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Vote-Buying and Growth*

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Abstract

Vote-buying is widely used by parties in developing countries to influence the outcome of elections. We examine the impact of vote-buying on growth. We consider a model with a poverty trap where redistribution can promote growth. We show that vote-buying contributes to the persistence of poverty as taxed wealthy people buy votes from poor people. We then show that there exists a democratic constitution that breaks vote buying and promotes growth. Such a constitution involves rotating agenda setting, a taxpayer-protection rule and repeated voting. The latter rule makes vote buying prohibitively costly.

Keywords: vote-buying, political economy, poverty traps, economic development, voting rules, repeated voting

JEL: D72, I20, I30, O10, P16.

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1 Introduction

Various studies suggest that vote-buying is an instrument widely used by parties in developing countries to influence the outcome of elections.[1] For example, buying votes has a long tradition in countries like Mexico, the Philippines, Senegal, Taiwan or Thailand. In the 2002 (community-level) elections in the Philippines, an estimated 3 million people were offered some form of payment. This corresponds to about 7 percent of all adults allowed to vote. In Thailand, 30 percent of the heads of households surveyed in a national sample said that they had been offered money during the 1996 general election. In Taiwan's 1999 election, 27 percent of a random sample of voters reported that they had accepted cash offers during previous electoral campaigns.[2]

However, if vote-buying exists, then the success of redistribution policies used to overcome poverty may be endangered. Vote-buying may be bad for society and may in particular prevent growth-promoting redistribution policies. There is both theoretical and empirical evidence supporting this view. Buchanan and Tullock (1962) argue that in vote markets, minority groups – for example the poor – are likely to face higher transaction costs than others, and may therefore become victims of income redistribution. Aghion and Bolton (2003) formalize the fear expressed by Schelling (1960) that vote trading tends to increase the scope of the expropriation of voters. Barro (2000) and Docquier and Tarbalouti (2001) analyze the potential effects of vote-buying on redistribution in developing countries, with special reference to economic growth. They argue that some (rich) groups may have an incentive to buy votes in order to prevent redistribution. Their main result is that vote-buying is likely to reduce growth-promoting redistribution.

The objective of this paper is twofold. First, we analyze whether vote-buying can explain the fact why democratic societies in many developing countries have been caught in a poverty trap. This is a positive analysis. We use a simple political economy model in which societies vote on growth-promoting redistribution, and combine it with the vote-buying model developed by Groseclose and Snyder (1996).[3] We show that growth-promoting redistribution is impossible, as people burdened by taxes would buy votes of poor people, and consequently, poverty persists.

[1] In the literature, different notions of "vote-buying" are discussed. For an overview see, for example, Schaffer (2006). In this paper, vote-buying is seen as a purely economic exchange where votes are traded for cash, for example.

[2] See, for example, Hicken (2002), Rigger (2002), and Schaffer (2004).

[3] The model has recently been generalized by Dekel, Jackson, and Wolinsky (2008), who allow for a sequential and alternating bidding process over multiple rounds.

Second, as a normative analysis, we suggest a set of constitutional rules that enable a society to break the negative consequences of vote-buying. Such rules must balance three requirements: proposals for growth-promoting redistributions must be made, such proposals must be approved by a majority and rich people must be protected from excessive taxation, as well as from the threat to become poor. A democratic constitution that fulfills these requirements and thus promotes growth is called a growth-promoting constitution. Our main result is that such a growth-promoting constitution exists. It consists of a repeated-voting rule, a rotating agenda-setting rule and a taxpayer-protection rule.

Repeated voting on the same proposal helps a society to break the negative consequences of vote buying. The main intuition runs as follows: Under repeated voting, a proposal that has been rejected will be brought to vote again. This procedure can be repeated a fixed number of times. Once the proposal is accepted, the process ends immediately. Such a repetition of the voting on a single proposal makes vote-buying prohibitively costly, as the buyers of votes have to pay for votes in each period.

In order to promote growth, the repeated-voting rule will be combined with rotating agenda-setting, ensuring that growth-promoting redistribution proposals are made, and with a taxpayer-protection rule guaranteeing that richer people do not slide back into poverty.

The paper is organized as follows: In the next section we outline the related literature. The basic model is presented in section 3. In section 4 we discuss the policy necessary to overcome a poverty trap. In section 5 we present the vote-buying model and we outline the political framework. In section 6 we show that if vote-buying is possible, overcoming a poverty trap is not possible. In section 7 we introduce repeated voting and show that a growth-promoting constitution exists under vote-buying. Section 8 concludes.

2 Review of the Literature

This paper is related to two different strands of the literature. First, there is a large literature dealing with the existence and persistence of poverty traps. Our focus on human capital and redistribution in a model with a poverty trap starts from the seminal contribution of Galor and Zeira (1993) (see also the important contribution of Azariadis

(1996) and the survey of Azariadis and Stachurski (2005)). Additionally, poverty traps are often connected with child labor, because poverty often means that children have to work to supplement the family's income. There is also a large literature on this subject. For an overview, see Basu and Tzannatos (2003) and Jafarey and Lahiri (2001).

Second, this paper refers to the constructive constitutional economics approach which goes back to Buchanan and Tullock (1962). This approach deals with the design of new constitutional rules that might be helpful in democratic decision-making. Recent papers on constitutional design focus on optimal majority rules in the context of reforms and public goods provision.[4] In this paper, we examine how democratic rules, such as a taxpayer-protection rule and a repeated voting rule, can help to ensure that proposals for growth-promoting redistributions are made, such proposals are approved by a majority and rich people are protected from excessive taxation and from the threat to become poor. In the concluding section we comment on how such constitutions might be implemented.

3 The Basic Model

3.1 Output Production and Human Capital Formation

We consider an OLG model in which individuals live for two periods and where human capital accumulation is a major source of economic growth. These periods are labeled childhood and adulthood, respectively. For simplicity, we assume that each household comprises one adult and one child. We consider a society $\Omega = \{1, \ldots, n\}$ consisting of $n > 3$ households, where n is assumed to be odd.[5] A generic household is indexed by i. In the basic model, all households are alike and we drop the index.

We now turn to output production and consider an aggregate consumption good. For simplicity, let us assume that the human capital of adults is the only input factor needed for production and that all output will accrue to the households as income. We use $\lambda_t \in [1, \infty)$ to denote the human capital of an adult in period t. The condition $\lambda = 1$ for the society as a whole can be thought of as a state of backwardness. The level of output in period t produced by an adult who has a human capital endowment

[4] See, for example, Aghion and Bolton (2003), Aghion, Alesina, and Trebbi (2004), and Gersbach (2004).

[5] This assumption is not essential, but it simplifies our analysis, as it eliminates the possibility of a draw.

of λ_t is given by

$$y_t = \alpha \lambda_t, \tag{1}$$

where $\alpha \in (0, \infty)$ denotes the marginal productivity of human capital.

We now turn to the formation of human capital. We assume that in period t adults can make educational investments, i.e. they can use part of their income to invest in the human capital of their children. We use $e_t \in [0, \infty]$ to denote the educational investments of an adult in period t. These costs can be interpreted in different ways. For instance, they may be the direct costs of school attendance. If school attendance is free of charge they may represent foregone income, as schooling may reduce the time children can contribute in household production. The child's human capital endowment on reaching adulthood at time $t+1$ is given by

$$\lambda_{t+1} = h(e_t) + 1. \tag{2}$$

The function $h(\cdot)$ represents the human capital technology. $h(\cdot)$ is assumed to be a continuous, strictly increasing and differentiable function in e_t, where $h(0) = 0$, i.e. no investments in education, lead to a human capital level amounting to 1. Equation (2) implies that educational investments are necessary for the formation of human capital in the next generation, i.e., for $\lambda_{t+1} > 1$.

