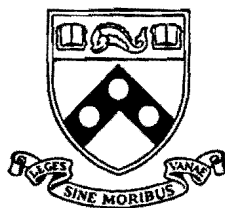


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*Democratic Choice of an Education System:  
Implications for Growth and Income Distribution*

by

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Democratic Choice of an Education System:

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## ABSTRACT

We use an OLG model to examine democratic choice between two modes of government support for education: subsidies for privately purchased education and free uniform public provision. We find little conflict between democracy and growth: the same factors that generate popular support for subsidization over free uniform provision – large external benefits, a large excess burden and little inequality – also favor its relative growth performance. Furthermore, restricting the franchise to an upper-income elite may also reduce growth. Two extensions examine the effect of intergenerational mobility and indicate the theoretical possibility of periodic swings in the balance between public and private spending.

## 1 Introduction

Recent theoretical models of the political economy of growth, *e.g.*, Alesina and Rodrik (1994) and Persson and Tabellini (1994), draw attention to popular demand for fiscal redistribution as a factor that may impede growth in a democratic system. However, empirical evidence presented in recent studies does not support this view. In particular, Perotti's (1996) findings on the effect of redistributive transfers on growth do not support the hypothesis that democracy harms growth by exerting redistributive pressure: his estimates indicate that such transfers have a positive effect on growth, if anything.<sup>1</sup> Barro's (1996) comprehensive study of growth in a panel of 100 countries finds that "the middle level of democracy is most favorable for growth", after controlling for education, demography, rule of law, initial income, *etc.*; and when the schooling, demography and rule-of-law variables are omitted, the positive effect of democracy is monotonic, suggesting that the beneficial effect of democracy may work through its impact on schooling or the rule of law.<sup>2</sup> Thus there is little in the empirical evidence to support a view of democratic choice as only too ready to sacrifice future growth for immediate redistribution.

The political-economic analysis presented in this paper offers a theoretical framework that is consistent with this evidence, reconciling democracy and growth. Focusing on the formation of human capital through education,<sup>3</sup> it posits a heterogeneous population of rational voters whose choice between alternative education systems balances different considerations, attaching value not only to current consumption and leisure but also to the future earning capacity of their children. Called upon to compare a system of subsidized private purchases of education with a system of free uniform public schooling, and with a purely private system, they consider the extent to which each system internalizes the external benefits of education; offsets the imperfection of capital markets that do not accept human capital as collateral; redistributes the cost of education to the

advantage of those earning less than average income; and imposes an excess burden in funding public expenditures from income taxes that reduce the incentive to work.<sup>4</sup>

These issues are formally examined in the context of an overlapping generations model in which households differ in their initial endowments and in their randomly acquired individual abilities, and public policy is determined by majority vote. Previewing our results, we show that because voters take into account all of these effects – and not just the distributional gains or losses from public intervention – democratic choice does not generally lead to the adoption of an education system that is worse for growth than other choices. The same factors that favor subsidization over public provision with regard to growth performance – larger external benefits, a heavier excess burden and less initial inequality – also strengthen its public support (and *vice versa*.) Of course, the machinery of democracy weighs these considerations differently than would a growth-promoting social planner, so the possibility that the growth-promoting system is not chosen remains, but the democratic system is not generally biased against growth. Nor does restricting the voting franchise to an upper-income elite generally promote growth: with high inequality, universal suffrage leads to a choice of free public education which generates stronger growth (and greater equity) than the subsidized private system which a sufficiently restricted franchise would choose.

This analysis speaks to central issues in the endogenous growth literature. The common assumption in this literature, that there are external benefits associated with human capital (*e.g.*, Romer, 1986; Lucas, 1988; Azariadis and Drazen, 1990) begs the question, how might public intervention internalize these benefits, raising the issues we consider here regarding the type of education policy likely to be selected by democratic choice, and its effect on economic performance and equity. In this respect, the present paper extends the theoretical work of several

recent studies. Closest to our approach, Glomm and Ravikumar (1992) compare purely private provision of education with a free public system in a similar formal context, concluding that democracy is harmful for growth inasmuch as a majority of individuals always prefer public education over private education, though private education induces more (immediate) investment in education than does public provision. However, they do not allow for the external benefits of education, nor do they consider the advantages of subsidized education, thus diminishing the force of their argument. As we show here, allowing external benefits and subsidized education substantially strengthens the case for public intervention. In other closely related work, Benabou (1995, 1996) compares public and private education in the context of an infinite horizon framework, concluding that private education exhibits stronger performance in the short run, but public education attains better results in the long run – hence the latter will be preferred by far-sighted individuals. However, his analysis ignores the efficiency cost of raising taxes to fund public education, a key element in the argument that democracy inhibits growth. We demonstrate the compatibility of democracy with superior growth even when such costs are present.<sup>5</sup>

Two additional points are addressed in the paper. We contrast two extreme cases of intergenerational mobility, and find that the greater inequality generated by immobility increases the popularity of a free public system. And we point to the theoretical possibility of periodic swings between public provision and subsidization, recalling Hirschman's (1981) broader analysis of periodic swings in the balance between the public and private sectors.

