag{30}$$

where K^o denotes the partial costs of the project borne by the older generation in period 1:

$$K^o = -W_1^o(I). \tag{31}$$

Since the welfare of the younger generation and total welfare differ by K^o in case **I**, one obtains (30) by simply replacing W_B and W_G with $W_B + K^o$ and $W_G + K^o$ in equation (27).

In the left-hand diagram of figure 1, we have plotted expected total welfare and the expected welfare of the younger generation in the case of investment as a function of reward C. At some value C^* the expected welfare becomes negative:

$$C^* = H + g\frac{W_G W_B}{gW_G + (1-g)W_B} \tag{32}$$

If the RSR value is larger than C^*, the overall expected welfare is negative. However, if the expected welfare of the younger generation W^y is higher than zero, the politician will still be given their votes at date E upon **I**.

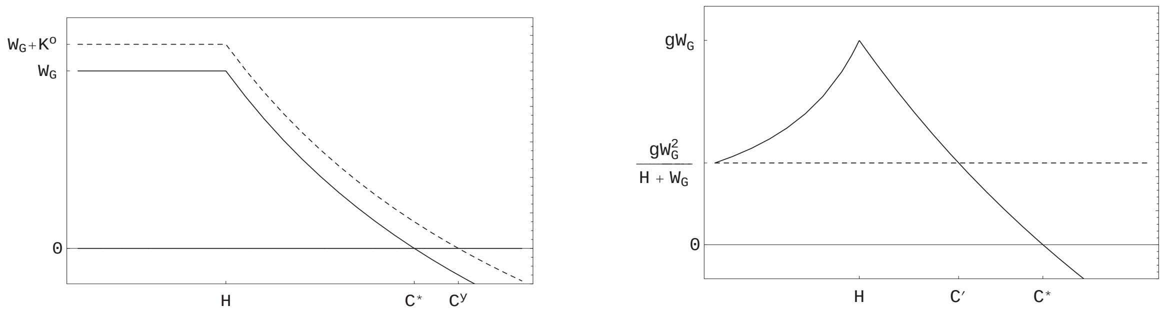

Figure 1: *Left-hand diagram*: Qualitative picture of the expected aggregate welfare (solid line) and the expected welfare for the younger generation (dashed line) in the case of an investment by the politician as a function of reward C. If the welfare of the younger generation is higher than zero, they will vote for the politician at E and he will receive the rejection reward. *Right-hand diagram*: Expected overall welfare in the case of a rejection reward (solid line) compared to the typical case of no reward (dashed line). For medium values of the RSR, the expected overall welfare is higher than in the absence of an RSR.

If $gW_G + (1-g)W_B < -K^o$, expected welfare for the younger generation will cross zero at a value C^y of the RSR. This is given by:

$$C^y = H + g\frac{W_B(W_G + K^o)}{gW_G + (1-g)W_B + K^o}. \tag{33}$$

For compensations C higher than C^y, one cannot find an equilibrium in pure strategies. Because of assumption 2, the young generation would not vote for the politician anymore and thus the agents cannot expect to receive the rejection reward. However, there are politicians (with $\alpha > \overline{\alpha}$) who always invest in a project, even in the absence of RSRs. Hence, rejecting politicians in the case of $\mathbf{I}$ is not a best response either[5].

With the probabilities defined in equations (24) and (25), we calculate the overall expected welfare as:

$$V = \begin{cases} g\frac{W_G^2}{H-C+W_G}, & \text{for } C < H; \\ gW_G + (1-g)\frac{W_B(C-H)}{C-H-W_B}, & \text{for } H < C < C^y; \end{cases} \tag{34}$$

For $C > H$ the function decreases monotonously and becomes negative at C^*. For $C > C^y$ one cannot define a function V. In the right-hand diagram of figure 1 we plotted the expected welfare in the case of an RSR compared to the case of no compensation

[5]One can easily construct equilibria in mixed strategies in which young voters randomize between rejection and adoption in the case of $\mathbf{I}$.