3.2 The Household's Behavior

We assume that all allocative decisions lie in the adult's hands. We rule out any bequests and the possibility of debts, so that (1) is the current real income used entirely for consumption,[6] denoted by c_t, and educational investments e_t. The family's budget constraint is given by

$$c_t + e_t \leq y_t. \tag{3}$$

Adults are assumed to be altruistic, i.e. they want to maximize current consumption and educational investments for their children. Let the adult's preference ordering be representable by the continuous, strictly increasing, differentiable, strictly quasi-

[6] Consumption includes the consumption of the adult and of the child which is often viewed as a fixed fraction of the adult's consumption.

concave function $u(c_t, e_t)$ and consider the problem

$$\begin{aligned} \max_{c_t, e_t} \{u(c_t, e_t)\} \qquad & \text{subject to} \\ c_t + e_t &\leq \alpha \lambda_t \\ e_t,\, c_t &\geq 0. \end{aligned} \tag{4}$$

In view of the assumptions on $u(\cdot)$, this problem has a unique solution, denoted by $(c^o(\lambda_t), e^o(\lambda_t))$, which is continuous in λ_t.

We make the following two assumptions regarding the optimal choices of $(c^o(\lambda_t), e^o(\lambda_t))$:

- Altruism is only operative if the human capital of adults is sufficiently large. Therefore, we assume that there exists a critical value $\lambda^S > 1$ such that

$$\begin{aligned} e^o(\lambda_t) &= 0 \quad \forall\ \lambda_t \leq \lambda^S, \\ e^o(\lambda_t) &> 0 \quad \forall\ \lambda_t > \lambda^S. \end{aligned} \tag{5}$$

- Both goods are non-inferior, i.e.

$$\begin{aligned} \frac{\partial c^o(\lambda_t)}{\partial \lambda_t} &> 0 \quad \forall\ \lambda_t \geq 1, \\ \frac{\partial e^o(\lambda_t)}{\partial \lambda_t} &> 0 \quad \forall\ \lambda_t > \lambda^S. \end{aligned} \tag{6}$$

A typical example that satisfies both assumptions are Stone-Geary preferences, which are widely used in development economics (see, e.g., Basu and Van (1998) and Bell and Gersbach (2008)). These preferences are given by:

$$u(c_t, e_t) = \begin{cases} (c_t - c^S)\, e_t & \text{if } c_t \geq c^S \\ c_t - c^S & \text{otherwise,} \end{cases}$$

where c^S is the critical consumption level above which adults are motivated to invest in schooling. Hence, $\lambda^S = \frac{c^S}{\alpha}$. It is readily verified that condition (6) holds.

3.3 Dynamics

Returning to (2) in the light of (5), we obtain

$$\lambda_{t+1} = \begin{cases} 1 & \forall \lambda_t \leq \lambda^S \\ h(e^o(\lambda_t)) + 1 & \forall \lambda_t > \lambda^S. \end{cases} \tag{7}$$

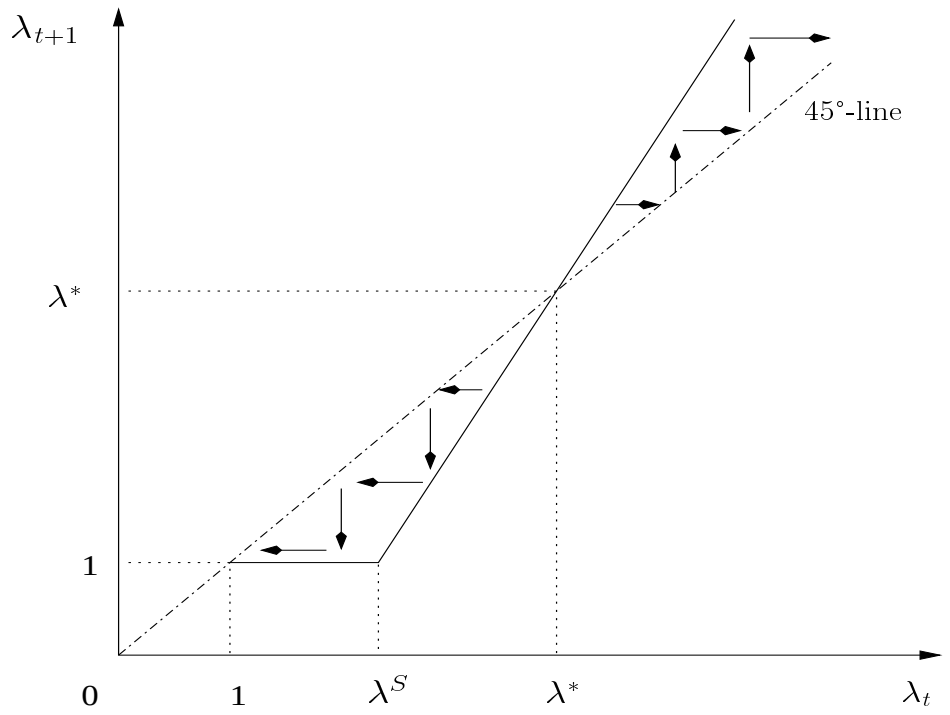

Figure 1: Human capital formation

In view of the assumption that $\lambda^S > 1$, it follows from the first part of (7) that the state of backwardness ($\lambda = 1$ for the society as whole) is a locally stable steady state. Henceforth, we will refer to this steady state as the poverty trap.

To describe the dynamic of (7) for all $\lambda_t > \lambda^S$, we have to consider the following derivative

$$\frac{d\lambda_{t+1}}{d\lambda_t} = \frac{\partial h\left(e^o\left(\lambda_t\right)\right)}{\partial e^o\left(\lambda_t\right)} \cdot \frac{\partial e^o(\lambda_t)}{\partial \lambda_t} \tag{8}$$

which is strictly positive, as $\frac{\partial h(e^o(\lambda_t))}{\partial e^o(\lambda_t)} > 0$ and $\frac{\partial e^o(\lambda_t)}{\partial \lambda_t} > 0$ for all $\lambda_t > \lambda^S$.

In the following, we consider the case where the human capital technology is sufficiently productive, i.e.

$$\frac{\partial h\left(e^o\left(\lambda_t\right)\right)}{\partial e^o\left(\lambda_t\right)} \cdot \frac{\partial e^o(\lambda_t)}{\partial \lambda_t} > 1$$

for all $\lambda_t > \lambda^S$. In this case, there exists a second threshold λ^* ($\lambda^* > \lambda^S$), which is given as follows

$$\lambda_{t+1} = \lambda^* = h\left(e^o\left(\lambda^*\right)\right) + 1.$$

λ^* is a second stationary level of human capital, where adults and their offspring share the same level of human capital. Note that λ^* is an unstable steady state. The dynamic of our model is shown in Figure 1.

Figure 1 illustrates how long-term growth depends on the size of educational investments made by the adults, which, in turn, depends on their human capital level. For example, if the educational investments $e_t^o(\lambda)$ of the adults in period t are not sufficiently large, i.e. $e_t^o(\lambda) < e^o(\lambda^*)$, then the human capital of these children and their offspring will be smaller than λ^* in subsequent periods, and subsequent generations will fall back into the poverty trap. However, if the adults choose $e_t^o(\lambda) > e^o(\lambda^*)$, then the human capital of these adults' descendants in the subsequent periods will be greater than λ^* and human capital will grow in subsequent periods.