The structure of the paper is as follows. In the next section we describe a basic overlapping generations model with education as a factor of production, and derive its equilibrium, absent intervention. In section 3 we characterize equilibrium under two alternative policy regimes: government subsidies for privately purchased education and free uniform public provision, both

funded by proportional taxation. The different regimes are compared with regard to growth performance, in section 4, and with regard to popular support, in section 5 where the link between democracy and growth is examined. In section 6 we consider two extensions: the implications of intergenerational immobility, and the dynamic stability of regime choice. The paper ends with some brief concluding remarks.

## 2 Basic definition of the model

Consider an overlapping generations economy in which individuals live for two periods. In the first period they study, supported by their parents, and in the second allocate their time between work and leisure. In each period  $t$  there is a continuum of heterogeneous families in the economy indexed by  $i$ , each comprising a parent and a child, the total population remaining constant over time.<sup>6</sup> Families are differentiated by the innate ability of the parent,  $a_{it}$ , and of the child,  $a_{it+1}$ , and by the education level of the parent,  $h_{it}$ , and we take the initial distribution of parental education,  $h_{i0}$ , as given. The distribution of ability in the population in each generation is an exogenous random variable (*cf.* Loury, 1981). These random ability shocks generate some measure of income inequality even when education is uniform. (Specific assumptions on the nature of their distribution will be made at a later point.)

The distribution of education in the population (for  $t > 0$ ) is determined by the individual and collective decisions of the population in each period, under the existing education regime. The earning capacity of parent  $i$ , reflected perfectly in the wage rate,  $w_{it}$ , is a function of individual ability and education, and of the average level of education in the parent generation,  $\bar{h}_t$ ; individual education thus generates a positive externality through the joint input  $\bar{h}_t$ . As is standard in the literature we assume a Cobb-Douglas technology:

$$w_{it} = \alpha_{it} h_{it}^{\alpha} \bar{h}_t^{\beta} \quad (1)$$

where  $0 < \alpha, \beta < 1$  are constants, and we allow education to exhibit decreasing ( $\alpha + \beta < 1$ ), constant ( $\alpha + \beta = 1$ ), or increasing returns to scale ( $\alpha + \beta > 1$ ) in human capital. We further assume that each parent is endowed with one unit of time per period which she divides between work and leisure; income is the product of earning ability and time allocated to work. Denoting time allocated to leisure by  $n_{it}$  and income by  $y_{it}$ ,

$$y_{it} = w_{it}(1 - n_{it}) \quad (2)$$

Parents make all relevant decisions in this economy. In addition to allocating their time between work and leisure, they allocate their income between current family consumption,  $c_{it}$ , and investment in their child's education,  $h_{it+1}$ :

$$y_{it} = c_{it} + h_{it+1} \quad (3)$$

and they make collective decisions on education policy by majority vote. The utility which they maximize derives from current consumption and leisure, and from the earning capacity they bequeath to their children,  $w_{it+1}$ , which depends on the child's innate ability and education, and on the education of the child's cohort. Assuming additively separable logarithmic utility we have:

$$u(c_{it}, n_{it}, w_{it+1}) = \ln c_{it} + \eta \log(n_{it}) + \delta \log(w_{it+1}) \quad (4)$$

where  $\eta$  and  $\delta$  are positive constants.<sup>7</sup>

We first consider the case of purely private provision of education, without government intervention. In each period  $t$ , the parent of family  $i$  first allocates her time between leisure and work, and then allocates her income from work between current consumption and (private) investment in her child's education. Hence, each parent can be said to maximize individual utility, (4), subject to equations (1) and (2), and the budget constraint, (3). In equilibrium, individual optimal choices must be mutually consistent. Straightforward calculation reveals that all



households always choose the same allocation of time to leisure. Letting superscript  $p$  denote equilibrium values under private provision of education,  $n_{it}^p = n^p = \eta/(1 + \delta\alpha + \eta)$ , and each parent allocates  $\delta\alpha(1 + \delta\alpha)$  of her income to education.<sup>8</sup> Therefore, initially  $y_{i0}^p = w_{i0}(1 - n^p)$ , and for  $t > 0$ ,

$$y_{it}^p = a_{it}[\delta\alpha(1 + \delta\alpha)]^{\alpha+\beta} (y_{it-1}^p)^\alpha (\bar{y}_{t-1}^p)^\beta (1 - n^p) \quad (5)$$

where  $\bar{y}_{t-1}^p$  is the equilibrium value of per capita output in period  $t-1$ .