(dashed line). For values of C smaller than C', the value where both mechanisms lead to the same result, the introduction of a rejection reward leads to higher expected welfare. C' is given by:

$$C' = H + \frac{gHW_BW_G}{gHW_G + (1-g)W_B(H + W_G)} \tag{35}$$

Welfare in the case of unknown type α is maximized by setting the reward C equal to the value of holding office H. This solution is also the conservative solution, since at $C = H$ politicians will never invest in **B**.

We summarize our findings in the following proposition.

Proposition 2

*Suppose the weight α of the politician is not known. If C is set to H, the politician will chose **I** upon **G** and **NI** upon **B**. Hence, $\mu_I(G) = 1$ at $C = H$. The younger generation will always cast their votes in his favor. Aggregate welfare is maximized.*

4.2 Random Type α and Uncertain Benefit H

In this subsection we analyze the case where the agent's benefit of holding office H is only known with a certain degree of accuracy. We take H to be randomly distributed across an interval with known borders $H \in [H_L, H_U]$.

We need to distinguish three regions for the value of C. Either C lies below H_L or above H_U or in between the two borders.

We first calculate the probabilities of an agent investing in a bad project **B**, $p_B \equiv p(U_B > U_{NI})$ in the case of an assured rejection reward.

For $C < H_L$ we obtain

$$p_B(C < H_L) = 0. \tag{36}$$

The probability in the interval $[H_L, H_U]$ is given by:

$$\begin{aligned} p_B(H_L < C < H_U) &= \frac{1}{H_U - H_L} \int\limits_{H_L}^{C} p(\alpha < \alpha_B) dH + \frac{1}{H_U - H_L} \int\limits_{C}^{H_U} 0 \cdot dH \\ &= \frac{1}{H_U - H_L} \left[(C - H_L) + W_B \log \left(1 - \frac{C - H_L}{W_B} \right) \right] \end{aligned} \quad (37)$$

Finally, we obtain

$$\begin{aligned} p_B(H_U < C) &= \frac{1}{H_U - H_L} \int\limits_{H_L}^{H_U} p(\alpha < \alpha_B) dH \\ &= 1 + \frac{W_B}{H_U - H_L} \log \left(1 + \frac{H_U - H_L}{C - H_U - W_B} \right) \end{aligned} \quad (38)$$

The analogous analysis for $p_G \equiv p(U_G > U_{NI})$ in the case of investment in a good project **G** yields:

If $C < H_L$,

$$p_G(C < H_L) = \frac{W_G}{H_U - H_L} \log \left(1 + \frac{H_U - H_L}{H_L - C + W_G} \right). \quad (39)$$

If $H_L < C < H_U$, we have

$$p_G(H_L < C < H_U) = \frac{C - H_L}{H_U - H_L} + \frac{W_G}{H_U - H_L} \log \left(1 + \frac{H_U - C}{W_G} \right) \quad (40)$$

and

$$p_G(H_U < C) = 1 \quad (41)$$

The conservative solution is to set the reward at $C = H_L$, since in the case of a bad project the agent will always decide not to invest and the probability of an investment in the case of a good project is highest in $C \leq H_L$.

With the given probabilities we can calculate the expected welfare in the case of investment $\overline{V}_I(C)$ as a function of reward C. It is defined by:

$$\overline{V}_I(C) = \mu_I(G) W_G + \mu_I(B) W_B = \frac{g p_G(I) W_G + (1 - g) p_B(I) W_B}{g p_G(I) + (1 - g) p_B(I)}. \quad (42)$$