In short, overcoming the poverty trap requires that uneducated individuals have to be given sufficient support for the adults to be able to choose $e^o(\lambda_t) > e^o(\lambda^*)$. In the following, we will call an individual educated if his human capital is larger than λ^*, i.e. if he will afford schooling for his offspring, that yields increasing human capital and output. Moreover, we will call a society educated if all its members have human capital larger than λ^*.

It is important to stress that growth-promoting redistribution is optimal for the society from a utilitarian perspective taking into account all generations if future generations have a sufficiently high weight, i.e. the discount factor is not too low. This justification rests on the following externality: The improvements in all future generations welfare that stem from a better education of today's children are not fully reflected in the preferences of today's parents. This hold, as parents care about their children's education, but not about what happens subsequently. If, as arguable, the social planner has a longer time-horizon than individual households, then the case for redistribution to promote schooling is, in principle, established (cf. Bell and Gersbach (2008)).

4 Redistribution to Overcome Poverty

In the following, we assume that the whole society is initially ($t = 0$) in a state of backwardness, i.e.

$$\lambda_0^i = 1 \ \ \forall i \in \Omega,$$

which represents a worst-case scenario.[7] The broad policy objective is to educate the whole society in order to enable all its members to escape from this backwardness, i.e.

$$\lambda^i > \lambda^* \ \ \forall i \in \Omega.$$

The instruments for this purpose are taxation and subsidization. Let τ_t^i denote the tax levied on the income of household i in period t. At the beginning of each period t, some individuals will be subsidized from the ensuing tax revenue. We use s_t^i to denote the subsidy each household i will receive in period t. We suppose that households are either taxed or subsidized. Since households in a state of backwardness have few resources, we assume that there is a subsistence level c^{sub} for an adult-child household that must be guaranteed under all circumstances. The taxation of a household i caught in the poverty trap is therefore assumed to be constrained by

$$\alpha - \tau_t^i \geq c^{sub},$$

where α is the income of households with $\lambda_t = 1$. In particular, the tax must fulfill the following condition:

$$\tau_t^i \leq \alpha - c^{sub} =: \tau^{sub}$$

Next, we assume that $\tau^{sub} > 0$. It is plausible for τ^{sub} to be small, as households caught in the poverty trap may already be close to the subsistence level c^{sub}.

We define s^* as the subsidy a household that is in a state of backwardness needs to achieve a human capital level of λ^* in the subsequent period. Hence, s^* is given by the implicit equation

$$h\left(e^o\left(\alpha + s^*\right)\right) + 1 = \lambda^*.$$

In order to overcome the poverty trap permanently, uneducated individuals have to be given sufficient support for educational investments that yield increasing human capital. Accordingly, we define $\overline{s}$ as the subsidy a household in a state of backwardness needs to achieve a human capital level larger than λ^* in the subsequent period. Hence, $\overline{s}$ is given by the equation

$$\overline{s} = s^* + \epsilon,$$

where ϵ is arbitrarily small, but positive.

[7]Note that in reality, income distribution in developing countries is typically unequal. In the following sections, we show that our results also hold true if we assume that there initially exists a minority of "educated" rich households.

We now look at households that have received subsidies of at least $\overline{s}$, i.e. $\lambda_t^i > \lambda^*$. If taxation of such households is very high, education of the offspring will be low and their human capital may fall below λ^*. Such a slide back into poverty does not happen if

$$\alpha\lambda_t^i - \tau_t^i \geq \alpha + \overline{s},$$

which defines an upper level for the taxes of educated households, denoted by τ^*:

$$\tau_t^i \leq \alpha\left(\lambda_t^i - 1\right) - \overline{s} =: \tau^*$$

The total government revenues in period t are denoted by B_t. The budget constraint in a period t is given by

$$B_t = \sum_{i=1}^{n} \tau_t^i \;\geq\; \sum_{i=1}^{n} s_t^i$$

Throughout the paper, we assume that $\frac{n-1}{2}\tau^{sub} \geq \overline{s}$. That is, the taxation of $(n-1)/2$ uneducated households is sufficient to subsidize at least one uneducated household with $\overline{s}$.

5 The Vote-buying Game

5.1 The Game Form

In the following, we consider the case where individuals who will be taxed if the proposal is implemented (henceforth called *taxpayers*) may engage in up-front vote-buying. Up-front vote-buying is a binding agreement that gives an individual full control of the vote of another individual in exchange for an up-front payment.

We assume that vote-buying is legally forbidden, but the agenda setter cannot observe which individuals are purchased and which are not. This implies that vote buyers and sellers face no risk of punishment. Since the agenda setter is aware of vote-buying, he may have an incentive to make a proposal which includes subsidy payments to untaxed individuals, to make vote-buying expensive.

We consider the possibility of taxpayers forming a coalition to prevent the adoption of a redistribution proposal by vote-buying. For simplicity, we assume that each taxpayer in the coalition will have the same bargaining power, i.e. if the taxpayers form a coalition to engage in vote-buying, each taxpayer has to pay the same amount. Moreover, we assume that the coalition of taxpayers can monitor the casting of votes by the purchased

individuals and can prevent deviations. In reality, there are several strategies for the vote buyers to generate and enforce compliance.[8] For example, vote buyers can instruct voters to fold the ballot in a distinctive way, or to put a pinhole in one corner of the ballot such that vote buyers can easily verify whether the voters have voted as instructed. Another way is to give a voter a fake or stolen pre-marked ballot before entering the polling station. The voter casts the filled-in ballot and gives the official blank ballot to another voter waiting outside. This voter fills out the (received) ballot to the buyer's satisfaction, and goes back into the polling station and repeats the process. Another common practice is to pay voters to abstain from voting, thereby preventing them from casting ballots for the opponent.

We apply the vote-buying game developed by Groseclose and Snyder (1996). We consider a sequential game with the agenda setter moving first and the coalition of taxpayers moving last. This assumption could be justified with the observation that the payments for votes by the agenda setter are part of his proposal and if it is costly to change proposals – which we will assume in the following – then the coalition of taxpayers is indeed able to move last.

We now turn to the sequence of the vote-buying game. The timing of events in period t can be summarized as follows:

1. An individual is randomly chosen to set the agenda. The agenda setter either announces a redistribution proposal or makes no proposal.
2. If the agenda setter announces a proposal, then
   (i) the taxpayers can form a coalition and decide on the basis of this proposal whether or not to buy votes;
   (ii) vote-buying does or does not take place;
   (iii) the society holds a vote on the implementation of the proposal;
   (iv) the proposal is adopted if it receives more votes than required by some voting rule.

The status quo will prevail if the agenda setter makes no proposal or if a redistribution proposal is not adopted. At the vote-buying stage, individuals know who will be taxed and who will receive subsidies if a proposal is accepted. In particular, at this point

[8] Schaffer (2006) gives a description of a number of strategies available to vote buyers to generate and enforce compliance.

in time, the coalition of taxpayers is perfectly informed about the offers made by the agenda setter.

5.2 Constitutional Rules

In this section, we explore the capacity of democratic constitutions to promote growth. Such a constitution is a set of rules that specify how the agenda setter is chosen and how decisions are taken. In order to give democracy a good chance to overcome poverty, we introduce the following set of rules:[9]

The democratic agenda-setting process is specified as follows:

- *Rotating agenda setting* (**RoA**): The agenda setter is selected randomly.[10] In the first period, each individual i has the opportunity to make a proposal. In the subsequent periods, only individuals who have not set the agenda in previous periods can apply for agenda setting. Each individual i allowed to make a proposal has the same chance of setting the agenda.

