LSE Research Online

Article (refereed)

[Gilat Levy](#)

The politics of public provision of education

THE POLITICS OF PUBLIC PROVISION OF EDUCATION[1]

Gilat Levy

Public provision of education is usually viewed as a form of redistribution in kind. However, does it arise when income redistribution is feasible as well? I analyze a two-dimensional model of political decision-making with endogenous political parties. Society chooses both the tax rate and the allocation of the revenues between income redistribution and public education. Agents differ in their income and in their age, where young agents prefer public education and the old prefer income redistribution. I find that when the cohort size of the young is not too large then public education arises as a political compromise between the rich and the young segment of the poor. They collude in order to reduce the size of government (which benefits the rich) and target some of its resources to education (which benefits the young poor). When the cohort size of the young is too large however, income redistribution crowds out public provision of education in the political equilibrium.

I. Introduction

Economists have long been puzzled by the question of public provision of private goods, such as education.[2] In the normative literature, the reasons that are put forward for government intervention in the provision of education are externalities or other market failures such as imperfect information. In the positive literature though, public provision of education is viewed as a form of *redistribution*. For example, Epple and Romano [1996a] or Glomm and Ravikumar [1998] view it as redistribution from the rich to the poor since the poor do not have enough means to finance private education.[3] In the context of high education, Fernández and Rogerson [1995] show that public provision of education is actually redistribution from the poor to the rich, where the former are financially constrained from

[2]   Other examples are health care, police protection or refuse collection. For an argument why education should be considered as a private and not a public good, see Barzel [1973].

[3]   This is also the view in the normative work of Besley and Coate [1991].

attending universities. Gradstein and Kaganovich [2003] perceive public education as re-distribution from the old (who do not benefit from education) to the young (whose future income is positively correlated with education).

All these papers analyze models in which the unique possible form of redistribution available to society is redistribution in kind, i.e., public provision of education. However, income redistribution may be a more efficient tool for shifting resources from one group of voters to the other, so that it can substitute for redistribution in kind while creating a Pareto improvement. By disregarding income redistribution as a possible policy tool, these descriptive models may predict an excessive level of public provision of education.

This paper engages in a positive analysis of public provision of education. In keeping with previous literature, I assume that governments may engage in education provision in order to redistribute resources (specifically, from the old to the young). In contrast to previous literature however, I allow society to use income redistribution as an additional policy tool. Society chooses in the model both the size of the government and how to allocate its resources between public provision of education and income redistribution. Questions that arise in this context are as follows. When income redistribution is feasible, is education publicly provided as well? What are the factors determining the level of public provision of education? For example, how is it related to income inequality or to demography parameters such as cohort size of school age children? Also, what is the size of government when society can choose both the size of government and how to target its resources? These are the questions I address in the paper.

I analyze a two-dimensional political economy model. Agents in the model are differentiated according to their income. The first conflict in society is therefore on the tax rate and pits the rich against the poor (whom I assume constitute a majority of the population), with the poor pushing for maximum taxation. Agents are also differentiated according to their age with young voters benefiting more from education relative to old voters. This can arise for example because education has a positive effect on future income which the old cannot capture.[4] Young voters are the ones that actually consume education and as in Epple and Romano [1996a], they can top up their consumption of public education by buy-

---

[4]   Empirically, old voters are indeed shown to be less supportive of education spending relative to young voters (e.g., voters with school age children) which indicates that they benefit less from it. See Koretz [1995], Rubinfeld [1977] and Button [1992].

ing private education. The second conflict in society pits therefore the young who support public provision of education against the old who prefer income redistribution (given the same size of government).

The tax rate and the level of public spending on education are determined by a political process. The political model follows the one in Levy [2004] and has realistic institutional features; it allows both for endogenous entry of politicians and for endogenous political parties. In this model, parties choose which platforms to offer (if at all), where each platform specifies the tax rate and how much of the budget will be spent on public education. An important feature of the model is that parties can only offer credible platforms, that is, policies in the Pareto set of their members. Given the platforms that are offered, voters cast their vote for the platform they like most and the political outcome is the platform which attracts the largest number of votes. Parties are also endogenous in the sense that given the political outcome, members do not wish to split from their party (and possibly induce a different political outcome). The equilibrium analysis pins down the composition of political parties as well as the level of public education, private education, income transfers and the total size of government.

The main results are as follows. First, I find that whether public education arises in equilibrium even when income redistribution is feasible, depends negatively on the cohort size of the young. Specifically, when the young are a minority in the population then there is relatively high level of per capita public provision of education whereas when the young are a majority, then income redistribution crowds out public provision of education. Second, I show that even though the poor are a majority, the political outcome does not prescribe the maximum tax level. The rich manage to take advantage of the divergent views among the poor with regard to how to spend tax revenues in order to reduce the size of government. Third, the winning parties are always composed of rich representatives and representatives from the minority segment of the poor - either the young or the old.

To see the intuition for these results, consider first the case when the old are a majority. In this case, the old segment of the poor represents majoritarian interests. The old poor would advocate a policy of maximum taxation, equal income for all, and no public education. However, when the old are a majority, it is also the case that public education would be consumed only by the few - the young. This implies that public education is relatively cheap in the sense that even a low tax rate can provide a generous per capita level of education.

3

Thus, the rich and the young segment of the poor can form a party which can credibly offer a policy that is better for both factions relative to the majoritarian policy of maximum taxation and no public education. Such policy reduces the tax burden but shifts resources to public education. This policy breaks the cohesiveness of the majority of the old voters (by rewarding the rich segment of the old with relatively high income) and as a result can win the election. Public education arises then in equilibrium as a political compromise between the rich who want low taxes, and the poor segment of the young voters who cannot afford to buy satisfactory level of education privately.

On the other hand, when the young voters are a majority, it is the young poor who represent majoritarian interests, advocating maximum taxation as well as high levels of public provision of education. However, when the young constitute a large proportion of society it also becomes expensive to provide significant levels of public education per capita. The rich would view it as an inefficient form of redistribution. The rich can then turn to form a winning coalition with the old segment of the poor. This coalition's policy would reduce the tax rate and shift tax revenues towards income redistribution. Thus, when income redistribution is feasible, public education may not be provided in equilibrium if the young are a majority.

As far as private education is concerned, I find that the rich and the poor are more likely to be equally educated when the young are a minority. In this case both the rich and the poor may consume only public education (which is generously provided) and are therefore educated at the same level. On the other hand when the young are a majority public provision of education is relatively low so that both income groups are likely to consume private education. But since the tax rate is not the maximum one, inequality of income persists in equilibrium. The rich have therefore more resources to invest in education and become more educated than the poor in this case.

Lastly, I show how the winning policies are affected by the level of income inequality. In the model, income inequality determines how cohesive are the different rich groups, the young and the old (where high income inequality increases their cohesiveness). Interestingly, the effect of this on the political outcome depends on demography as well. I find that when the young are a minority, higher income inequality (and hence more cohesive rich groups) may increase both tax rates and public education. When the young are a majority on the other hand, higher income inequality may decrease tax rates. Thus, higher income inequality

may result in a different income distribution starting from a different age distribution.