### 3 Intervention

The positive externality associated with education implies that private provision will not yield an optimal outcome, indicating a potential role for government intervention. Our analysis focuses on two alternative modes of intervention: an *education subsidy* determined by majority vote and financed by a proportional income tax; and *public provision*, where the government sets a uniform level of education for all, also determined by majority vote and financed by a proportional income tax. We begin by deriving the political-economic equilibrium under each regime, assuming throughout that the initial endowments of ability and education are given, and that the first-period wage rate derives from them via equation (1).

#### 3.1 Subsidized education

Consider first that education is provided privately but supported by a subsidy at the proportional rate  $s$ , financed by a proportional income tax of  $\tau^s$ , where superscript  $s$  denotes parameter values under subsidization. We stipulate that the budget must always be balanced so

that  $s\bar{h}_{t+1}^s = \tau^s \bar{y}_t^s$ ;  $\tau^s/s$  is then the share of national income spent on education. In each period, parents first vote on the desired education subsidy (taking full account of its tax implications), then allocate their time between labor and leisure, and finally allocate their after-tax income between the subsidized education of their children and current consumption. Parents' votes and individual decisions depend on their expectations regarding the current aggregate labor supply curve (which links the education level to the tax rate), and we require that in equilibrium these expectations are fulfilled.

The heterogeneity of the population notwithstanding, straightforward derivation shows that all parents prefer the same subsidy and tax rates:

$$s = \beta(\alpha + \beta) \quad (6)$$

$$\tau^s = \delta\beta[1 + \delta(\alpha + \beta)] \quad (7)$$

As might be expected, the subsidy level varies positively with the magnitude of the external effect; if there is no external effect ( $\beta = 0$ ) parents prefer that no subsidy be given, *i.e.* they prefer a purely private regime. Parents also agree on the amount of leisure they desire:

$$n_{it}^s = n^s = \eta(1 + \delta\alpha + \eta) \quad (8)$$

Initial income of household  $i$  is then  $y_{i0}^s = w_{i0}(1 - n^s)$ , and its income in later periods is:

$$y_{it}^s = a_{it}(\tau^s/s)^{\alpha + \beta} (y_{it-1}^s)^\alpha (\bar{y}_{t-1}^s)^\beta (1 - n^s) \quad (9)$$

### 3.2 Public provision

Now consider the alternative policy of free public provision. We assumed that, in each period  $t$ , parents vote on a communal level of education for their children,  $h_{it+1}^g \equiv \bar{h}_{t+1}^g$ , where superscript  $g$  denotes parameter values under public provision, and then decide individually on the

amount of labor each wants to supply. Income is produced, and wages are then taxed proportionally at a rate that fully funds the desired level of education:

$$\bar{h}_{t+1}^g = \tau_t^g \bar{y}_t^g \quad (10)$$

where  $\tau_t^g$  is both the tax rate and the share of national income spent on education under public provision. Children are educated at a uniform level from tax revenues, and all disposable income is consumed. Again, parents' votes depend on their expectations regarding the current aggregate labor supply curve, and we require that in equilibrium their expectations are met. As in the previous case, all parents prefer the same tax rate:

$$\tau^g = \delta(\alpha+\beta) / [1+\delta(\alpha+\beta)] \quad (11)$$

Comparison of equations (6), (7) and (11) reveals that  $\tau^g = \tau^s/s$ : the same proportion of national income is spent on education under public provision as under subsidization – though costs and benefits are distributed differently under the two regimes. Note also that the proportion of income devoted to schooling under public provision is greater than under private provision, the more so the larger is the magnitude of the externality,  $\beta$ . (If there is no externality the share of total spending on education in total income is the same as under private provision.) All parents also desire the same amount of leisure:

$$n_{i0}^g = n^g = \eta / (1+\eta) \quad (12)$$

Initial income is then  $y_{i0}^g = w_{i0}(1-n^g)$ , and income in later periods is

$$y_{it}^g = a_{it} (\tau^g \bar{y}_{t-1}^g)^{\alpha+\beta} (1-n^g) \quad (13)$$

Collecting results:

*Proposition 1.* For any initial distribution of education and ability,

(i) If leisure is at all valued ( $\eta > 0$ ) free public provision reduces the supply of labor compared with other systems:  $1-n^p = 1-n^s > 1-n^g$ .

(ii) The education subsidies do not redistribute income: each household receives as a subsidy the same amount it paid in taxes,  $\tau^s y_{it}^s = s h_{it}^s$ .

(iii) When education has external benefits ( $\beta > 0$ ), public intervention increases the share of total resources allocated to education,  $\bar{h}_t^g = \bar{h}_t^s > \bar{h}_t^p$ .