This rule implies that the number of permitted reelections is zero. It ensures that each individual will be the agenda setter at some point in time and will therefore have the chance to make an education-enhancing redistribution proposal on which the society will hold a vote.

Moreover, we assume that a proposal has to satisfy the following agenda rule:

- *Balanced budget* (**BB**): A proposal has to satisfy a balanced budget, i.e.,

$$\sum_{i=1}^{n} \tau_t^i - \sum_{i=1}^{n} s_t^i = 0, \quad \forall t.$$

By requiring a balanced budget in each period, the possibility of capital market-financed subsidies for education is excluded. Thus, we analyze a worst-case scenario in the following. Obviously, a society that can be educated without access to capital markets can also be educated if it has access to them.

[9] Indeed, Gersbach and Siemers (2005) show that without vote-buying the set of rules introduced in this subsection induce education-promoting redistribution and growth.

[10] Random selection is widely used in the literature on political science and political economy (see for example, Baron and Ferejohn (1989) and Mueller, Tollison, and Willet (1972)), and it is commonly seen as a decision rule generally accepted by individuals.

As a decision rule, we use a variant of the flexible majority rules (see, e.g. Gersbach (2004)) in order to limit the taxation of educated households, so that they do not fall back into poverty. We define

$$\tau_t^{max} = \max_{i \in \Omega} \ \tau_t^i.$$

- *Threshold flexible majority rule* $\left(\mathbf{TFM}[\tau_t^{max}, \overline{\tau}]\right)$: Under this rule, the share of votes needed to implement a proposal, denoted by $m(\tau_t^{max}, \overline{\tau})$, jumps from $\frac{1}{2}$ (simple majority) to 1 (unanimity) if any individual i is taxed higher than the threshold tax $\overline{\tau}$ stated in the constitution:

$$m(\tau_t^{max}, \overline{\tau}) = \begin{cases} \frac{1}{2} & \text{if} \quad \tau_t^{max} \leq \overline{\tau}; \\ \\ 1 & \text{if} \quad \tau_t^{max} > \overline{\tau}. \end{cases}$$

The flexible majority rule effectively operates as tax protection rules. It ensures that a winning majority for the proposal can be obtained if and only if educated adults are not taxed adversely, i.e. if $\tau_t^{max} \leq \ \overline{\tau}$. As soon as an agenda setter suggests an adverse tax scheme, i.e. $\tau_t^{max} > \overline{\tau}$, the constitution requires unanimous agreement, which, de facto, makes expropriation impossible to implement. A particular form for m of such threshold flexible majority rules is to set $\overline{\tau} = \min\{\tau^{sub}, \tau^*\}$. Recall that τ^{sub} is the highest taxation allowed for households in a state of backwardness, while τ^* is the highest tax burden for an already-subsidized household that does not endanger educational investments in the future. Hence, the minimum of τ^{sub} and τ^* ensures that uneducated households will not fall below the subsistence level, and educated households will not fall back into the poverty trap.

5.3 Equilibrium Concept

Given the constitutional rules described in subsection 5.2, we will look at subgame-perfect equilibria in the vote buying game. It is convenient to introduce the following tie-breaking rule for agenda setting. We assume

- **TR 1**: Individual i will apply for agenda setting if and only if he can strictly improve his utility by agenda setting.

That is, the agenda setter expects that he can make a proposal with $s_t^{ag} > 0$ that will be adopted. Alternatively, we can assume that there are small, but positive fixed costs for agenda setting.

5.4 Voting Behavior of Unbribed Individuals

In this subsection, we examine the voting behavior of unbribed individuals. Recall that we have assumed that a proposal either levies taxes on individuals (including a zero tax rate), or provides subsidies. Obviously, taxpayers will vote against the proposal, whereas subsidized individuals who have not been bribed will support it. If an unbribed individual i is neither taxed nor subsidized, then he is indifferent between supporting and rejecting the proposal. As a tie-breaking rule, we assume

- **TR 2**: An unbribed individual i will support the proposal if

$$s_t^i = \tau_t^i = 0.$$

5.5 Incentives to Buy and Sell Votes

In the next step, we examine the incentives to buy and sell votes. The incentive of the coalition of taxpayers to buy votes depends on whether the agenda setter proposes an adverse tax scheme or not. If the tax scheme satisfies $\tau_t^{max} > \overline{\tau}$, then unanimity rule prevails. In this case, there is no need for the taxpayers to engage in vote-buying, as each individual has the power to vote a proposal down.

If the agenda setter suggests a tax scheme with $\tau_t^{max} \leq \overline{\tau}$, the simple majority rule prevails. Given this situation, the agenda setter and the coalition of taxpayers will be interested in obtaining a majority of votes for and against the proposal respectively, while spending as little as possible. That is, they will compete for the votes of the individuals who will not be taxed if the proposal is accepted. We now turn to the payment promises made by the agenda setter and by the coalition of taxpayers to the untaxed individuals. We define

$$NT = \{i \in \Omega \mid \tau_t^i = 0 \ \wedge \ i \neq ag\}$$

as the set of untaxed individuals in which the agenda setter is not included. Let s_t^i denote the offer from the agenda setter to the untaxed individual $i \in NT$, and let p_t^i denote the payment offer of the coalition of taxpayers to the untaxed individual $i \in NT$.

Both the agenda setter and the coalition of taxpayers have an incentive to bribe untaxed individuals if and only if, the expected tax revenues B_t, are at least as high as their total payment promises to the untaxed individuals. If this is not the case, vote-buying

will not occur. Alternatively, B_t can be interpreted as the budget or the willingness to pay for implementing and preventing the proposal, on the part of the agenda setter and the coalition of taxpayers, respectively.

The incentives of these individuals can be formalized as follows:

- **VB(1)**: The agenda setter will buy votes if and only if

$$B_t \geq \sum_{i \in NT} s_t^i, \quad \text{with } s_t^i \geq 0$$

- **VB(2)**: The coalition of taxpayers will buy votes if and only if

$$B_t \geq \sum_{i \in NT} p_t^i \quad \text{with } p_t^i \geq 0$$

The preference of both the agenda setter and the coalition of taxpayers is to win at minimal cost. In equilibrium, the agenda setter's winning utility is

$$s_t^{ag} = B_t - \sum_{i \in NT} s_t^i \geq 0$$

and his losing utility is zero, where s_t^{ag} is the subsidy for the agenda setter and $\sum_{i \in NT} s_t^i$ the total of all payments incurred by the agenda setter (including zero subsidies to some of the untaxed individuals). By contrast, in equilibrium, the utility from winning for the coalition of taxpayers amounts to $-\sum_{i \in NT} p_t^i$ and its utility from losing is $-B_t$, where $\sum_{i \in NT} p_t^i$ is the total of all payments incurred by the coalition (including zero-payment offers to some of the untaxed individuals) and

$$B_t - \sum_{i \in NT} p_t^i \geq 0$$

is the value from winning if the majority votes against the proposal in equilibrium. Note that the coalition of taxpayers will only engage in vote-buying if it knows that it will win in equilibrium. Otherwise, the coalition will not buy any votes, as the money would be wasted.