Currently there are no papers which look at these integrated predictions of both the nature of political parties and their economic policies but the model can shed some light on other findings in the literature. Lindert [1996] looks at both welfare transfers and education expenditure in OECD countries in the years 1960-1981. He finds that the level of social spending is primarily governed by the relative sizes of age groups in the population and by income distribution. In particular, he finds that a larger cohort of school age children decreases educational spending per child and that an increase in the cohort size of young adults (ages 20 to 39) has increased welfare (as well as pensions, a spending which favours the old), in accordance with my results. Finally, the cohort size of those over 65 increased welfare and pensions up to a point in which larger group size implied negative returns per recipient. My model suggests an explicit political mechanism in which group size has such diminishing returns.

The rest of the literature does not look at the effect of age groups on both welfare and education. Still, as in the OECD countries above, both Poterba [1997] and Case, Hines and Rosen [1993] find strong negative effect of student cohort size (children aged 5 to 17) on spending per pupil in state expenditures in the United States.

In terms of the effect of the share of the elderly on redistributive policies, the empirical results are not as conclusive. Poterba [1997] finds that the size of the cohort of old citizens has a negative effect on education spending. However, this effect was not statistically significant when urban population was included in the regression. Case, Hines and Rosen [1993] find that a larger proportion of elderly residents reduces per capita expenditures on both expenditures which favour the young such as education and expenditures which favor the old such as health. Additional empirical studies on the effect of the cohort size of the old on education spending at the county and the municipality level produce mixed results.[5]

The theoretical literature on public provision of education (when there is also a private option) was pioneered by Stiglitz [1974]. Since his work, the literature has focused on whether a median voter result exists in a one-dimensional model in which all tax revenues are targeted to public provision of education.[6] My paper provides an analytical analysis of

---

[5]   Ladd and Murry [2001] and Harris *et al* [2001] find that the elderly have no significant effect on public education in the United States. Alesina, Baqir and Easterly [1999] find a positive effect of the elderly share on education spending per pupil in U.S. municipalities.

[6]   See Epple and Romano [1996a,1996b], Gloom and Ravikumar [1998], Fernández and Rogerson [1995]

a two-dimensional model in which society simultaneously chooses the tax rate and how to divide its revenues between income redistribution and public education; the preferences on the induced policy space are single-peaked and since I explicitly model political institutions, the model yields stable political outcomes despite being two-dimensional.

Another focus of the literature on public education is whether the political outcomes accord with the views of the majority. Both in Epple and Romano [1996b] and Fernández and Rogerson [1995], a voting coalition of an 'ends against the middle' arises between the rich and the poor (who vote against the middle class). This results in a political outcome which is not the preferred choice of the voter with the median income. In my analysis, outcomes are non-majoritarian as well; the coalition that arises between the rich and the poor however is not against the middle but against the 'expensive' segment of the poor.

Roemer [1998] also shows that the poor do not expropriate the rich when the policy space is two-dimensional. In his model, agents differ in their income and in their preferences on a non-economic dimension (religion); he therefore does not address the issue of education or more generally redistribution in kind.[7] In my model, the two conflicts in society are tied through a budget constraint. This is why I can identify the negative cohort size effect with respect to public education.

Finally, Fernández and Levy [2005] also analyze the trade-off between general redistribution and targeted transfers. In that paper, however, we focus on goods that are explicitly targeted to many small interest groups, such as local public goods, and study the effect of diversity in society (the probability that two individuals belong to the same interest group) on redistribution. In contrast, here I analyze targeted goods that affect large segments of society and hence can have a negative cohort size effect.

The rest of the paper is organized as follows. In the next section I present the model. The main results about public education versus income redistribution are in Section III. Section IV discusses some extensions and the main assumptions of the model. I conclude in section V. All formal proofs are in a companion working paper, Levy (2005).

II. The Model

and Austen-Smith [2003]. Bearse, Glomm and Janeba [2001] show that the median voter result fails when the tax rate is fixed but voters decide between income redistribution and public education.

[7]   See also Austen-Smith and Wallerstein [2003], who analyze a model in which the poor are divided on the level of affirmative action.

II.A. The Economic Environment

Preferences and feasible policies: There are four groups of agents in the economy, distinguished by their income and according to their preferences for education. I first describe how agents are differentiated on the latter issue.

There are two types of goods, a numeraire good denoted by x which all agents like, and education, denoted by e, towards which agents have different attitudes. I use the labels "young" and "old" to distinguish between those who like education and those who have less affinity for education. Education is traditionally seen as a spending which favours the young, due to its positive effect on future income or social capital, which the old cannot capture. Empirically, old voters are shown to be less supportive of education spending compared with young voters, which indicates that they benefit less from education.[8] The young/old distinction can also be correlated with whether voters have school age children or not and how much they care for their children's education or future income.[9]

I assume that the utility function of the young voters, $u(e, x)$, is strictly increasing in both elements, strictly concave and twice differentiable. Both education and the numeraire are assumed to be normal goods.[10] These assumptions are general enough and can capture for example the idea that the amount of education consumed when young affects future income. Thus, the utility function of the young can be interpreted as a reduced form of a utility function in a two-period model, where agents enjoy present income or consumption of the numeraire good as well as future income, which increases in present consumption of education. To keep matters simple, I analyze a static model. The results are robust however to a dynamic extension, which I discuss in section IV.A.

The old voters, on the other hand, only care about the numeraire good and for simplicity their utility function is linear in x. The extreme assumption that old voters do not benefit at all from education is not important; it simplifies substantially the calculations

[8]   Koretz [1995] shows that support for public schooling declines from 77 percent if the respondent is under 30 to 47 percent if the respondent is above 70. See also Rubinfeld [1977].

[9]   In particular, we can think of young voters as those who have school age children and altruistically care about their education. Stromberg [2000] has shown that indeed it is young adults between the ages of 18 to 44 who represent children's interests when voting (this age group probably accounts for parents with school age children). Since the degree of altruism decreases with generational distance, old voters care less about grandchildren's education.

[10]   The assumptions about the utility function and the goods being normal goods are not all necessary but simplify matters.

of the political outcome, but the qualitative results remain even if the old were to benefit from education somewhat (for example, through education externalities). Lastly, I assume that only young voters consume education. This assumption is again not necessary and the results hold if one assumes that the old consume public education at a sufficiently low level (I discuss the different assumptions about the young and the old in section IV.B).

Agents are also differentiated according to their income. There are two levels of income in the economy. The poor have income w_l and the rich have income $w_h > w_l$. The four groups in the population are then the old rich (r_o), the young rich (r_y), the old poor (p_o), and the young poor (p_y). The share of the poor in the population is π (for simplicity there is no correlation between income and the preferences for education and therefore the share of the poor is the same among the young and among the old). The average income w is therefore

$$w = \pi w_l + (1 - \pi)w_h.$$

Society has to choose a tax level $t \in [0, 1]$. Tax revenues can finance either an income transfer in a lump sum way to the whole population, denoted by $T \geq 0$ per capita, or the provision of education, denoted by $g \geq 0$ per capita (a larger investment in education can be interpreted as increasing its quality).[11] The price of education in terms of the numeraire x is q. Denote the share of the young in the economy by $\theta \in (0, 1)$. For simplicity, taxation is not distortionary and hence the budget constraint per capita is

$$tw = T + \theta qg.$$

Thus, income redistribution can be viewed as a transfer from the rich to the poor whereas public education, if provided, can be interpreted as a transfer of resources from the old to the young, since the latter are those who consume education.