## 4 Growth and distribution

### 4.1 Income means and variances

We turn now to a comparison of growth and income distribution over time under alternative regimes. We assume that the initial distribution of parental education is lognormal; that innate ability is independently distributed in each generation with a lognormal distribution, the mean of its logarithm equal to zero and its variance equal to  $\phi^2$ ; and that its distribution in each cohort is statistically independent of the initial distribution of education. (In section 6 we consider the implications of fully inherited ability.) It follows that the initial wage distribution is also lognormal (Aitchison and Brown, 1969) – say with parameters  $(\gamma_0, \sigma_0^2)$  – and so is initial income. Denoting the mean of  $\log(y_t^j)$  by  $\mu_t^j$ , where  $j = p, s, g$  denotes the education regime, we have,

$$\mu_0^j = \gamma_0 + \log(1-n^j) \tag{14}$$

and the variance of  $\log(y_{i0}^j)$  is  $\sigma_0^2$ . Initial mean income is then:

$$\bar{y}_0^j = \exp[\gamma_0 + \log(1-n^j) + \sigma_0^2/2] \tag{15}$$

It follows from equations (5), (9), and (13) that all future income distributions are also lognormal, and we can calculate their parameters recursively from these equations. (We assume here that it is impossible to switch from one regime to another. Regime choice and the implications of switching regimes are considered in the following sections.)

Under *private provision*, mean income in period  $t > 0$  can be calculated from:

$$\bar{y}_t^p = \exp(\mu_t^p + \sigma_t^2/2) \quad (16)$$

where, from equation (5):

$$\mu_t^p = \log(1-n^p) + (\alpha+\beta)\log[\delta\alpha/(1+\delta\alpha)] + (\alpha+\beta)\mu_{t-1}^p + \beta\sigma_{t-1}^2/2 \quad (17)$$

and  $\sigma_t^2$ , the variance of  $\log(y_{it}^p)$ , equals

$$\sigma_t^2 = \phi^2 + \alpha^2\sigma_{t-1}^2 = \phi^2(1-\alpha^{2t})/(1-\alpha^2) + \alpha^{2t}\sigma_0^2 \quad (18)$$

and converges to  $\phi^2/(1-\alpha^2)$ .

Similarly, under *subsidization* mean income in period  $t > 0$  can be calculated from

$$\bar{y}_t^s = \exp(\mu_t^s + \sigma_t^2/2) \quad (19)$$

where from equation (9):

$$\mu_t^s = \log(1-n^s) + (\alpha+\beta)\log(\tau^s/s) + (\alpha+\beta)\mu_{t-1}^s + \beta\sigma_{t-1}^2/2 \quad (20)$$

$\sigma_t^2$  is the same as for private education, and  $\tau^s/s = \delta(\alpha+\beta)/(1+\delta(\alpha+\beta))$  from (6) and (7).

Finally, under *public provision* variation in income derives only from differences in ability, hence the variance of  $\log(y_{it}^g)$  is  $\phi^2$  for all  $t > 0$ , and average income is:

$$\bar{y}_t^g = \exp(\mu_t^g + \phi^2/2) \quad (21)$$

where, from equation (13):

$$\mu_t^g = \log(1-n^g) + (\alpha+\beta)\log(\tau^g) + (\alpha+\beta)\mu_{t-1}^g + (\alpha+\beta)\phi^2/2 \quad (22)$$

and  $\tau^g = \tau^s/s$  from (11).

#### 4.2 Growth rates

Comparing growth rates under subsidization and private provision, the preceding analysis implies that for a given distribution of parental education initial average income is the same under the two regimes, but in subsequent periods, if there is a positive external effect ( $\beta > 0$ ), investment in education is stronger under subsidization and the rate of growth is higher in each period (and *a fortiori*  $\bar{y}_t^s > \bar{y}_t^p$  for all  $t > 0$ .)<sup>9</sup>

Comparing subsidization with public provision, we find that average income is initially higher under subsidization because of the greater excess burden under public provision, and next-period growth rates under the two regimes satisfy:

$$\log(\bar{y}_1^s/\bar{y}_0^s) - \log(\bar{y}_1^g/\bar{y}_0^g) = (\alpha + \beta)\log[(1-n^s)/(1-n^g)] - \alpha(1-\alpha)\sigma_0^2/2 \quad (23)$$

The factors that favor subsidization over public provision with regard to growth are: a large external effect (large  $\beta$ ), a strong bequest motive (large  $\delta$ ), a large excess burden (large  $\eta$ ), and a small dispersion of income (small  $\sigma_0^2$ ). Qualitative conditions for subsidization to promote stronger growth in all subsequent periods are similar though more stringent.<sup>10</sup> Summarizing,

*Proposition 2.* (i) Comparing subsidization and private provision, if there is a positive external benefit from education then growth is stronger under subsidization in all periods.

(ii) Comparing subsidization and public provision, average income is initially higher under subsidization, and this advantage is sustained in all periods if the external benefits of education ( $\beta$ ), the bequest motive ( $\delta$ ), and the excess burden of a free public system (which varies directly with

$\eta$ ) are large enough, and if initial inequality ( $\sigma_0^2$ ) and the dispersion of ability in the population ( $\phi^2$ ) are small enough.