Using the probabilities given above, we obtain

$$\overline{V}_I(C)=\begin{cases} W_G, & \text{for } C < H_L; \\ \frac{(C-H_L)(gW_G+(1-g)W_B)+gW_G^2\log\left(1+\frac{H_U-C}{W_G}\right)+(1-g)W_B^2\log\left(1-\frac{C-H_L}{W_B}\right)}{(C-H_L)+gW_G\log\left(1+\frac{H_U-C}{W_G}\right)+(1-g)W_B\log\left(1-\frac{C-H_L}{W_B}\right)}, & \text{for } H_L < C < H_U; \\ \frac{(H_U-H_L)(gW_G+(1-g)W_B)+(1-g)W_B^2\log\left(1+\frac{H_U-H_L}{C-H_U-W_B}\right)}{(H_U-H_L)+(1-g)W_B\log\left(1+\frac{H_U-H_L}{C-H_U-W_B}\right)}, & \text{for } H_U < C. \end{cases} \tag{43}$$

Thus for $C > H_U$, expected welfare in the case of **I** is monotonously decreasing. At a value C^* of the RSR, expected welfare becomes negative:

$$C^* = W_B + \frac{H_U e^{-\frac{gH_LW_B+H_UW_B+gH_UW_G}{(1-g)W_B^2}} - H_L e^{-\frac{gH_UW_B+H_LW_B+gH_LW_G}{(1-g)W_B^2}}}{e^{-\frac{gH_LW_B+H_UW_B+gH_UW_G}{(1-g)W_B^2}} - e^{-\frac{gH_UW_B+H_LW_B+gH_LW_G}{(1-g)W_B^2}}}. \tag{44}$$

Again, the expected welfare of the younger generation $W^y(I)$ in the case **I** is given by the overall expected welfare plus the costs of the project borne by the older generation.

$$\overline{V}_I^y(C) = \overline{V}_I(C) + K^o. \tag{45}$$

Welfare $\overline{V}_I^y(C)$ may fall below zero again at a value $C^y > C^*$ of the RSR. If the compensation is chosen to be lower than C^y, the younger generation will give their votes to the politician at E in the case of **I**. Again, it is not clear how the younger generation will respond to an investment decision **I** if compensation C is higher than C^y. C^y is given by:

$$C^y = H_L + W_B - \frac{H_U - H_L}{e^{\frac{(H_U-H_L)(gW_G+(1-g)W_B+K^o)}{(1-g)W_B(W_B+K^o)}} - 1} \tag{46}$$

To find the solution that maximizes expected welfare, we calculate the welfare as a function of C in the three different regions of C.

In the region $C < H_L$ expected welfare is given by

$$\begin{aligned} V(C < H_L) &= gp_G(C < H_L)W_G \\ &= g\frac{W_G^2}{H_U - H_L}\log\left(1 + \frac{H_U - H_L}{H_L - C + W_G}\right) \end{aligned} \tag{47}$$

Again, g is the probability of a good project the agent can invest in. For the interval $[H_L, H_U]$ expected welfare is given by:

$$\begin{aligned} V(H_L < C < H_U) &= gp_G(H_L < C < H_U)W_G + (1-g)p_B(H_L < C < H_U)W_B \\ &= \frac{C - H_L}{H_U - H_L}\left[gW_G + (1-g)W_B\right] \\ &\quad +g\frac{W_G^2}{H_U - H_L}\log\left(1 + \frac{H_U - C}{W_G}\right) \\ &\quad +(1-g)\frac{W_B^2}{H_U - H_L}\log\left(1 - \frac{C - H_L}{W_B}\right) \end{aligned} \tag{48}$$

Finally, for $C > H_U$ we obtain:

$$\begin{aligned} V(H_U < C) &= gW_G + (1-g)p_B(H_U < C)W_B \\ &= gW_G + (1-g)W_B + (1-g)\frac{W_B^2}{H_U - H_L}\log\left(1 + \frac{H_U - H_L}{C - H_U - W_B}\right) \end{aligned} \tag{49}$$

The following proposition summarizes the result.

Proposition 3

Suppose the weight α and the value of holding office H of the politician are not known. There exists an optimal value $C_{max} \in [H_L, H_U]$ of the RSR, where aggregate expected welfare is maximized and the younger generation will vote for the incumbent.