As in the 'top up' model of Epple and Romano [1996a], young voters may also supplement the public provision of education by buying education in the market, through private tutors for example, for the same price q. I show in the proofs that the price q has no effect on the results and hence I normalize it to $q = 1$. Denote the additional consumption of education by s.

The parameters of the model are therefore π, θ, w_h, w and the utility function of the

---

[11]   I therefore fix the system of public education finance. See Fernández and Richardson [2003] for a recent analysis of different finance systems of (local) public education.

young. I focus the analysis on the case of the poor being the majority, that is, $\pi > \frac{1}{2}$. Also, for the sake of interest, assume that none of the four groups composes a majority in the population.

The political variables that are chosen by society, given these parameters, are t, T and g; these choices will be determined through a political process, which I describe later on. It will sometimes be more convenient to describe policy in terms of the net income transfer from the rich to the poor, denoted by I, $I \equiv T - tw_l$. Finally, note that given the budget constraint $I = t(w - w_l) - \theta g$, the 3-dimensional policy problem of choosing t, g, and I reduces to a problem of choosing a two-dimensional policy, (t, g). The policy space is therefore bounded by a triangle, i.e., $t \in [0, 1]$ and $g \leq \dfrac{tw}{\theta}$ (see Figure I).

Ideal policies and induced preferences: I now characterize the ideal policies and indifference curves of the different groups in society, in the policy space (t, g). The old are indifferent between all policies that provide them with the same income. This implies, for $w_i \in \{w_l, w_h\}$:

$$w_i + t(w - w_i) - \theta g = const \rightarrow \frac{\Delta g}{\Delta t} = \frac{w - w_i}{\theta}.$$

The indifference curves of the old are therefore linear, with a positive slope for the poor and a negative slope for the rich. Figure I depicts the indifference curves of r_o and p_o in the policy space. It is also easy to see from Figure I that the ideal policy of r_o is $(t = 0, g = 0)$, and that of p_o is at $(t = 1, g = 0)$, i.e., the old poor's ideal policy is equality of income with $I = w - w_l$.

Figure II describes the indifference curves of the young in the (t, g) space. To understand the shape of the indifference curves, note that given some (t, g), each young household chooses how much private education s to buy, i.e., they choose $s \geq 0$ to maximize

$$u(g + s, \ w_i + t(w - w_i) - \theta g - s).$$

When g is relatively low both the young rich and the young poor need to supplement it by buying private education ($s > 0$ in the optimal solution). This implies that when g is sufficiently low, any additional transfer of g is seen as a pure money subsidy and substitutes private consumption. As a result, the indifference curves are linear for low values of g. When g is high enough there is no need in private education (that is, $s = 0$). The indifference curves become concave (given the strict quasi-concavity of u).

9

In terms of ideal policies the young poor obviously prefer the highest tax level, $t = 1$, and only have to consider how to divide it between public provision of education and an income transfer. Both are viewed by the young poor as transfers from other groups in society to themselves. Denote by $g^*(1)$ their optimal level of public education given $t = 1$.

The young rich, r_y, clearly prefer not to redistribute any income. But, as opposed to the old rich, they view public provision of education favorably, since this is a transfer from the old to the young. If the size of the cohort of young voters (θ) is relatively low or if income inequality is low then such redistribution is beneficial for r_y (technically, this arises when the slope of the linear part of their indifference curve is less steep than society's budget constraint). Their ideal policy is therefore $(t = t^*, g = \frac{t^*w}{\theta})$ for some $t^* \in (0,1)$. If on the other hand θ is relatively high or if income inequality is high then it is too costly for r_y to finance public education, and the young rich prefer no redistribution at all. Their ideal policy is therefore $(0,0)$. Lemma 1 summarizes the above discussion:

LEMMA 1 In the (t, g) policy space:[12]

(i) The ideal policy of p_y is $(t = 1, g = g^*(1))$ and the ideal policy of r_y is $(t = 0, g = 0)$ if $\theta > \frac{w}{w_h}$ and otherwise it is $(t = t^*, g = \frac{t^*w}{\theta})$ for some $t^* \in (0,1)$. The indifference curves of r_y and p_y are weakly concave and differentiable. For all $t' \in [0,1]$, an indifference curve of $r_y(p_y)$ that goes through $(t', 0)$ lies on or above a line that goes through $(t', 0)$ and has a slope $\frac{w_h - w}{1 - \theta}(\frac{w_l - w}{1 - \theta})$.

(ii) The ideal policy of r_o is $(t = 0, g = 0)$, and that of p_o is $(t = 1, g = 0)$. The indifference curves of $r_o(p_o)$ are linear, with a slope $\frac{w - w_h}{\theta}(\frac{w - w_l}{\theta})$.

In the analysis of the political model described below, I will focus on pure strategy equilibria. This makes the results more stark but does not change their qualitative nature. To insure the existence of pure strategy equilibrium in this general economic environment, I make the following restrictions on the parameters of the utility functions. Let $v_i(t, g)$ denote the (indirect) utility of type $i \in \{p_o, p_y, r_o, r_y\}$ from a policy (t, g). I assume that the poor 'stick' together, i.e., that p_o prefers the ideal policy of p_y to that of r_o, and that p_y prefers the ideal policy of p_o to that of r_y:

ASSUMPTION 1 $v_{p_y}(1, 0) = v_{p_y}(t^*, \frac{t^*w}{\theta}) + \delta$, and $v_{p_o}(1, g^*(1)) = v_{p_o}(0, 0) + \mu$, where $\delta \geq \delta_0 > 0$ and $\mu \geq \mu_0 > 0$. δ_0 and μ_0 are defined in the appendix.

---

[12] All formal proofs are in a companion working paper, Levy (2005).

II.B. The Political Process

The economic model has constructed a society with four groups of citizens who are divided on two dimensions, age and income. The political process translates their economic preferences into a policy outcome, namely the size of government (t) and whether to redistribute income to all or education to the young (g). I adopt the political model of parties introduced in Levy [2004]. A more detailed and formal description is provided there.

The main assumption about parties in this model is that each party can only offer credible policies, that is, policies in the Pareto set of its members. Thus, when a politician runs as an individual candidate he can only offer his ideal policy, as in the 'citizen candidate' model.[13] On the other hand, when heterogeneous politicians join together in a party, their Pareto set is larger than the set of their ideal policies. For example, the party of the old rich and the old poor can offer all policies with $g = 0$ and different tax rates, $t \in [0, 1]$. The party of the old poor and the young poor can offer $t = 1$ and some level of public education ranging from 0 to $g^*(1)$, and so on. The assumption about parties captures the idea that parties allow different factions to reach (efficient) internal compromises.[14]

Assume therefore that there are four politicians participating in the political process, each representing a different group of voters. In other words, politician i has the preferences of group $i \in \{r_o, p_o, r_y, p_y\}$. Consider a partition on the set of politicians. For example, $p_o|p_y|r_o|r_y$ is the partition in which each politician can only run as an individual candidate, and the partition $p_o p_y|r_o|r_y$ is such that the poor representatives- young and old -join together in one party and each of the rich politicians can only run as an individual. Suppose for now that the partition of politicians into parties is given.

In an election all parties (including one member parties) in this given partition simultaneously choose whether to offer a platform and if so, which platform in their Pareto set to offer. Voters (the whole population) then vote for the platform they like most. The election's outcome is the platform which receives the largest number of votes (if winning platforms tie then each is chosen with equal probability). If no policy is offered, a default status quo is implemented. For simplicity I assume that the status quo is a situation of

---

[13]   See Besley and Coate [1997] and Osborne and Slivinski [1996].