#### 4.3 Steady-state output levels

When there are decreasing returns to scale ( $\alpha+\beta < 1$ ) the preceding analysis implies convergence to a finite steady state and allows us to derive explicit average output levels in the steady state. Denoting their values by  $\bar{y}_\infty^j$  for  $j = p, g, s$ , we have

$$\bar{y}_\infty^p = \exp\{[(\alpha+\beta)\log(\delta\alpha/(1+\delta\alpha)) + \log(1-r^p) + \phi^2/2(1+\alpha)]/(1-\alpha-\beta)\} \quad (24)$$

$$\bar{y}_\infty^s = \exp\{[(\alpha+\beta)\log(\tau^s/s) + \log(1-r^s) + \phi^2/2(1+\alpha)]/(1-\alpha-\beta)\} \quad (25)$$

$$\bar{y}_\infty^g = \exp\{[(\alpha+\beta)\log(\tau^g) + \log(1-r^g) + (\alpha+\beta)\phi^2/2]/(1-\alpha-\beta)\} \quad (26)$$

where  $\tau^s/s = \tau^s = \delta(\alpha+\beta)/(1+\delta(\alpha+\beta))$ ,  $1-r^p = 1-r^s = (1+\delta\alpha)/(1+\delta\alpha+\eta)$ , and  $1-r^g = 1/(1+\eta)$ .

Comparing steady state output under subsidization and under unsubsidized private provision, we have:

$$\log(\bar{y}_\infty^s/\bar{y}_\infty^p) = [(\alpha+\beta)/(1-\alpha-\beta)]\log\{[(\alpha+\beta)/(1+\delta(\alpha+\beta))]/[\delta\alpha/(1+\delta\alpha)]\} \quad (27)$$

which is positive when there are external benefits from education ( $\beta > 0$ ), increases when those benefits increase and decreases when the bequest motive,  $\delta$ , increases: a strong private bequest motive reduces the growth advantage of public intervention.

Comparing steady state output under subsidization and under public provision we do not find a general advantage for one regime or the other. The ratio of steady state outputs is:

$$\log(\bar{y}_\infty^s/\bar{y}_\infty^g) = (1-\alpha-\beta)\log[1+\eta(\alpha/(1+\delta\alpha+\eta))] + \phi^2[\beta(1+\alpha^2)-(\alpha+\beta)]/[2(1-\alpha-\beta)] \quad (28)$$

indicating that the relative advantage of subsidized education increases with the excess burden (which varies directly with  $\eta$ ), with the bequest motive ( $\delta$ ), and with the relative importance of the

appropriable benefits of education ( $\alpha$ , holding  $\alpha+\beta$  fixed), while it decreases with the inherent heterogeneity of the population ( $\phi^2$ ). Under a free public system the excess burden of funding education is increased, and the bequest motive loses importance, but inequality is reduced. Collecting results,

*Proposition 3.* When returns to scale in human capital are decreasing, average income converges to a steady state under each of the three regimes. A comparison of the three steady states reveals that steady state output under subsidization is always higher than under private provision, but the comparison between subsidization and free public provision depends on specific parameter values. A strong external effect (large  $\beta$ ) favors public intervention over private provision; a strong bequest motive (large  $\delta$ ) mitigates the disadvantage of private provision; a large excess burden (large  $\eta$ ) favors private provision and subsidization over free public provision; and a large dispersion of innate ability (large  $\phi^2$ ) favors free public provision over subsidization and private provision. In any event, free public provision results in less inequality than the other regimes.

## 5 Democracy

We now consider which mode of intervention is likely to emerge as the preferred outcome under majority voting by comparing the utility that each provides. As parents are in unanimous agreement regarding the preferred level of subsidization we can disregard “pure” private provision without a subsidy; if  $\beta > 0$  it is Pareto inferior to subsidization – and always generates less growth. Note, however that no level of subsidization can produce a Pareto optimal outcome – unless leisure has no value ( $\eta=0$ ) – because of the excess burden of funding the subsidy.



Therefore we focus on a comparison of subsidization with public provision. The parent of family  $i$  in period 0, choosing between the two regimes, considers the utility differential

$$u_{i0}^s - u_{i0}^g = \eta \log(n^s/n^g) + [1 + \delta(\alpha+\beta)] \log[(1-n^s)/(1-n^g)] + \delta \alpha \log(y_{i0}^s/\bar{y}_0^s) \quad (29)$$

which is clearly an increasing function of individual income, reflecting the redistributive property of public provision, and implying that the preference of the median-income voter is decisive. For the median voter we have:

$$u_{m0}^s - u_{m0}^g = \eta \log(n^s/n^g) + [1 + \delta(\alpha+\beta)] \log[(1-n^s)/(1-n^g)] - \delta \alpha \sigma_0^2/2 \quad (30)$$

where the first term on the right-hand side is negative and the second is positive if  $\eta > 0$  (recall that  $n^s < n^g$  from Proposition 1); if  $\eta = 0$  – i.e., the education tax does not generate an excess burden – the median voter prefers free public provision. Differentiation of (30) reveals that this utility differential is increasing in the external benefits of education ( $\beta$ ) and in the size of the excess burden (which varies directly with  $\eta$ ), and decreasing in the dispersion of income ( $\sigma_0^2$ ).