Proof

Expected aggregate welfare is given by:

$$V(C) = \begin{cases} g\frac{W_G^2}{H_U - H_L}\log\left(1 + \frac{H_U - H_L}{H_L - C + W_G}\right), & \text{for } C < H_L; \\ \frac{C - H_L}{H_U - H_L}(gW_G + (1-g)W_B) + g\frac{W_G^2}{H_U - H_L}\log\left(1 + \frac{H_U - C}{W_G}\right) \\ +(1-g)\frac{W_B^2}{H_U - H_L}\log\left(1 - \frac{C - H_L}{W_B}\right), & \text{for } H_L < C < H_U; \\ gW_G + (1-g)W_B + (1-g)\frac{W_B^2}{H_U - H_L}\log\left(1 + \frac{H_U - H_L}{C - H_U - W_B}\right), & \text{for } H_U < C. \end{cases} \tag{50}$$

In the whole region of the RSR value C, $V(C)$ and its first derivative are continuous functions of C. For $C < H_L$, $V(C)$ is monotonically increasing in C, while it is monotonically decreasing for $C > H_U$. Thus, expected welfare reaches a maximum in

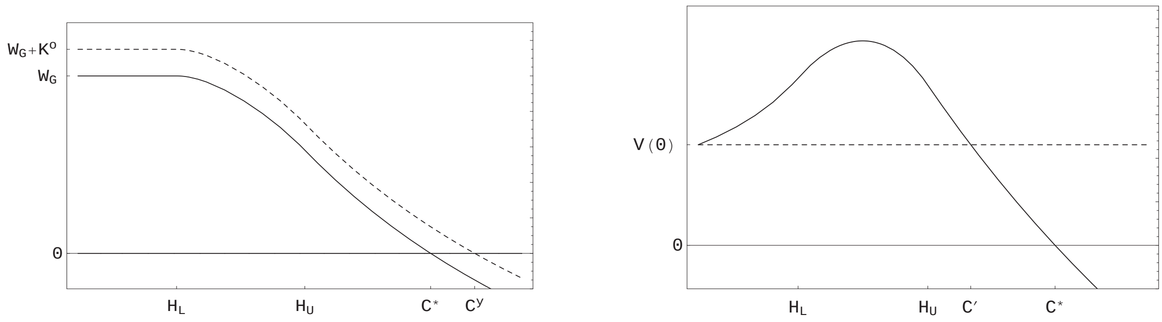

Figure 2: Qualitative picture of the expected welfare in case **I** (left-hand diagram) and overall expected welfare (right-hand diagram) as a function of compensation C if the weight α and the value of holding office H of the politician are not known.

$[H_L, H_U]$ for any finite values of all parameters. By differentiating $V(H_L < C < H_U)$ with respect to C, we get:

$$V'(H_L < C < H_U) = \frac{1}{H_U - H_L}\left((1-g)\frac{(C-H_L)W_B}{C-H_L-W_B} + g\frac{(H_U-C)W_G}{H_U-C+W_G}\right) \quad (51)$$

Setting $V'(C) = 0$ yields a quadratic equation in C, which can easily be solved. However, we do not give the explicit expressions for C_{max} and V_{max} in this paper, since the results are rather uninformative functions of the input parameters.

For $C \leq H_U$, the expected welfare for the younger generation $\overline{V}_I^y(C) = \mu_I(G)W_G + \mu_I(B)W_B + K^0$ is positive. The younger generation will vote for the politician in case **I** if C is set to C_{max}.

■

The functions $\overline{V}_I(C)$ and $V(C)$ are plotted in figure 2 for some typical values of the parameters g, W_G and W_B (solid lines). In the right-hand diagram, we compare total welfare with and without RSRs. For compensations C lower than C', expected welfare is higher in the presence of an RSR. C' is defined by:

$$V(C') = V(0). \quad (52)$$

However, this equation is not analytically solvable.