We now regard the untaxed individuals, who may have incentives to sell their votes to the coalition of taxpayers. As vote-buying is illegal, we assume that there are positive moral costs of vote-selling, denoted by ϕ.[11] A bribed individual i will support the

[11] Alternatively, we can drop the assumption that the risk for vote sellers to be arrested and punished is zero, and assume instead that there is a small, but positive probability that the agenda setter can observe which individuals have been bought by the coalition of taxpayers. In this case, ϕ could also be interpreted as a risk premium demanded by the vote sellers to compensate the risk of being arrested and punished.

proposal if $s_t^i + \phi > p_t^i$ and reject it if $s_t^i + \phi < p_t^i$. If $s_t^i + \phi = p_t^i$, then the bribed individual i will be indifferent between supporting and rejecting the proposal. As a tie-breaking rule, we assume

- **TR 3**: A bribed individual i will sell his vote to the coalition of taxpayers if

$$s_t^i + \phi = p_t^i.$$

6 The Impossibility Result

In this section, we examine the outcome of the entire game with constitutional rules as set out in subsection 5.2 and the tie-breaking rules TR 1 – TR 3. We use T to denote the number of periods a democratic society needs to educate itself. Recall our assumption that initially ($t = 0$), the whole society is in a state of backwardness, i.e. $\lambda_0^i = 1 \ \forall i \in \Omega$. If vote-buying is possible, we obtain the following result:

Proposition 1
Consider the case of a democracy with a constitution that provides for:

- *rotating agenda setting (RoA)*[12]
- *threshold flexible majority rule (TFM[$\tau_t^{max}, \overline{\tau}$]), with $\overline{\tau} = \min\{\tau^{sub}, \tau^*\}$*
- *balanced budget (BB)*

Such a democracy cannot educate a society in finite time, i.e. $T = \infty$, if vote-buying is possible and if the moral costs of vote-selling are sufficiently small, that is, if

$$\phi < \frac{(n-3)\tau^{sub}}{(n-1)(n-2)}.$$

The proof is given in the appendix.

The reason for the result of Proposition 1 is the following: Suppose that the randomly-chosen agenda setter in $t = 0$ makes a proposal where he taxes at most $(n-1)/2$ individuals with τ^{sub} to subsidize himself and other untaxed individuals. As the agenda setter knows that the taxpayers can form a coalition after he has announced a proposal and buy the "cheapest" untaxed individuals of his proposal, the best thing he can do is to make a proposal with equal subsidies to all untaxed individuals. By contrast, the

[12] If there is a dynasty that holds the agenda setting power, a society has a priori no possibility to overcome the poverty trap, as is evident from the proof of Proposition 1.

coalition of taxpayers has the advantage of buying only a small number of untaxed individuals to form a simple majority against the proposal, as all taxpayers will vote against the proposal. Moreover, it is sufficient to offer these individuals slightly more than the subsidies of the agenda setter and the moral costs of vote-selling together to win their votes. If the moral costs of vote-selling are not too large, then vote-buying is always profitable for the coalition of taxpayers. This, in turn, implies that no proposal made by the agenda setter would ever be accepted, because a majority would always vote against it. Since the agenda setter expects that he cannot strictly improve his utility by agenda setting, he will refuse to make a proposal. The preceding argumentation holds true for every period t. Hence, the education of a society is not possible in finite time, and the economy remains in a state of backwardness.

The result of Proposition 1 also applies to societies where a share of individuals is already educated.

Corollary 1

Consider a society where some individuals are already educated, i.e. $\lambda_0 > \lambda^*$ *holds for these individuals. A constitution with RoA, BB, and TFM cannot educate such a society in finite time if the moral costs of vote-selling are sufficiently small.*

The proof of this statement follows the same logic as the proof of Proposition 8 and is therefore omitted.

Corollary 1 states that the failure in the education of a society does not depend on the fact that the whole society is initially in the poverty trap. The reason for this result is the following: If some individuals are already rich and educated, the size of the expected tax burden may change. A change in the expected tax burden, however, affects the vote-buying budget of the agenda setter and of the coalition of taxpayers in the same way. As the coalition of taxpayers will make its payment offers to the poor untaxed individuals after the agenda setter has announced his proposal, the advantage of buying only a small number of untaxed individuals remains. Hence, the coalition of taxpayers is still able to bid in such a way that the proposal of the agenda setter will be rejected, as long as the moral costs of vote-selling are sufficiently small.

7 Repeated Voting

To eliminate the negative impact of vote-buying, we introduce repeated voting.[13] The additional agenda rule is described as follows:

- *Repetition of Voting* (**RoV[R]**): If the proposal of an agenda setter i is rejected, the voting on that proposal will be repeated. A vote will be repeated R times. If the proposal is accepted, voting ends. However, if the proposal is rejected R times, the status quo prevails.

We now describe the sequence in period t in more detail. At the beginning of period t, the agenda setter is allowed to make a proposal. In the next stage, the society holds a vote on the implementation of this proposal. If a majority votes in favor of the proposal, it is accepted. Otherwise, there will be a new vote on this one. If the project is rejected again, then there will be a yet another vote on this subject. This procedure will be repeated as long as the proposal is not accepted. However, repetition of voting stops if the proposal is rejected R times. In this case, the status quo will prevail. If the buying of votes is possible, we obtain

Proposition 2
Consider the case of a democracy with constitution that provides for:

- *rotating agenda setting (RoA)*
- *threshold flexible majority rule (TFM[$\tau_t^{max}, \overline{\tau}$]) with* $\overline{\tau} = \min\{\tau^{sub}, \tau^*\}$
- *balanced budget (BB)*
- *repetition of voting (RoV[R])*

and the number of possible voting repetitions amounts to

$$R = \lceil R^* \rceil \quad with \quad R^* = \frac{(n-1)\tau^{sub}}{2\phi}, \quad \phi > 0.$$

Such a democracy can educate a society in finite time, i.e., $T < \infty$*, if vote-buying is possible.*

[13] We will use repeated voting to break the blockade against education-enhancing proposals induced by vote-buying. Repeated voting may also have other virtues. For example, Morton (1988) has shown that agents can acquire information on voter preferences by observing the results of early referenda and use that information in formulating a strategy for subsequent referenda. Repeated voting is actually applied in practice. For instance, the possibility of repeated referenda is allowed in the constitutions of the Republic of Tajikistan (1995) or of Slovakia (1992) (see, e.g., Article 31 of the Constitutional Law of Republic of Tajikistan on a Referendum, or Article 99 of the Constitution of the Republic of Slovakia).

Note that $\lceil R^* \rceil$ denotes the minimal natural number larger than or equal to R^*. The proof of Proposition 2 is given in the appendix.

The reason for the result of Proposition 2 is the following: Suppose that the randomly-chosen agenda setter in $t = 0$ makes a proposal where he taxes at most $(n-1)/2$ individuals with τ^{sub} to subsidize himself with $\overline{s}$. The possibility of repeated voting makes vote-buying prohibitively costly, as the coalition of taxpayers has to buy at least one untaxed individual in each voting to form a minimal coalition against the proposal. If the number of possible voting repetitions is sufficiently large, then vote-buying would not be profitable for the coalition of taxpayers, since the total payments needed to prevent the implementation of the proposal would outweigh tax demand in the first round. Hence, it is optimal for the coalition of taxpayers not to engage in vote buying in the first round. According to TR 2, all untaxed individuals will vote in favor of the proposal in the first vote, which implies that the proposal of the agenda setter will be accepted. The rotating agenda-setting rule ensures that each poor individual will have the right to set the agenda in the future, which implies that all individuals will receive the required transfer $\overline{s}$. The threshold flexible majority rule guarantees that educated rich people are not excessively taxed and become poor. Hence, a constitution consisting of RoV, RoA and TFM promotes growth. As a result, the society will be educated in finite time.