Thus our analysis does not support the hypothesis that democracy is harmful for growth. The factors that favor subsidization over free public provision with regard to growth – a large external effect, a large excess burden, and a small dispersion of income – also promote public support for subsidization. Moreover, comparison of equations (23) and (30) reveals that when income inequality is high enough, free public provision is both the popular choice and promotes stronger growth than subsidization; and when it is small enough, subsidization is both the popular choice and promotes stronger growth than free public provision. Furthermore, comparison of (28) and (30) when  $\alpha+\beta < 1$  shows that if  $\phi^2$  is large enough then free public provision is both more popular and generates a higher level of steady state output, and if it is small enough the same holds for subsidization. All of this suggests that in a wide range of circumstances democratic choice will

favor the policy regime that promotes stronger growth.<sup>11</sup>

*Proposition 4.* In choosing between subsidies and free public education, the median voter's preference for subsidization increases with the magnitude of the externality and the excess burden, and decreases with the degree of income inequality; and these same factors also favor subsidization over public provision with regard to growth. When income inequality is high enough, free public provision is the popular choice, promotes stronger immediate growth and if  $\alpha + \beta < 1$  leads to a higher level of steady state output than subsidization; and when it is low enough subsidization is preferred on all three counts. Thus a contradiction between democratic choice and growth can only arise at intermediate levels of inequality.

There is another sense in which democracy leads to a growth-promoting choice of education system. Consider the comparison between a democratic regime with universal suffrage and a regime in which the franchise is limited to an upper-income elite. To sharpen the comparison, suppose that inequality is sufficiently high so that free public education is chosen under the fully democratic regime and promotes stronger growth; and that when the franchise is restricted, the restriction is stringent enough that the decisive voter earns more than average income. Then equation (29) implies that subsidization will be chosen although it yields less growth than the free public system chosen under universal suffrage.<sup>12</sup>

*Proposition 5.* When inequality is high enough, universal suffrage will choose a system of free public education, with less inequality and stronger growth, where a sufficiently restricted franchise would choose a system of subsidization with greater inequality and slower growth.

## 6 Extensions

We conclude with a brief discussion of two extensions: the dynamic stability of the choice of education systems, and the effect of intergenerational immobility on the choice of education system.

### *6.1 Stability of education regimes*

The effect that income distribution has on the relative popularity of free public education and subsidization suggests that the balance of popular support may swing back and forth between education regimes from one generation to the next. Assume, for example, that the distribution of income is initially disperse (large  $\sigma_0^2$ ) so that a free public system is adopted in the first generation. This then works to reduce the dispersion of income which may tilt the balance to subsidization in the next generation. This will increase the dispersion of income in the following generations, which could eventually tilt the balance back to a public system. Thus, theoretically, we could have periodic swings from a free public regime to a subsidy regime and back again, with income inequality rising under subsidization until it reaches an "unacceptable" level at which point free public provision is adopted, which then reduces income inequality and allows subsidization to be restored. This suggests a formal underpinning for a more general analysis of periodic swings in the balance between public and private provision of services which could be applied in other contexts as well (*cf.* Hirschman, 1981).

Analytical conditions for the stability or instability of the education regime can be derived from equation (30) and are summarized as follows.

*Proposition 6.* (i) If the distribution of ability in the population is sufficiently dispersed, *viz.*, if

$$\phi^2/2 > \{(1 + \delta\alpha + \delta\beta)\log[(1 - n^s)/(1 - n^e)] + \eta\log((1 + \eta)/(1 + \delta\alpha + \eta))\}/\delta\alpha, \quad (31)$$

then free public provision is stable, in the sense that once adopted it is always preferred.

(ii) If the distribution of ability is sufficiently uniform, *viz.*, if

$$\phi^2/2 < \{(1 + \delta\alpha + \delta\beta)\log[(1 - n^s)/(1 - n^e)] + \eta\log((1 + \eta)/(1 + \delta\alpha + \eta))\}(1 - \alpha^2)/\delta\alpha \quad (32)$$

then subsidization is stable in the same sense.

(iii) When  $\phi^2/2$  takes on intermediate values, so that neither inequality is satisfied, then free public provision and subsidization will alternate periodically over time.

## 6.2 Intergenerational correlation of innate ability

In all of the above we postulated intergenerational independence in the distribution of innate abilities. We now briefly explore the implications of inherited ability on the choice of education regime. As discussed in Galor and Tsiddon (1997), “local” externalities that arise from intergenerational correlation of human capital generate a “centrifugal” force that increases inequality, as opposed to “global” externalities among unrelated individuals in the same cohort which create a “centripetal” force that reduces inequality. Similarly in our model, inherited ability constrains intergenerational mobility. This increases inequality, and implies stronger popular support for free public education.