In the cases of propositions 1 and 2, the compensation could be set to an optimal value to obtain sustainability. The politician chooses (**I,G**) and (**NI,B**) depending on the quality of the project. In these cases, expected aggregate welfare reached its maximal value of $V = gW_G$. However, the optimal RSR value in the case of proposition 3 leads to expected welfare that is lower than gW_G. This is because politicians whose interest in holding office H is higher than compensation C_{max} may choose **NI** upon **G**, depending on their weight α. In the case of $H < C_{max}$, politicians may be induced to invest in **G** as well as **B**. If C is set to H_L, agents would never invest in a bad project **B**. However, depending on α, some politicians would prefer **NI** upon **G**. Therefore, when there is asymmetric information regarding α and H, society can not achieve sustainability in all circumstances at C_{max}.

In all cases we have investigated, the introduction of an RSR leads to expected aggregate welfare that is higher than it is in the absence of any rejection reward, if the corresponding compensation C is set at a medium value.

5 Robustness and Non-Commitment

In this section we explore the robustness of our results with respect to some of the key assumptions of our model.

We have already shown how the analysis can be extended to situations where the public is uncertain with respect to the preferences of the politicians in terms of variables α and H. We next discuss the robustness of our findings for uncertain reelection when a politician chooses **NI** for a broader range of policies and for inefficient investment projects.

Consider a variant of the model where a politician faces a reelection probability of less than one if he selects **NI**. Reelection may be uncertain since a more competent challenger may emerge or the incumbent may be unsuccessful in other policy areas than the ones considered in the model. Uncertain reelection upon selecting **NI** makes investment more attractive. Hence, the optimal value of RSRs has to be set at lower levels. For instance, in proposition 1 the value of holding office H has to be replaced by $q(NI)H$, where $q(NI)$ denotes the probability of an incumbent being reelected at date E if he chooses **NI**.

Consider next a policy space that involves additional projects benefiting the older generation. If reelection probability is one when the politician selects **NI**, there are no immediate effects since the politician will only undertake such policies if they are welfare-improving. If, however, reelection chances are uncertain upon choosing **NI**, a politician may attempt to increase the welfare of the older generation and his own reelection probability by reverting to inefficient policies that benefit the older generation at the cost of future generations. This would call for higher values of RSRs to induce investment if the quality of the project is good.

Furthermore, RSRs may tempt politicians to undertake projects that lower aggregate welfare but benefit the younger generation. As welfare would be reduced, politicians are less inclined to undertake such policies. But high RSR values may lead to the adoption of such inefficient projects, which in turn calls for moderate values for the RSRs.

Moreover, suppose the politician can choose among different projects leading to the same aggregate welfare. Then he might tend to invest in the projects with higher costs. This is because the costs are partially borne by the older generation and with increasing costs the welfare of the younger generation also increases if aggregate welfare stays the same. Higher welfare for the younger generation may strengthen their voting decision in his favor at date E. This can also be inferred from the left-hand diagrams of figures 1 and 2, where the dashed line increases with the costs of the project, whereas the solid line stays the same. Thus there is an incentive for politicians to burden the older generation with costs in order to obtain the approval of the younger generation and to gain from RSRs. Obviously, the older generation must be protected against exploitation. As the older generation constitutes a majority, it is unlikely that the exploitation of a majority is a potential danger to the introduction of RSRs[6].

[6]Usually, modern democratic societies have a variety of policy instruments (e.g. tax codes, income protection clauses) that protect parts of a society from excessive exploitation. E.g. in March 1983, the

Finally, one might ask whether the altruism of parents with regard to the younger generation may not make the introduction of RSRs superfluous. Of course, if altruism is sufficiently strong the older generation would support the introduction of policy projects that would increase overall welfare and utility for the younger generation. However, there are three arguments why RSRs are beneficial in such cases. First, RSRs would not cause welfare losses if altruism is strong. Second, it is plausible that even under strong altruism the old generation may discount future utility that would make RSRs welfare-improving again. Third, modern societies are characterized by a decoupling of older and younger generations (see e.g. Putnam 1995), which may undermine the strength of altruism across generations. For such societies, the introduction of RSRs may be particularly valuable.