However, it is clear that RoV will only work if repeated voting actually reduces the wealth of the vote buyer. The success of a constitution consisting of RoV, RoA and TFM might conceivably be endangered by "long-term vote-buying contracts". A long-term vote-buying contract is a binding agreement that gives the vote buyer full control of the vote of another individual for more than one vote, in exchange for an up-front payment. However, we believe that in reality, long-term vote-buying contracts are not feasible. The reason is that vote-buying contracts are illegal, therefore they cannot be enforced by courts.

In our analysis, we have considered a society where the moral costs of vote-selling are relatively small, where vote buyers and sellers face no risk of punishment, and where vote buyers can monitor the casting of the votes they bought perfectly. These features tend to apply to many developing countries. If we considered a society where, for example, the risk of being punished is very high or where the moral costs of vote-selling are large, vote-buying would be prohibitively costly and thus less attractive. This tends to hold for industrial countries.

8 Conclusions

This paper has provided two insights. First, we have shown that if agents can trade votes, and if the moral costs of vote-selling are not too large, the education of a democratic society is impossible. Hence, this society will remain in the poverty trap. This pessimistic result is due to the fact that the potential losers from redistribution have strong incentives to buy votes to prevent redistribution. This impossibility result may provide one possible explanation as to why many developing countries have been caught in the poverty trap for such a long time.

Second, we have shown that a constitution consisting of a repeated voting rule, a rotating agenda-setting rule and a threshold flexible majority rule enables a society to escape the poverty trap if vote-buying is possible, as the opportunity of repeated voting makes vote-buying prohibitively costly, and therefore unattractive for the taxpayers. The threshold flexible majority rule guarantees that rich people are not taxed excessively, which would impoverish them. Rotating agenda-setting ensures that each individual will have his turn in agenda-setting and will receive his growth-promoting transfers.

Numerous issues deserve further scrutiny. For instance, it is important to look into the opportunities to introduce a growth-promoting constitution. While, in principle, the standard "veil of ignorance" argument could be used, in overlapping generation models, it may be sensible to use the requirement that the current generation of adults must support a new constitution. In such circumstances, delayed implementation could be used, which works as follows.[14] Consider a proposal to introduce the growth-promoting constitution, coupled with the requirement that the constitution can only be abolished by a qualified majority. Moreover, suppose that if accepted, the constitution would become effective only after a delay – after the old generation has died. Then, as long as the current generation of adults is minimally and equally concerned[15] about the well-being of its children and grand-children, the current generation of adults will favor the proposal. The high majority hurdle for its abolishment would ensure that the rule will not be eliminated once it has been introduced.

[14]Delayed implementation is a common practice. An example has recently taken place in Germany, where the increase of the official retirement age from 65 to 67 will become effective only after the current old generation has retired (See Deutscher Bundestag, 2006).

[15]It suffices that there is a very small level of altruism.

Appendix: Proofs

Proof of Proposition 1

In the following, we show that there exists a unique subgame-perfect equilibrium in the voting buying game with constitutional rules TFM, RoA and BB and the tie-breaking rules TR 1 – TR 3 in which the randomly chosen agenda setter makes no redistribution proposal if the moral costs of vote-selling are sufficiently low.

In order to prove the result, we proceed in three steps. In the first and in the second step, we examine the second stage of the voting game, i.e. the subgame that follows if the agenda setter has made a proposal in the first stage. In the third step, we consider the first stage of the voting game. We use the results of step 1 and 2 to identify the subgame-perfect Nash equilibrium of the entire game in step 3.

Step 1:

Consider a proposal where the agenda setter taxes at most $(n-1)/2$ individuals and he uses a part of the tax revenues B_t to subsidize himself ($s_t^{ag} > 0$) and the remaining part of the tax revenues ($B_t - s_t^{ag}$) to subsidize untaxed individuals to form a coalition which supports his proposal. In the following, we will use $\mathcal{T}$ ($0 < \mathcal{T} \leq \frac{n-1}{2}$) to denote the number of taxed individuals and $\mathcal{S}$ to denote the number of untaxed individuals which receive positive subsidies. Accordingly, the maximal number of untaxed individuals which the agenda setter can subsidize amounts to $n-1-\mathcal{T}$, i.e. $0 \leq \mathcal{S} \leq n-1-\mathcal{T}$.

Recall that the taxpayers will form a coalition and bribe the $\frac{n+1}{2} - \mathcal{T}$ least expensive untaxed individuals if condition VB(2) holds. To make vote-buying most expensive and thus least attractive for coalition of taxpayers, we consider proposals where the agenda setter makes equal subsidies to all individuals he subsidizes. That is, all subsidized individuals receive the same subsidy which is given by $s_t = \frac{B_t - s_t^{ag}}{\mathcal{S}}$.

We now show that the total bribes of the coalition of taxpayers needed to defend the proposal of the agenda setter are maximal, if the agenda setter makes a proposal with equal subsidies for all $n-1-\mathcal{T}$ untaxed individuals.

If $0 \leq \mathcal{S} \leq \frac{n-3}{2}$, then, according to TR 3, the coalition of taxpayers can defeat the proposal of the agenda setter by paying ϕ to $\frac{n+1}{2} - \mathcal{T}$ non-subsidized individuals. The

total bribes of the coalition of taxpayers, denoted by P, for $\mathcal{S} \leq \frac{n-3}{2}$ are then given by

$$P = \left(\frac{n+1}{2} - \mathcal{T}\right)\phi. \tag{9}$$

If $\frac{n-3}{2} < \mathcal{S} \leq n-1-\mathcal{T}$, then, according to TR 3, the coalition of taxpayers has to pay $s_t + \phi$ to $\mathcal{S} - \frac{n-3}{2}$ subsidized individuals and ϕ to the remaining $n-1-\mathcal{T}-\mathcal{S}$ non-subsidized individuals to form a least expensive majority against the proposal. The total bribes of the coalition of taxpayers for $\mathcal{S} > \frac{n-3}{2}$ are given by

$$\begin{aligned} P &= (n-1-\mathcal{T}-\mathcal{S})\,\phi + \left(\mathcal{S} - \frac{n-3}{2}\right)(s_t+\phi) \\ &= \left(\frac{n+1}{2} - \mathcal{T}\right)\phi + \left(\mathcal{S} - \frac{n-3}{2}\right)\frac{B_t - s_t^{ag}}{\mathcal{S}} \end{aligned} \tag{10}$$

where we have used the fact that $s_t = \frac{B_t - s_t^{ag}}{\mathcal{S}}$ for each subsidized individual. Comparing (9) with (10) yields that the total bribes for the coalition of taxpayers are larger if $\frac{n-3}{2} < \mathcal{S}$. Moreover, analyzing (10) yields that total bribes for the coalition of taxpayers are maximal if $\mathcal{S} = n-1-\mathcal{T}$, as P is strictly increasing in $\mathcal{S}$.

Step 2:

In the second step, we show that, given the moral costs of vote-selling are sufficiently low, it is always profitable for the coalition of taxpayers to engage in vote-buying, even if the agenda setter makes a proposal with equal subsidies to all $n-1-\mathcal{T}$ untaxed individuals.