To focus on essentials, we assume that the abilities of parent and child are perfectly correlated, so that there is no intergenerational mobility, and denote by  $a_i$  the innate ability of dynasty  $i$  in all periods. Thus one’s wage depends directly on the human capital of one’s parent, as well as on education and on average human capital. We continue to assume that the distribution of

abilities in the population is lognormal and independent of the initial education level, and we denote the variance of the logarithm of initial human capital by  $\phi_0^2$ . Proceeding as in the main analysis, we can calculate the intertemporal evolution of the economy under each regime. As the choice of regime is affected by income inequality, we are particularly interested in the variance of income distribution. Calculations similar to those presented in preceding sections show that under public provision the variance of income distribution is given by  $\phi^2[(1-\alpha^{t+1})/(1-\alpha)]^2$  whereas under subsidization (as well as under private provision) it equals  $\phi^2[(1-\alpha^{t+1})/(1-\alpha)]^2 + \alpha^{2(t+1)}\phi_0^2$ . It is interesting to note that, in contrast to the case of independent abilities, although inequality is greater under subsidization than under free public provision, it increases under both regimes, and the difference between the two regimes eventually becomes negligible. In any event, income inequality is higher than in the case of independent abilities. This implies, in turn, that when intergenerational mobility is restricted free public education is more likely to be adopted eventually.<sup>13</sup> Summarizing,

*Proposition 7.* Income inequality is greater when ability is inherited than when it is uncorrelated across generations, hence popular support for free public education is stronger when intergenerational mobility is restricted.

## 7 Concluding remarks

Combining elements of the theories of growth and public choice, we describe the choice of education system as a political-economic equilibrium, and examine its implications for growth and income distribution. Our analysis highlights the main forces that motivate (or restrain) public intervention: the bequest motive that leads one to invest in the education of one's children; the

advantages of internalizing the external benefits of education through public intervention; the popularity of the redistributive effect of free public education; and the excess burden associated with funding public spending.

In comparing how these forces affect different education regimes with respect to growth and popularity, we found that subsidies fully funded by a proportional income tax are both unanimously preferred to purely private provision and promote stronger growth. Furthermore, the same factors that contribute to popular support for education subsidies over free uniform public provision – a large external benefit, a large excess burden, and homogeneity in the distribution of individual ability – also favor the relative growth performance of subsidies. Thus democratic choice of an education system by majority vote does not generally imply a sacrifice of growth for redistribution. We also showed that greater intergenerational mobility favors subsidization; and indicated the theoretical possibility of periodic generational swings between the two regime types.

There are several directions in which our analysis could be extended. One possibility would be to specify more general functional forms for utility and wages and different tax structures, which could be calibrated to more closely approximate empirically observed patterns of aggregate behavior, though possibly at the price of analytical tractability. Another avenue of further research might consider more richly structured education systems, allowing publicly provided education to be supplemented or supplanted by private schooling; some previous work in this vein is cited in the notes, and it could be extended along the lines developed in the present paper. Finally, our analysis could be embedded in a multi-community context, in which the mobility of labor capital would add new dimensions to the analysis of democracy and growth.

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<sup>1</sup> Such an effect is also consistent with Ranis' (1990) comparison between East Asian and Latin American countries: in the former, extensive land reform preceded strong growth; in the latter, both were absent.

<sup>2</sup> Barro's *a priori* arguments are ambivalent, citing redistribution (including land reform) and rent-seeking activities as drawbacks of democracy, which may be outweighed by the checks it offers on the abuse of power in autocratic regimes. The absence of an explicit theoretical model leaves his findings open to various interpretations.

<sup>3</sup> Empirical evidence on the role of human capital, generally measured by schooling levels, as a key determinant of growth, is overwhelming; *e.g.*, Barro (1991).

<sup>4</sup> Of course, there are other important considerations that do not appear in our model. Public education is favored at younger ages because minors cannot enter into binding contracts, and some require protection from parents who do not have their best interests at heart. In addition, public education is widely used as a means of instilling social norms and promoting social cohesion (*cf.* Lott, 1990). Thus our analysis is perhaps best understood as applying to higher education, at least in the context of advanced industrial economies: some have free university systems (*e.g.*, France, Germany, Italy), while others subsidize university fees (*e.g.*, the United States, Japan,

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Israel). While James (1993) shows evidence of substantial variation in the share of private spending on primary and secondary schooling even among industrial countries, much of this must be ascribed to “opting out” or “topping up” of public education, neither of which figure in the present analysis (we look at “topping up” in Gradstein and Justman, 1996).