[14]   The assumption about heterogenous parties relies on the idea that it is relatively easy for a small group of politicians to monitor one another. The public can then trust promises which represent internal compromises in the party. See also Ray and Vohra [1997] who analyze a general model in which agreements within coalitions are binding, as here.

"chaos" which is worse for all players than any other outcome (alternatively one can assume that the status quo is simply the policy of no redistribution, i.e., a 'government shut-down', and the analysis would be exactly the same).

In this given partition, a set of platforms is an equilibrium if given the other platforms, no party can change its action (by withdrawing, offering another platform, or joining the race) and improve the utility of all its members.[15] In addition I assume the following tie-breaking rule: In equilibrium a party does not offer some platform if, given the other platforms that are offered, all party members are indifferent between offering this platform and not running at all. This refinement is reasonable if one considers some small costs of running (I do not assume such costs explicitly but this assumption will not change the analysis).

Generically, given a set of platforms, there is only one platform that will receive the largest number of votes. As I show in the proofs, this together with the tie-breaking rule and the structure of preferences implies that only one platform is actually offered in equilibrium and obviously it wins. Thus, for any fixed partition we can find the set of such *equilibrium winning platforms*. Each such platform belongs to the Pareto set of one of the parties and there is no other party which can win against it while increasing the utility of all its members.

Finally, I focus on stable political outcomes, namely, equilibrium winning platforms which are immune to politicians changing their party membership. Consider a politician or group of politicians who split from their party, while the rest of the representatives maintain their party membership. In this new partition, a new set of equilibrium winning platforms can arise. A *stable political outcome* is an equilibrium winning platform such that no politician (or a group of politicians) can break their party and receive a (weakly) higher utility from some equilibrium winning platform in the new partition.[16]

Parties are therefore endogenous in the model in the sense that we identify the array of political parties and political outcomes such that no group of politicians wish to quit their party. As I show below, endogenous parties (namely, stable coalitions of different representatives) always arise in equilibrium. The prediction of the model is then the set of stable political outcomes with endogenous parties.

---

[15]   For a general definition of equilibria and proof of existence see Levy [2004].

[16]   The stability requirement introduced here is simpler than the one in Levy [2004], which is recursive.

III. The Politics of Public Education

The characterization of stable political outcomes allows us to determine the composition of the winning coalitions, their tax policies, and how they suggest to divide tax revenues between income transfers and public education. Furthermore, we can predict how much private education is consumed (and by who) and how income inequality affects the winning policies. I now present the main results, about the composition of parties and their winning policies, whereas the other sections which follow describe the results about private education and the effect of income inequality. The full characterization of stable political outcomes is in Lemma 2 in the appendix.

III.A Political Parties and Public Education

The main results uncover a negative cohort size effect with respect to public provision of education. The cohort size of the young or the old can matter in the model in two -conflicting- ways. On the one hand, a large cohort of old voters may push for income redistribution if it votes as a bloc; on the other hand, a small cohort of young voters may be more flexible in making intraparty compromises with other groups. As Proposition 1 shows, the latter effect dominates and allows minorities to be politically successful:

PROPOSITION 1 With endogenous political parties,

(i) When the young are a minority, per capita public provision of education is strictly higher and per capita net income transfer is strictly lower than when the young are a majority.

(ii) All stable political outcomes are characterized by a positive but not a maximum tax rate.

(iii) When the young are a minority, any winning party is composed of the young poor and some rich representatives (young or old). When the young are a majority, then any winning party is composed of the old poor and some rich representatives.

The winning coalitions are therefore a combination of minorities: the rich (who are a minority) and the minority segment of the poor, either the young or the old. As a result, income redistribution crowds out public education when the young are a majority whereas public education is generously provided, at the expense of income transfers, when the young are a minority. Moreover, since some rich representatives are always in the winning coalition,

13

the tax level remains relatively low and thus the poor do not fully expropriate the rich in equilibrium.

To understand the results about the winning coalitions and their policies, let us start with the case of $\theta < \frac{1}{2}$, i.e., when the old are the majority. To fix ideas, let us also assume that $\theta > \dfrac{w}{w_h}$. In this case, income inequality is relatively high, so that the young rich and the old rich are both against any redistribution and have $(0,0)$ as their ideal policy.

There are two things to note in this environment. First, consider the benchmark case when no coalitions have formed. This is the partition $p_o|p_y|r_o|r_y$. In this situation, each politician can only offer his ideal policy to the voters. It is then easy to see that the unique equilibrium is that p_o, the representative of the old poor, wins the election with his ideal policy, $(1,0)$. To see why he wins, note that if any of the rich representatives challenges the old poor, they are defeated; the young poor prefer some redistribution to none and hence vote with the old poor. Since the poor are the majority, the rich cannot win. If the representative of the young poor challenges the old poor, he is defeated as well. This is because the old voters, who are the majority, would vote for the old poor since they prefer income redistribution to public provision of education. The political outcome, when parties don't exist, is therefore equal income for all, and no public provision of education.

Second, let us consider how coalitional parties can change this 'default' state of affairs. Consider the partition $r_o p_y|p_o|r_y$. The party $r_o p_y$ of the old rich and the young poor, can offer policies in its Pareto set which is depicted in Figures III.A and III.B (the bold lines). In Figure III.A, the Pareto set of r_o and p_y is 'interior'. This happens when $\theta < \dfrac{w_h - w}{w_h - w_l}$.[17] Intuitively, when θ is low enough, education is consumed only by few voters and hence it is relatively cheap to provide it. This implies that the Pareto set does not contain policies with $t > 0$ and $g = 0$ because both factions can improve on such policies by lowering the tax rate and providing some public education. In Figure III.B on the other hand the Pareto set is on the boundaries of the policy space. This arises when θ is relatively high and education becomes expensive to provide. In that case, the two factions cannot improve upon policies with $t > 0$ and $g = 0$ and the Pareto set includes for example the ideal policy of p_o, $(1,0)$.

Note however that since $w_h > w_l$ and $\pi > \frac{1}{2}$, then $\frac{1}{2} < \dfrac{w_h - w}{w_h - w_l}$ which implies that whenever $\theta < \frac{1}{2}$, it is also the case that $\theta < \dfrac{w_h - w}{w_h - w_l}$. In other words, when $\theta < \frac{1}{2}$, the

---

[17] Technically, this arises when the indifference curve of the old rich (whose slope is $\frac{w - w_h}{\theta}$) is more steep than the linear part of the indifference curve of the young poor (whose slope is $\frac{w_l - w}{1 - \theta}$).

Pareto set is interior as described in Figure III.A and the ideal policy of p_o is not in the Pareto set of $r_o p_y$. As a result, r_o and p_y can find policies in their Pareto set (that is, credible policies), characterized by $t < 1$ and $g > 0$, which both prefer to (1,0). By reducing and shifting tax revenues from a costly universal income redistribution to the public provision of education, the party of r_o and p_y increases the utility of p_y (who is in need of positive public provision of education) as well as the income of r_o. Figure IV describes these policies.