For $\mathcal{S} = n-1-\mathcal{T}$, the total bribes of the coalition of taxpayers are given by

$$P(n-1-\mathcal{T}) = \left(\frac{n+1}{2} - \mathcal{T}\right) \cdot \left(\frac{B_t - s_t^{ag}}{n-1-\mathcal{T}} + \phi\right). \tag{11}$$

Note that initially all individuals are caught in the poverty trap ($\lambda_0^i = 1 \ \forall i \in \Omega$). According to TFM, τ^{sub} is the highest taxation allowed for households in a state of backwardness. Hence, the expected total tax revenue for the agenda setter is given by

$$B_t = \mathcal{T}\tau^{sub}. \tag{12}$$

We now examine the conditions under which the taxpayers will form a coalition and engage in vote-buying. According to VB(2), taxpayers will form a coalition and buy votes if the gain of vote-buying, which is given by

$$B_t - P(n-1-\mathcal{T}) = \mathcal{T}\tau^{sub} - \left(\frac{n+1}{2} - \mathcal{T}\right) \cdot \left(\frac{B_t - s_t^{ag}}{n-1-\mathcal{T}} + \phi\right), \tag{13}$$

is weakly positive. The expression in (13) is weakly positive, if the moral costs of vote-selling, ϕ, are sufficiently small, i.e. if the following condition holds true:

$$\phi \leq \frac{(n-3)\mathcal{T}\tau^{sub} + (n+1-2\mathcal{T})s_t^{ag}}{(n+1-2\mathcal{T})(n-1-\mathcal{T})} \tag{14}$$

Note that we have assumed that $n > 3$ and $0 < \mathcal{T} \leq \frac{n-1}{2}$. Now suppose that the subsidies for the agenda setter are arbitrarily small but positive. Formally, for $s_t^{ag} \to 0$,

$$\frac{(n-3)\mathcal{T}\tau^{sub} + (n+1-2\mathcal{T})s_t^{ag}}{(n+1-2\mathcal{T})(n-1-\mathcal{T})}$$

converges to

$$\overline{\phi}(\mathcal{T}) = \frac{(n-3)\mathcal{T}\tau^{sub}}{(n+1-2\mathcal{T})(n-1-\mathcal{T})} \ .$$

That is,

$$\overline{\phi}(\mathcal{T}) \leq \frac{(n-3)\mathcal{T}\tau^{sub} + (n+1-2\mathcal{T})s_t^{ag}}{(n+1-2\mathcal{T})(n-1-\mathcal{T})}$$

for every $s_t^{ag} > 0$. So condition (14) is fulfilled if $\phi \leq \overline{\phi}(\mathcal{T})$ for every $s_t^{ag} > 0$. Also note that $\overline{\phi}(\mathcal{T})$ is increasing in $\mathcal{T}$. That is, for $\mathcal{T} = 1$ and $n > 3$, we obtain

$$\overline{\phi}(1) = \frac{(n-3)\tau^{sub}}{(n-1)(n-2)} > 0.$$

If $\phi \leq \overline{\phi}(1)$ holds true, then the potential gain from vote-buying for the coalition of taxpayers is positive for every $\mathcal{T} \in [1, (n-1)/2]$ and every $s_t^{ag} > 0$. Thus, it is profitable for the coalition of taxpayers to engage in vote-buying. Hence, the proposal will not be adopted.

Step 3:

We now turn to the first stage of the vote-buying game. According to tie-breaking rule TR 1, the agenda setter will never apply for agenda setting, because he expects that every proposal with $s_t^{ag} > 0$ to be rejected with certainty if the moral costs of vote-selling are sufficiently small. Hence, no growth-promoting redistribution occurs in period t which implies that the human capital in the next period amounts to $\lambda_{t+1}^i = 1$ for all individuals.

Note that the preceding argumentation holds true for every period t. Hence, the education of a society is not possible in finite time.

□

Proof of Proposition 2

In the following, we show that there exists a subgame-perfect equilibrium in the voting buying game with constitutional rules TFM, RoA, BB and RoV and the tie-breaking rules TR 1 – TR 3 in which the agenda setter makes a growth-promoting redistribution proposal, taxpayers do not engage in vote-buying and the proposal is accepted in the first vote.

To show this result, we have to proceed in three steps. In the first step, we examine the second stage of the voting game. In particular, we derive the condition for the number of voting repetitions where vote-buying is never profitable for the coalition of taxpayers. In the second step, we consider the optimal behavior of the agenda setter in the first stage of the voting game. In the third step, we show that a democracy with TFM, RoA, BB and RoV can educate a society.

Step 1:

We will now derive the condition for the number of voting repetitions where vote-buying is never profitable for the coalition of taxpayers. The repetitions of votes are indexed by $r \in \{0, 1, \ldots, R\}$. Let $B_t(r)$ denote the total expected tax revenue in period t if the voting is repeated r times. Let $s_t^i(r)$ denote the subsidy that individual $i \in NT$ will receive from the agenda setter in period t, if the proposal is accepted after having been rejected r times before. Correspondingly, let $p_t^i(r)$ denote the payments that individual $i \in NT$ would receive in period t from the coalition of taxpayers, if it again votes against the proposal that has already been rejected r times before.

In the following we focus on the proposal where the agenda setter will tax $(n-1)/2$ individuals and pay no subsidies to the untaxed individuals. That is, $s_t^{ag}(r) = B_t(r)$ and $s_t^i(r) = 0 \ \forall i \in NT$ and $\forall r \in \{0, 1, \ldots, R\}$. Note that, according to TR 2, all untaxed individuals will vote in favor of this proposal if they are not bribed by the coalition of taxpayers, i.e. the proposal is adopted without vote-buying.

Recall that, initially, all individuals are caught in the poverty trap, $\lambda_0^i = 1 \ \forall i \in \Omega$. According to TFM, τ^{sub} is the highest taxation allowed for households in a state of backwardness. So the expected tax revenues in the first round, i.e., when the number of repetitions is zero, are given by

$$B_t(0) = \frac{n-1}{2}\tau^{sub}. \tag{15}$$

Recall that we have assumed that $\frac{n-1}{2}\tau^{sub} \geq \overline{s}$, i.e. $s_t^{ag}(0) \geq \overline{s}$.

Since the agenda setter will tax $(n-1)/2$ individuals, it suffices for the coalition of taxpayers to buy only one untaxed individual in order to form a minimal coalition that will vote against the proposal, and to pay this individual

$$p_t(r) = \phi > 0$$

in each vote (see TR 3). In order to win the voting against the proposal R times, the coalition of taxpayers has to pay the total amount of

$$\begin{aligned} \sum_{r=0}^{R} p_t(r) &= [p_t(0) + p_t(1) + \ldots + p_t(R)] \\ &= \phi R. \end{aligned} \tag{16}$$

We are now able to derive the number of repetitions of this proposal that will ensure that vote-buying will not be attractive for the coalition of taxpayers. The condition where vote-buying is never profitable for the coalition of taxpayers is given by

$$\sum_{r=0}^{R} p_t(r) \geq B_t(0).$$

Hence, the number of repetitions R^* where vote buying will be not profitable for the coalition of taxpayers is implicitly given by

$$\sum_{r=0}^{R^*} p_t(r) = B_t(0). \tag{17}$$

We now return to equation (17) in the light of equations (15) and (16). We obtain

$$\phi R^* = \frac{n-1}{2}\tau^{sub}. \tag{18}$$

Rearranging equation (18) yields

$$R^* = \frac{(n-1)\tau^{sub}}{2\phi}.$$

Since R^* is a positive real number, we have to use the ceiling function for R^*. The ceiling function is denoted by $\lceil R^* \rceil$, and it denotes the minimal natural number larger than, or equal to, R^*.