<sup>5</sup> Also closely related is Saint-Paul and Verdier’s (1993) political analysis of democracy, education and growth, which differs from the present study in not associating an excess burden with public provision, and in assuming that the poor vote for more education than the rich. Other work that sheds light on the public choice of education systems includes Stiglitz’ (1974) early study of education policies in a static framework, and Fernandez and Rogerson’s (1996) study of public funding of education in a static multi-community world. Relevant non-political analyses include Eckstein and Zilcha (1994) on the beneficial effect of public education on growth; Devarajan *et al.* (1996) on the superiority of subsidization over public provision of a production input that has external benefits, for a homogeneous population; and Galor and Zeira’s (1993) analysis of private education, inequality and growth.

<sup>6</sup> Alternatively, one could interpret families as homogenous communities of equal size that either function as independent school districts possibly subsidized from state or national funds (under “private education”); or as part of a uniform state system of education in which a single education policy for all localities is determined by a majority vote of the entire population (under “public education”). See Benabou (1996) for further elaboration of this interpretation.

<sup>7</sup> Clearly, other specifications of the bequest motive are possible. One alternative might be to condition the parent’s utility on the child’s (individual) human capital, but this would mean the parent ignores the external benefits of education, obviating an obvious benefit of public

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intervention – and reducing both its popularity and its advantages for growth. Or parents' utilities could be conditioned on their children's utility (or income), but this would require them to take into account the effect of their voting behavior on future income distributions and future voting patterns, and undermine an analytical solution. Our approach follows most of the recent literature in imposing assumptions which make it unnecessary to consider the full dynamics of sequential voting, allowing us to derive the political economic equilibrium explicitly. For an alternative approach see Boldrin (1993), who assumes forward-looking agents with a limited ability to predict future outcomes; and Huffman (1996) and Krusell *et al.* (1994) who introduce fully dynamic and rational agents, but do not present analytical solutions.

<sup>8</sup> In this and the other cases considered here, our specification of utility, wages and taxes just balances the declining marginal value of income against the redistributive effect of public spending so that within a given regime all households offer the same amount of labor, allocate uniform shares of income to consumption and to private spending on education, and desire the same level of public spending on education, irregardless of individual or average income; the variation in these variables is only between regimes, which of course facilitates their comparison. Regarding labor supply, our assumptions are broadly consistent with empirical evidence of low elasticities of labor supply (Stiglitz, 1988, pp. 464-470), and small changes in average labor supply when real per-capita income rises (hours per worker fall slightly while hours per household rise). Regarding spending on education, Benabou (1996), citing Bergstrom *et al.* (1982) maintains that micro evidence on education expenditures is not inconsistent with a unit income elasticity, and notes that the share of education spending in GNP remained roughly constant at 4% over the 1960-1990 period. Regarding public expenditures, James (1993) finds no significant effect of per capita GNP

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on the share of public spending on education in GNP. A different utility function, e.g., a CES specification, could accommodate income effects in each of these variables but would add substantial complexity.

<sup>9</sup> Specifically, the sequence  $a_t = \log(\bar{y}_t^s / \bar{y}_{t-1}^s) - \log(\bar{y}_t^p / \bar{y}_{t-1}^p)$  is a geometric sequence in which the first term,  $a_1 = (\alpha + \beta) \{ \log \delta (\alpha + \beta) \lambda (1 + \delta (\alpha + \beta)) - \log \delta \alpha \lambda (1 + \delta \alpha) \}$  is positive if  $\beta > 0$ , and the quotient is  $\alpha + \beta$ , so all subsequent terms are also positive. The growth rates diverge iff there are increasing returns in human capital ( $\alpha + \beta > 1$ ).

<sup>10</sup> A sufficient condition for average income under subsidization to exceed average income under free public provision in all periods is:  $(2/\alpha) \log[(1-r^s)/(1-r^p)] + \beta \alpha \min\{\phi^2 + \sigma_0^2, \phi^2 \lambda (1 - \alpha^2)\} - \phi^2 > 0$  (A detailed derivation is available from the authors on request.) This holds if  $\eta$ ,  $\delta$  and  $\beta$  are large enough and if  $\sigma_0^2$  and  $\phi^2$  are small enough; if  $\phi^2 = 0$ , it holds for all values of  $\eta$ ,  $\delta$  and  $\beta$ .

<sup>11</sup> Other special cases also yield similar results. For example, if  $\eta = \delta = 1$  then  $u_{m_t}^s - u_{m_t}^p < \log(\bar{y}_1^s / \bar{y}_0^s) - \log(\bar{y}_1^p / \bar{y}_0^p)$ , so that subsidization is preferred to public provision only if it promotes stronger growth (but public provision may be preferred even when it leads to weaker growth because of its redistributive advantages).

<sup>12</sup> This is supported by James's (1993) empirical finding that political rights are positively associated with public spending on education.

<sup>13</sup> See Rustichini *et al.* (1996) for a comparison of intergenerational mobility, inequality and education systems, between Italy and the United States, that supports our conclusion.