We can now put all the ingredients together. First, when $\theta < \frac{1}{2}$, the party $r_o p_y$ can win the election against p_o. It can offer policies which receive the support of the groups it represents as well as the support of r_y, for whom (1,0) is the worst possible policy. Second, we have established that when $\theta < \frac{1}{2}$ and parties don't form, then p_o wins the election. Thus, $r_o p_y$ winning is also a stable political outcome: The party wins with policies that provide each of its members a higher utility than the ideal policy of p_o. Consequently, both party members would be worse off were they to split the party.

As I show in the formal proof, p_o cannot be in any winning coalition because he has strong incentives to break his party, run alone and win the election. He therefore cannot credibly commit to cooperate with other representatives. As a result, any coalition must win against p_o; thus, any coalition must cater to the votes of the young poor and the old rich, since if any of these votes with p_o, then p_o wins (other stable coalitions may therefore be $r_y p_y$ and $r_o r_y p_y$). This implies that all stable political outcomes have positive public provision of education, i.e., $g > 0$, a tax level which is not at its maximum, i.e., $t < 1$ and possibly some positive level of net income transfer. With endogenous parties and a minority of young voters, education is therefore provided even when income redistribution is a possible policy tool.

We can now move to the case in which $\theta > \frac{1}{2}$ and the young voters are a majority. In this case, when parties don't form, the "default" policy changes and it is p_y who wins the election with the policy $(1, g^*(1))$. To see why, note that if the old vote all together they cannot win against the young since they constitute a minority. By the same reasoning, if all the rich vote together against the poor they cannot win. Thus, the representative of the young poor emerges as the unique winner in the election.

To win against p_y, a coalition needs then the support of both r_y and p_o (since if each votes instead for p_y, then p_y wins). But also when $\theta > \frac{1}{2}$, a large proportion of the population consumes education. The provision of significant levels of public education per

15

capita becomes relatively expensive. The rich can then cooperate with the old poor in order to reduce taxes and target the revenues to income redistribution instead of public education. In particular, when $\theta > \frac{1}{2}$, the Pareto set of r_y and p_o does not include the ideal policy of p_y. Figure V depicts this Pareto set (the bold line) for the case of $\theta > \frac{1}{2}$ and $\theta < \frac{w}{w_h}$.[18] It also depicts the (credible) policies of the $r_y p_o$ coalition which are better for both factions relative to the ideal policy of p_y; these are the policies on their Pareto set which are bound by the indifference curves of r_y and p_o that go through $(1, g^*(1))$.

Thus, the party of the young rich and the old poor can win by advocating policies with tax level that is less than the maximum, relatively high levels of income redistribution, and no public provision of education. Against possible competition from p_y, the party's policies attract the votes of the groups it represents as well as the votes of the old rich. The party is also stable since neither p_o nor r_y prefers to split; in such a case p_y would win.[19]

Thus, when income redistribution is feasible, it becomes the dominant form of redistribution when the young are a majority, at the expense of public education. The result here (see Figure V) that the level of public provision of education goes down all the way to zero should not be taken literally: it is an artifact of the simplifying assumption that the old do not care at all about education. If the old would somewhat benefit from education, public education may be provided but still at a lower level (per capita) than when the young are a minority.

To summarize, minorities are successful in the political process because both decisions are taken simultaneously in equilibrium: the size of government and the use of its resources. It allows for a "give and take" compromise within parties. In this intraparty compromise, minorities overcome majoritarian interests; the minority segment of the poor agrees to lower taxes and the rich in return agree to finance some level of the "cheaper" type of redistribution.

III.B. Private Education

The political outcomes are translated back into private choices in the education market. To understand how private education is affected by the political process, consider first the case in which the old are a majority. Another glance at Figures III.A and IV allows us to

---

[18]   It is obvious that the Pareto set of $r_y p_o$ does not contain the ideal policy of p_y when $\theta > \frac{w}{w_h}$ since in this case the Pareto set contains only policies with $g = 0$.

[19]   Another possible stable coalition in this case is that of $r_o p_o$.

see that the political outcomes in this case are on the non-linear part of the indifference curves of the young poor. This implies that for the young poor, $s = 0$ in equilibrium so that they do not buy additional education in the private market. This has two implications. First, in equilibrium the level of education provision may be inefficient. The inefficiency arises because agents cannot scale back on their education (i.e., I assume that s cannot be negative) and because indeed in equilibrium this constraint is binding. Second, for some parameters, $s = 0$ for the young rich as well. This means that the rich and the poor can be equally educated since both settle for public education only.

On the other hand, when the old are a minority, there is a lower provision of public education. This means that the young - both rich and poor - are more likely to buy private education. Another feature of the equilibrium is that income inequality persists, i.e., that the tax level is not at its maximum. Obviously then the rich invest more in education due to larger resources, which implies that the rich are better educated than the poor. We therefore have:

PROPOSITION 2 The rich and the poor are more likely to be equally educated when the young voters are a minority.

This may have interesting dynamic implications. If education is positively related to future income, then a small cohort of young voters is more likely to lead to equality of income in the long term (because the poor are more likely to be as educated as the rich are) than a large cohort of young voters.[20]

III.C. The Effects of Income Inequality

Finally, we can assess the effects of income inequality on equilibrium outcomes. When $\theta > \dfrac{w}{w_h}$ and income inequality is relatively high, then the young rich prefer no redistribution at all or in other words, the young rich and the old rich have similar preferences. On the other hand, when $\theta < \dfrac{w}{w_h}$, the young rich advocate public education and thus become more similar in their preferences to the young poor. This, as shown below, has different effects depending again on relative cohort sizes:

PROPOSITION 3 When the old are a majority, higher income inequality may increase tax rates and the level of public education. When the young are a majority, higher income inequality may decrease tax rates.

---

[20] I discuss additional dynamic issues in section IV.A.

When the old are a majority, cohesiveness among the rich can affect policies in two ways. First, recall that any winning coalition would need to win against the old poor and hence would need to attract the votes of both the old rich and the young poor (otherwise, the old poor win the election). We have described one possible coalition that is always stable, that of the old rich and the young poor themselves. When the preferences of the rich groups are similar (or when income inequality is high) then a coalition of the young rich and the young poor can also manage to attract all votes necessary to win the election (in particular, the votes of the old rich). The policies of this "young" coalition will typically be characterized by higher public provision of education, compared with those of the old rich and the young poor. When income inequality is low on the other hand, the preferences of the different rich groups are more divergent and hence the "young" coalition is less likely to attract the votes of the old rich and therefore less likely to win.

Second, since they have similar preferences, the two rich groups may compete with one another too fiercely for the votes of the poor. Consider again the coalition of the old rich and the young poor. This coalition may face a possible competition not only from the old poor but also from the young rich who may run for election (offering a policy of zero taxation). The young rich would attract the votes of all the rich. If also the old poor would vote for them, the young rich will win. Thus, the coalition of the old rich and young poor must offer relatively high tax rates and high income transfers in order to attract the old poor voters and fend off competition from the young rich. On the other hand, when income inequality is low and the young rich's ideal policy advocates only public education and no income redistribution, the young rich cannot attract the old poor voters. The coalition is therefore 'safe' even by offering relatively low taxes.