To sum up: If the voting is only repeated $R < \lceil R^* \rceil$ times, then it is profitable for the coalition of taxpayers to buy votes, since $\sum_{r=1}^{R} p_t(r) < B_t(0)$. However, if $R \geq \lceil R^* \rceil$, then it is optimal for the coalition of taxpayers not to engage in vote-buying, which implies that the proposal will be adopted in the first vote.

Step 2:

We now turn to the first stage of the vote-buying game. In this step, we examine the optimal behavior of the agenda setter in the first stage of the voting game. In step 1, we have seen that the proposal of the agenda setter – where he taxes $(n-1)/2$ uneducated individuals with τ^{sub} to subsidize himself with at least $\overline{s}$ – will be adopted in the first vote, if the voting on this proposal can be repeated $\lceil R^* \rceil$ times. Now we show that no profitable deviations exist for the agenda setter.

First, it is not profitable for the agenda setter to make a proposal where more than $(n-1)/2$ individuals are taxed. Taxing of more than $(n-1)/2$ individuals would imply that the agenda setter cannot strictly improve his utility, because such a proposal would never be accepted, as a majority would always vote against it.

Second, it is also not profitable for the agenda setter to make a proposal where fewer than $(n-1)/2$ individuals are taxed. Obviously, these proposals would also be accepted. However, taxing fewer than $(n-1)/2$ individuals would entail a reduction of the subsidies for the agenda setter. Hence, taxing fewer than $(n-1)/2$ individuals is not profitable for the agenda setter either.

Third, it is not profitable for the agenda setter to make a proposal where he taxes uneducated individuals with more than τ^{sub}. According to TFM, this proposal could be prevented easily by the taxpayers without vote-buying, as the unanimity rule would prevail in this case.

Fourth, it is not profitable for the agenda setter to make a proposal where he taxes uneducated individuals with less than τ^{sub}. Obviously, this proposal would be accepted by a majority either. However, taxing uneducated individuals with less than τ^{sub} would entail a reduction of the subsidies for the agenda setter.

Finally, it is not profitable for the agenda setter to pay positive subsidies to the untaxed individuals. It appears that proposals of this kind would also be accepted, since the subsidizing of untaxed individuals would make vote-buying more costly and therefore less attractive for the coalition of taxpayers. However, subsidizing untaxed individuals would also lead to lower subsidies for the agenda setter. Hence, subsidizing of untaxed individuals is not profitable for the agenda setter either.

Step 3:

In steps 1-2, we have shown that there exists a subgame-perfect equilibrium in the voting buying game with constitutional rules TFM, RoA, BB and RoV and the tie-breaking rules TR 1 – TR 3 in which the agenda setter makes a growth-promoting redistribution proposal, taxpayers do not engage in vote-buying and the proposal is accepted in the first vote. We now show that such a democracy can educate a society.

Because of the rotating agenda setting rule (RoA), each individual will have the right to set the agenda. RoV ensures that vote-buying will not occur which implies that each individual will receive the required transfer $\overline{s}$. The threshold flexible majority rule, TFM$[\tau_t^{max}, \overline{\tau}]$, with $\overline{\tau} = \min\{\tau^{sub}, \tau^*\}$, ensures both that uneducated households will not fall below the subsistence level and that educated households will not fall back into the poverty trap. Hence, the education achieved in the period of transfer yields a human capital amounting to $\lambda > \lambda^*$ in the next and in the following periods, which implies that the society will be educated in $T < \infty$.

□

References

Aghion, P., A. Alesina, and F. Trebbi (2004): "Endogenous Political Institutions," *Quarterly Journal of Economics*, 119(2), 565–611.

Aghion, P., and P. Bolton (2003): "Incomplete Social Contracts," *Journal of the European Economic Association*, 1(1), 38–67.

Azariadis, C. (1996): "The Economics of Poverty Traps: Part One: Complete Markets," *Journal of Economic Growth*, 1(4), 449–96.

Azariadis, C., and J. Stachurski (2005): "Poverty Traps," in *Handbook of Economic Growth*, ed. by P. Aghion, and S. N. Durlauf, vol. 1, chap. 5, pp. 295–384. Elsevier.

Baron, D. P., and J. A. Ferejohn (1989): "Bargaining in Legislatures," *The American Political Science Review*, 83(4), 1181–1206.

Barro, R. J. (2000): "Inequality and Growth in a Panel of Countries," *Journal of Economic Growth*, 5(1), 5–32.

Basu, K., and Z. Tzannatos (2003): "The Global Child Labor Problem: What Do We Know and What Can We Do?," *World Bank Economic Review*, 17(2), 147–173.

Basu, K., and P. H. Van (1998): "The Economics of Child Labor," *American Economic Review*, 88, 412–427.

Bell, C., and H. Gersbach (2008): "Child Labor and the Education of a Society," *Macroeconomic Dynamics*, forthcoming.

Buchanan, J. M., and G. Tullock (1962): *The Calculus of Consent: Logical Foundations of Constitutional Democracy*. University of Michigan Press, Ann Arbor.

Dekel, E., M. O. Jackson, and A. Wolinsky (2008): "Vote Buying: General Elections," *Journal of Political Economy*, 116(2), 351–380.

Docquier, F., and E. Tarbalouti (2001): "Bribing Votes: A New Explanation to the "Inequality -Redistribution" Puzzle in LDC's," *Public Choice*, 108(3-4), 259–272.

Galor, O., and J. Zeira (1993): "Income Distribution and Macroeconomics," *Review of Economic Studies*, 60(1), 35–52.

Gersbach, H. (2004): "Dividing Resources by Flexible Majority Rules," *Social Choice and Welfare*, 23(2), 295–308.

Gersbach, H., and L.-H. Siemers (2005): "Can Democracy Educate a Society?," Discussion Paper 1693, Institute for the Study of Labor (IZA), Bonn.

Groseclose, T., and J. M. Snyder, Jr. (1996): "Buying Supermajorities," *The American Political Science Review*, 90(2), 303–315.

Hicken, A. D. (2002): "The Market for Votes in Thailand," Paper Presented at the Conference "Trading Political Rights: The Comparative Politics of Vote Buying", MIT.

Jafarey, S., and S. Lahiri (2001): "Child Labour: Theory, Policy and Evidence," *World Economics*, 2(1), 69–93.

Morton, S. (1988): "Strategic Voting in Repeated Referenda," *Social Choice and Welfare*, 5(1), 45–68.

Mueller, D. C., R. D. Tollison, and T. W. Willet (1972): "Representative Democracy via Random Selection," *Public Choice*, 12(1), 57–68.

Rigger, S. (2002): "Weighing a Shadow: Toward a Technique for Estimating the Effects of Vote-Buying in Taiwan," Paper Presented at the Conference "Trading Political Rights: The Comparative Politics of Vote Buying", MIT.

Schaffer, F. C. (2004): "Vote Buying in East Asia," in *Global Corruption Report 2004*, pp. 83–87. Transparency International.

——— (2006): "What is Vote Buying?," in *Elections for Sale: The Causes and Consequences of Vote Buying*, ed. by F. C. Schaffer. Lynne Rienner Publishers, Boulder, CO, and London.

Schelling, T. C. (1960): *The Strategy of Conflict*. Havard University Press, Cambridge, Massachusetts.

Slovakia (1992): "Constitution of the Slovak Republic," http://slovakia.eunet.sk/slovakia/history-politics/slovak-constitution.txt.

Tajikistan (1995): "Law of The Republic of Tajikistan and Constitutional Law of Republic of Tajikistan on a Referendum in Republic of Tajikistan," http://www.eurasianet.org/departments/election/tajikistan/reflaw.html.

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