To sum up, the introduction of RSRs appears to be robust with respect to several extensions of the basic model. Overall, the preceding discussions suggest that the value of the RSR should be set at moderate values.

6 Conclusion

In this paper we have advanced the idea that rejection/support rewards may increase the sustainability of economic systems governed by democratic systems. RSRs affect the behavior of politicians in a socially desirable way. The theoretical building-block has been a political agency model in which politicians should sometimes follow the minority preferences of future generations to achieve sustainable economic outcomes. There are several modifications of our approach that are worth pursuing. While RSRs may provide appropriate incentives, it remains to be examined how RSRs alter the pool of candidates putting themselves forward for office. Moreover, the monetary benefits of RSRs may be only one part of the private benefits that motivate politicians to serve in office. Hence, we may want to design RSRs as non-monetary utility increases.

Second Senate of the German Constitutional Court (Bundesverfassungsgericht) declared tax burdens that are excessive and would basically impair wealth to be unconstitutional because of Article 14 of the Grundgesetz (the German Basic Law) [see Grundgesetz 1949].

For instance, RSRs may involve special honors so that the politicians receiving them advance to the status of great statesmen.

Overall, we think that combining the electoral mechanism with incentive elements such as RSRs opens up a rich vein of possibilities for democracies in achieving socially desirable outcomes.

References

[1] Barro, R. (1973), "The Control of Politicians: An Economic Model", *Public Choice*, Vol. 14, 19-42.

[2] Bleicken, J. (1991), Die athenische Demokratie. UTB, Paderborn.

[3] Börsch-Supan, A. (2000), "A Model under Siege: A Case Study of the Germany Retirement Insurance System.", *The Economic Journal*, Vol. 110 No. 461, F42-45.

[4] Browning, E.K. (1975), "Why the Social Insurance Budget is Too Large in a Democracy", *Economic Enquiry*, 13, 373-388.

[5] Casamatta, G., Cremer, H. and Pestieau, P. (2000), "Political Sustainability and the Design of Social Insurance", *Journal of Public Economics*, 75, 341-364.

[6] Cline, W.R. (1992), "The Economics of Global Warming", Institute for International Economics, Washington DC.

[7] Fankhauser, S. (1995), "Valuing Climate Changes - The Economics of the Greenhouse", Earth Scan, London.

[8] Ferejohn, J.A. (1986), "Incumbent Performance and Electoral Control", *Public Choice*, 50, 5-25.

[9] Gersbach, H. (2003), "Incentive Contracts and Elections for Politicians and the Down-Up Problem", *Advances in Economic Design*, Springer.

[10] Gersbach, H., Liessem, V. (2004), "Reelection Threshold Contracts in Politics", *Cesifo Working Paper Series*, No. 622.

[11] Grundgesetz (1949), *Grundgesetz für die Bundesrepublik Deutschland*, Parlamentarischer Rat und Der Deutsche Bundestag, *http://www.bundestag.de/gesetze/gg/gg_07_02.pdf.*

[12] IPCC (2001), "Climate Change: The IPCC Scientific Assessment", Working Group 1, J.T. Houghton, G.J. Jenkins, J.J. Ephraums, Cambridge University Press, Cambridge.

[13] Myles, G. (1995), *Public Economics*, Cambridge University Press, Cambridge.

[14] Nordhaus, W.D. (1991), "To slow or not to slow: The economics of the greenhouse effect", *Economic Journal*, 101 (6), 920-937.

[15] Persson, T., Roland, G. and Tabellini, G. (1997), "Separation of Powers and Political Accountability", *Quarterly Journal of Economics*, 112, 1163-1202.

[16] Putnam, R. (1995), "Bowling Alone: America's Declining Social Capital", *Journal of Democracy*, 6(1995), 65-78.

[17] Tabellini, G. (2000), "A Positive Theory of Social Security", *Scandinavian Journal of Economics*, 102(3), 523-545.

[18] Wagner, A. (2002), "Intergenerational Transfer Schemes as Incomplete Social Contracts", *Constitutional Political Economy*, 13, 337-359.