Importantly, higher income inequality has completely different effect on equilibrium outcomes when the young are a majority. When the young are a majority, it is low income inequality rather than high income inequality that can result in higher taxes. To see why, consider a coalition composed of old representatives, rich and poor, who may attempt to win the election with the policies described in Figure V (these policies are on the coalition's Pareto set). But low income inequality implies that the young rich become more attractive to the young poor since the former are actually in favour of public education. Thus, when income inequality is low, the "old" coalition has to overcome competition from the young rich who can cater to the young poor and therefore the coalition must choose a policy with

relatively high taxes and high income transfers (it cannot offer any public education) in order to win. When income inequality is high, the young rich cannot attract the votes of the young poor since they advocate a policy of zero taxation.

A dynamic path of income inequality can be therefore non trivial in the context of this model. High income inequality may lead to lower income inequality when the young are a minority but to an even higher inequality when the young are a majority. Thus, whether, starting from an unequal distribution of income would result in convergence of income or in a further divergence may depend on demographic parameters such as the cohort size of young voters.

IV. Discussion and Extensions

In this section I discuss the main assumptions of the model. This illustrates the robustness of the results and also suggests some possible extensions.

IV.A. Dynamics

Although the model is static it can still capture many features of dynamic environments. An important feature of education in a dynamic environment is that costly investment in education at present may yield benefits only in the future. In the model I assume a general enough utility function for young voters, which can capture the fact that young voters enjoy present income as well as future income, which can then be an increasing function of investment in education.

Apart from capturing the dynamic features of education in a reduced form manner in the utility function, dynamic considerations may also affect the political process. The results of the model can be robust to such an extension. Suppose that indeed there are two periods and that the political process repeats itself at each period (with the demographic features of the population possibly evolving). In such a model, society determines tax and education policies in period 1, while these do not commit the period 2 population who then determines its own tax and education policies. In this case, as long as the poor believe that as a group they are likely to remain more than half of the population despite some of them investing in education, then the model's results are maintained since voting incentives in period 1 are the same as in the model. The reason is that at period 2 any voter is better off being rich, disregarding the particular equilibrium outcome. Thus young voters who will

19

become old at period 2 still want at period 1 to trade-off income for education.

An alternative environment is one in which there is political commitment across periods so that the same taxing and spending decisions in period 1 are re-instated in period 2. In such a case a young voter must take into consideration in period 1 the effect of tax also on her future income in period 2, when she turns old (and possibly rich, if she invests in education). Voting incentives can still be maintained as in my analysis but this would demand imposing more assumptions on the utility function of the young mainly in order to maintain single-peaked preferences and equilibrium existence.

IV.B. Old, Young and Preferences over Public Education

Several assumptions created a stark distinction between the old and the young in the model, or more generally between the two groups who have different attitudes towards education. Most of these assumptions were made to facilitate the analysis but are not crucial. First, I have assumed that the old do not benefit at all from education; the results can be modified if we allow the old to care somewhat about education (but less than the young do).

Second, I have assumed that only the young consume education. All the results hold if the old consume sufficiently low levels of publicly provided education. To see that, note that the share of those in the population who consume education determines how costly it is to provide it. When the young are a majority, allowing the old to consume education would just reinforce the results since public education is already perceived by the rich as too expensive. When the old are a majority the results are sustained as long as public education is not too costly, so that the young rich and the old poor could credibly offer it in equilibrium. This happens either when the old do not consume too much education, or otherwise when either the share of the poor is relatively large, or when income inequality is relatively low.

Third, the utility function of the old is assumed to be linear is income or in the consumption of the numeraire good; this is not important and alternatively, one can assume that their utility is concave. Similarly, the utility function of the young is assumed to be concave in the consumption of education as well as in the consumption of the numeraire good. An alternative assumption is that their utility function is linear and public education is simply an income transfer from the old to the young. The model can be modified to

maintain the results in this case.

Finally, it is important in the model that society is divided according to agents' attitudes towards education. In the extreme cases of homogenous societies, when $\theta = 0$ (all are old) or when $\theta = 1$ (all are young), there is only one dimension of conflict. It is then easy to see that in such cases the stable political outcome is majoritarian and coincides with the ideal policy of the poor.[21] This illustrates the importance of analyzing a model with more than one dimension of conflict, in which different groups in society 'trade' with one another to produce non-majoritarian outcomes.[22]

IV.C. Political Institutions and Electoral Rules

To simplify the political model, the analysis was focused on the electoral system of plurality rule. Some electoral systems are indeed majoritarian and can be approximated by plurality rule. Adapting the model for other electoral systems and forms of government is clearly an important avenue for future research.

Let us consider for example an electoral rule of proportional representation (PR). In PR systems, the political outcome is a weighted average of the policies offered in the election (the weights would depend on the parties' vote shares as well as on the process of government formation). As a result, the probability of each party affecting the political outcome is not 0 or 1 as in the majoritarian system described in this paper, but is smoother. A reasonable conjecture in such a case is that more parties would run for election and that the political outcome would represent a larger share of the population. This may imply that the equilibrium outcomes will be less stark compared with the current model. Thus, a possible test of the model is in the context of a cross-country analysis. By exploiting the variation of electoral rules we can test whether indeed the effects described in this paper are stronger in countries with majoritarian systems than in countries with PR.[23]

---

[21] This can also be generalized for societies with more than two levels of income. The general result would then be that if the median income is less than the mean, there is maximum taxation, whereas if the median income is higher than the mean, there would be no taxation at all. Such results accord with previous literature on redistribution, notably Roberts [1977]

[22] The fact that outcomes are majoritarian at the extreme cases of $\theta = 0$ and $\theta = 1$ implies that political outcomes exhibit discontinuity when $\theta \to 1$ or $\theta \to 0$. Such discontinuities are reasonable. They arise because when a group of voters increases its share in the population from 0 to a positive share, it becomes represented in the political process and gains political power.

[23] Research in comparative political institutions has shown that typically proportional representation

V. Conclusion

In this paper I have shown how, when income redistribution is feasible as well, a negative cohort size effect arises with respect to public provision of education. When the young are a minority then the poor segment of the young forms a winning coalition with the rich. Such coalition provides public education. When the old are a minority on the other hand, it is the old poor who form a coalition with the rich and this coalition provides income transfers instead. In any case, since the rich are always represented in the winning coalition, the poor do not fully expropriate the rich. These results imply that the poor and the rich are more likely to be equally educated when the young are a minority. I have also shown that income inequality may have different effects on tax rates and public provision of education, depending on its interaction with demographic parameters.

The results arise due to a combination of economic and political factors; the economic factor links the size of the cohort of young voters to the relative costs of the two different types of redistribution - the targeted (education) and the universal (income redistribution). The political factor on the other hand determines how easy it is for a group, given its size and hence the relative cost of the redistribution it advocates, to make political compromises when forming parties with other groups.

In terms of empirical work, it may be fruitful to conduct an analysis which looks simultaneously at the composition of parties or coalitions, the level of income redistribution or the welfare state, the level of public provision of education as well as the consumption of private education. Finally, although the paper focuses on education, the analysis may apply to other private goods which are publicly supplied or also to local public goods. It might therefore be useful to continue in this direction and investigate, theoretically and empirically, how the results of the model extend when the minority groups in the economy advocate other specific private goods or local public goods.

Appendix

A. Definition of δ_0 and μ_0 :

systems have larger governments and larger welfare states than majoritarian system countries (where welfare can be interpreted as income redistribution in the model). For theoretical and empirical analysis of the economic effects of different electoral systems see Persson and Tabellini [2000, 2003].

Denote the Pareto set of $r_o p_y$ when it is interior as $\tilde{Q}_{r_o p_y}$. Define $(t', g') \in \tilde{Q}_{r_o p_y}$ as the policy that makes r_o indifferent to the ideal policy of p_o, i.e., $v_{r_o}(t', g') = v_{r_o}(1, 0)$. Similarly, let $(t'', 0) \in \tilde{Q}_{r_o p_o}$ be defined by $v_{r_y}(t'', 0) = v_{r_y}(1, g^*(1))$. I then define:

$$\delta_0 \equiv v_{p_o}(1, g^*(1)) - v_{p_o}(t', g'), \quad \mu_0 \equiv v_{p_y}(1, 0) - v_{p_y}(t'', 0).$$

Note that $\mu_0 > 0$. I also assume that $\delta_0 > 0$.

B. Full Characterization of Stable Political Outcomes:

LEMMA 2 With endogenous parties:[24]

(i) When $\theta < \frac{1}{2}$:

-The partition $r_o p_y | r_y | p_o$ is stable for all parameters with the party $r_o p_y$ winning with policies in its Pareto set which r_o and p_y prefer to $(1, 0)$. These policies have $g > 0$ and $t < 1$ and are worse for p_o than the ideal policy of p_y. If $\theta > \dfrac{w}{w_h}$, these policies are also preferred by p_o to $(0, 0)$.

-The partition $r_y p_y | r_o | p_o$ is stable for some parameters and more often when $\theta > \dfrac{w}{w_h}$, with $r_y p_y$ winning the election with policies in its Pareto set which r_o and p_y prefer to $(1, 0)$, and are thus characterized by $g > 0$ and $t < 1$. These policies have higher level of g than the winning policies of the party $r_o p_y$.

-The partition $r_o p_y r_y | p_o$ is stable when $\theta > \dfrac{w}{w_h}$, with the party $r_o p_y r_y$ winning with policies in its Pareto set which r_o and p_y prefer to $(1, 0)$, and thus satisfy $g > 0$ and $t < 1$. These policies are also worse for p_o than $(0, 0)$.

(ii) When $\theta > \frac{1}{2}$:

-The partition $r_y p_o | r_o | p_y$ is stable for all parameters with the party $r_y p_o$ winning with policies in its Pareto set which r_y and p_o prefer to the ideal policy of p_y. These policies have $g = 0$ and $0 < t < 1$.

-The partition $r_o p_o | r_y | p_y$ is stable for all parameters with the party $r_o p_o$ winning with policies in its Pareto set which r_y and p_o prefer to the ideal policy of p_y. These policies have $g = 0$ and $0 < t < 1$. If $\theta < \dfrac{w}{w_h}$, these policies are such that p_y prefers them to the ideal policy of r_y.

DEPARTMENT OF ECONOMICS, LONDON SCHOOL OF ECONOMICS.

---

[24]   For the proof, see Levy [2005].

REFERENCES

Alesina, Alberto, Reza Baqir and William Easterly, "Public Goods and Ethnic Divisions", *Quarterly Journal of Economics* CXIV (1999), 1243-1284.

Austen-Smith, David, "Majority Preferences for Subsidies over Redistribution", *Journal of Public Economics*, LXXXVII (2003), 1617-1640.

Austen-Smith, David and Michael Wallerstein, "Redistribution in a Divided Society", MEDS discussion paper no. 1362, 2003.

Barzel, Yoram, "Private Schools and Public School Finance", *Journal of Political Economy*, LXXXVI (1973), 174-186.

Bearse, Peter, Gerhard Glomm and Eckhard Janeba, "Composition of Government Budget, Non-Single Peakedness, and Majority Voting", *Journal of Public Economic Theory*, III (2001), 471-481.

Besley, Timothy, and Stephen Coate, "An Economic Model of Representative Democracy", *Quarterly Journal of Economics*, CVIII (1997), 85-114.

Besley, Timothy, and Stephen Coate, "Public Provision of Goods and the Redistribution of Income", *American Economic Review*, LXXXI (1991), 979-984.

Button, James, "A Sign of Generational Conflict: The Impact of Florida's Aging Voters on Local School and Tax Referenda", *Social Science Quarterly*, LXXIII (1992), 786-797.

Case, Anne, James R. Hines and Harvey S. Rosen, "Budget Spillovers and Fiscal Policy Interdependence: Evidence from the States", *Journal of Public Economics*, LII (1993), 285-308.

Epple, Dennis, and Richard E. Romano, "Public Provision of Private Goods", *Journal of Political Economy*, IV (1996a), 57-84.

Epple, Dennis, and Richard E. Romano, "Ends Against the Middle: Determining public service provision when there are private alternatives", *Journal of Public Economics*, LXII (1996b), 297-325.

Fernández, Raquel, and Gilat Levy, "Diversity and Redistribution", mimeo.

Fernández, Raquel, and Richard Rogerson, "On the Political Economy of Education Subsidies", *Review of Economic Studies*, LXII (1995), 249-262.

Fernández, Raquel, and Richard Rogerson, "Equity and Resources: An Analysis of Education Finance Systems", *Journal of Political Economy*, CXI (2003), 858-897.

Glomm, Gerhard, and B. Ravikumar, "Opting out of publicly provided services: a majority voting result", *Social Choice and Welfare*, XV (1998), 187-193.

Gradstein, Mark, and Michael Kaganovich, "Aging Population and Education Finance", CEPR discussion paper No. 3950, 2003.

Harris, Amy, R., William.N. Evans and Robert M. Schwab, "Education Spending in an Aging America", *Journal of Public Economics*, LXXXI (2001), 449-472.

Koretz, G. "Pitting Grandpa Against Junior?", Business week, April 3 (1985), p. 42.

Ladd, Helen, and Sheila E. Murray, "Intergenerational Conflict Reconsidered: Country Demographic Structure and the Demand for Public Education", *Economics of Education Review*, XX (2001), 343-357.

Levy, Gilat, "A Model of Political Parties", *Journal of Economic Theory*, CXV (2004), 250-277.

Levy, Gilat, "The Politics of Private Provision of Education: Proofs", LSE working paper, 2005. Available on http://personal.lse.ac.uk/levyg1/eduqjeappendix.pdf.

Lindert, Peter, "What Limits Social Spending", *Explorations in Economic History*, XXXIII (1996), 1-34.

Osborne, Martin, and Al Slivinski , "A Model of Political Competition with Citizen-Candidates", *Quarterly Journal of Economics*, CXI (1996), 65-96.

Persson, Torsten, and Guido Tabellini, *Political Economics - Explaining Economic Policy*, (Cambridge, MA; MIT Press, 2000).

Persson, Torsten, and Guido Tabellini, *The Economic Effects of Constitutions*, (Cambridge, MA; MIT Press, 2003).

Poterba, James, "Demographic Structure and the Political Economy of Public Education", *Journal of Policy Analysis and Management*, XVI (1997), 48-66.

Ray, Debraj, and Rajiv Vohra, "Equilibrium Binding Agreements", *Journal of Economic Theory,* LXXIII (1997), 30-78.

Roberts, Kevin, "Voting over Income Tax Schedule", *Journal of Public Economics*, VIII (1977), 329-340.

Roemer, John, "Why Don't The Poor Expropriate the Rich", *Journal of Public Economics*, LXX (1998), 399-424.

Rubinfeld, Daniel, "Voting in a Local School Election: A Micro Analysis", *Review of Economics and Statistics*, LIX (1977), 30-42.

Stiglitz, Joseph, "The Demand for Education in Public and Private School Systems", *Journal of Public Economics*, III (1974), 349-385.

Stromberg, David, "Demography, Voting, and Local Public Expenditures. Theory and Evidence from Swedish Municipalities", Princeton University working paper, 2000.
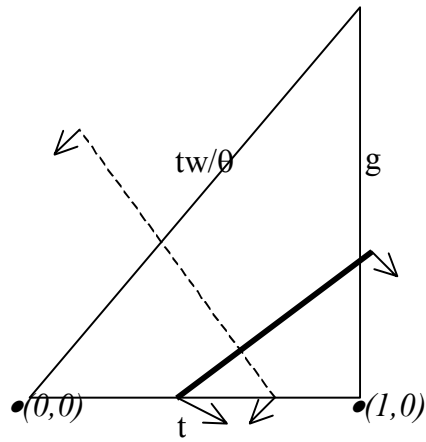
Figure I

Indifference curves for r_o (the dashed line) and for p_o (the bold line). Arrows shows direction of increase in utility.
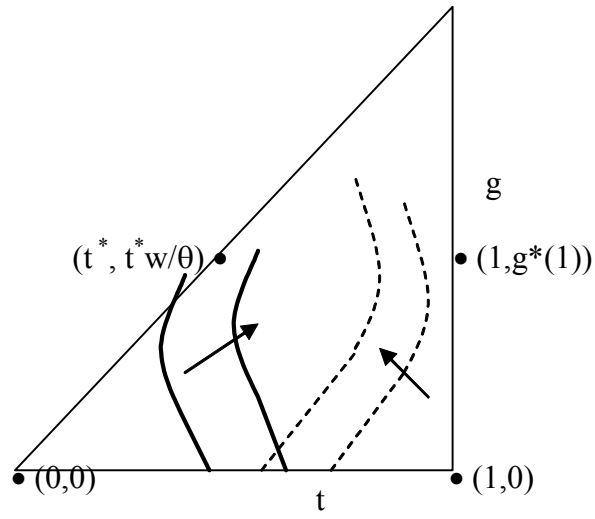
Figure II

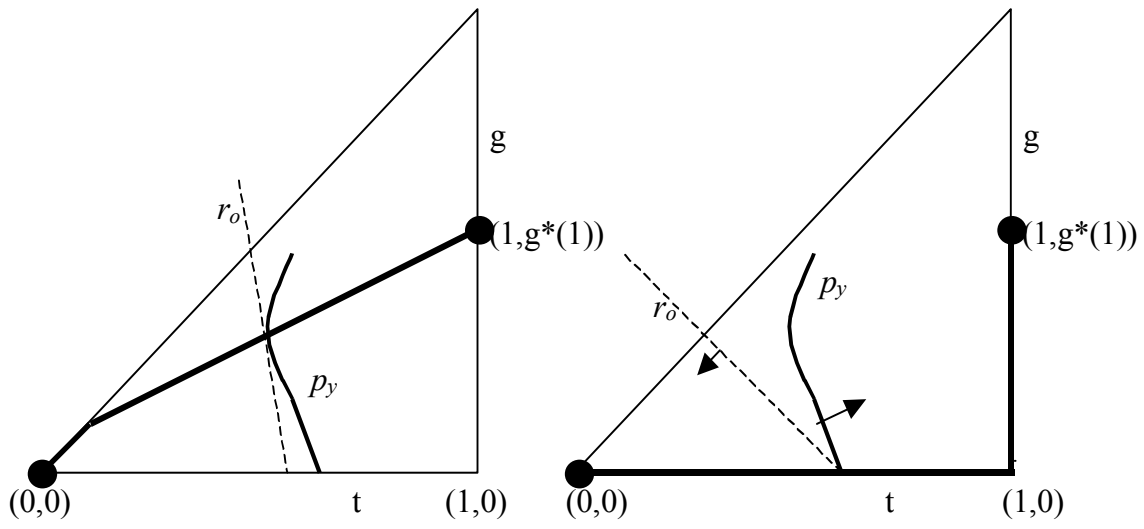Indifference curves for r_y (dashed) and for p_y (bold) with arrows denoting direction of increase in utility.

g

r_o

$(1,g^*(1))$

p_y

(0,0)

t

(1,0)

g

$(1,g^*(1))$

r_o

p_y

(0,0)

t

(1,0)

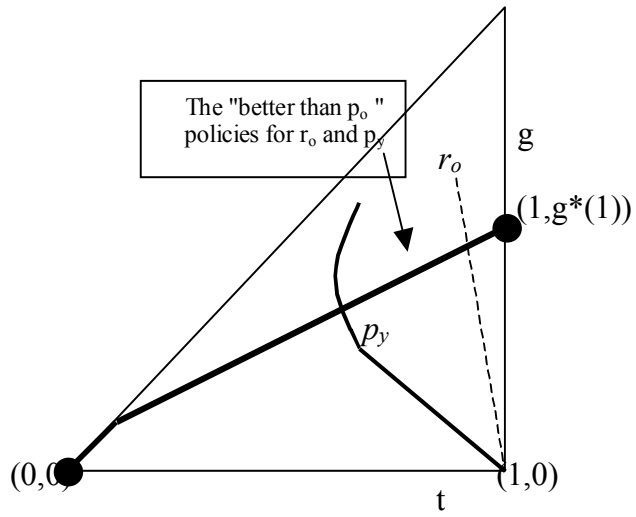Figure III.A (left) and Figure III.B (right).

Figure IV

The indifference curve of r_o (the dashed line) that goes through the ideal policy of p_o, $(1,0)$, and that of p_y that goes through $(1,0)$, define the set of policies on the Pareto set of r_o and p_y (the bold line) which are better for both relative to the ideal policy of p_o.
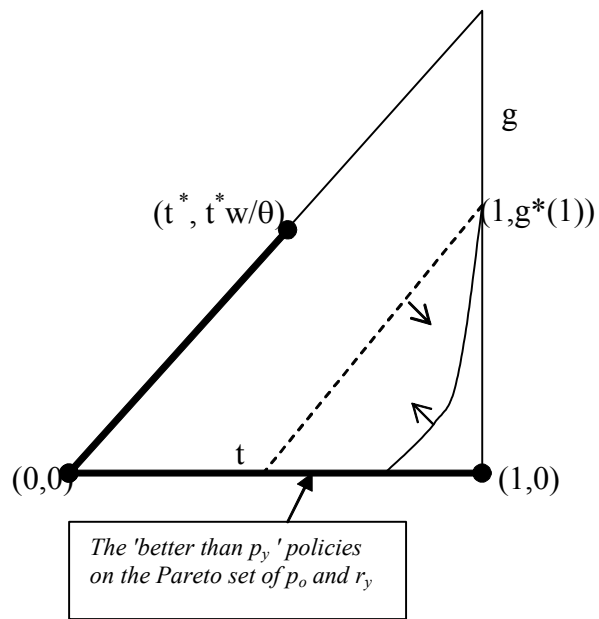
g

$(t^*, t^*w/\theta)$

$(1, g^*(1))$

t

$(0,0)$

$(1,0)$

The 'better than p_y' policies
on the Pareto set of p_o and r_y

Figure V