

# Education, democracy and growth

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This note presents a model of endogenous growth where redistribution, determined by a political equilibrium, is in the form of public education. It is shown that there need not be a negative relationship between growth and redistribution as public education increases the level of human capital in the economy and, at the same time, tends to produce a more even income distribution.

## 1. Introduction

Economists have for a long time been aware of the dangers of democracy. In the development literature this has been emphasized with, for example, the concept of ‘antagonistic growth’ of A. Hirschman [Foxley et al. (1986)] in which democratic governments have much problems solving conflicting claims of vested interests and pursuing at the same time sustainable growth paths. More recently, economists have studied the flaws of populism [Dornbusch and Edwards (1991)] and voiced the concern that in a democracy there might be an incentive to expropriate capital. Assuming that the political process can be caricatured by a voting process and given the shape of income (or wealth) distribution, this is more likely to happen if the median voter is relatively poorer [Persson and Tabellini (1990)] or has relatively less capital [Alesina and Rodrik (1991)], and if the poor have more political rights. In those cases income redistribution creates adverse incentives for investment, and hence is bad for growth.

In this paper, we want to stress the idea that redistribution and democratization of a society do not necessarily have adverse effects on growth. We construct a model, based on Becker and Tomes (1979) and Aghion and Bolton (1990), where the main channel of redistribution is *public education*. Typically from a political economy aspect public education has the two following essential features: first it may be an instrument of intra-

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generational redistribution and therefore is an issue of redistributive politics. Secondly, it is an activity that creates human capital and therefore promotes long-run growth. More precisely in our model, public education is provided in an egalitarian way and financed by proportional taxation on labor income [in the tradition of Meltzer and Richard (1981)]. Agents are altruistic in the sense that they care about their children's human capital levels. Each individual's human capital has an inherited component and a component due to public education. Therefore, more public education fosters growth because it increases a generation's human capital relative to the previous generation.

A second motivation of this paper is to present a simple political economy model of growth and development where distribution and growth are two interrelated endogenous variables<sup>1</sup> [see also Perotti (1990)]. On the one hand, growth is affected by the amount of public education which, through the political process, depends on the shape of the income distribution. On the other hand, the income distribution evolves endogenously through the equalizing effects of public education on the inter-generational transmission of human capital. Hence the dynamics of the economy will involve two state variables: income distribution and average stock of human capital.

The main result of the model is that for a given structure of (*wide enough*) political rights, the economy converges towards a steady-state growth path; during this convergence process, income distribution becomes more equal, tax rates decline as well as the growth rate. The intuition is that as the distribution of human capital gets more even through public education, the median voter gets relatively richer, so that his children will benefit less from public education relative to inherited human capital. Therefore the level of public education implied by the political equilibrium tends to decline.

After presenting the model, we characterize the politico-economic equilibrium along the whole transitional path. We also discuss some comparative dynamics on the impact of initial inequality, variations in political rights and possible interactions between immigration, politics and growth. Finally we conclude briefly.

## 2. The model

There is an infinity of non-overlapping generations, each living one period. There is a continuum of individuals within each generation, and total population in each generation is constant and normalized to 1. Each individual  $i$  within generation  $t$  has one child in generation  $t+1$ , indexed by the same subscript  $i$ . People care about their consumption level. Moreover, following Banerjee and Newman (1991), Galor and Zeira (1990) or Eckstein

<sup>1</sup>There is already a long tradition in Development Economics that emphasizes the impact of growth on income distribution and inequality. [See for example Kuznets (1955), Anand and Kanbur (1985), De Janvry and Sadoulet (1983) or Bourguignon (1990)].



and Zilcha (1991), we assume a very simple specification for altruism in the sense that agents care also for the human capital stock of their children. More precisely, they maximize a utility function  $U(c_{it}, h_{it+1})$  where  $c_{it}$  is the consumption level of individual  $i$  at date  $t$  and  $h_{it+1}$  is the human capital stock of his/her child.<sup>2</sup>  $U(.,.)$  is supposed to be strictly concave with positive and decreasing marginal utility in each argument (with obvious notations  $U'_k > 0$ ,  $U''_{kk} \leq 0$  for  $k=c$  or  $h$ ). Moreover  $U(.,.)$  is homothetic and the marginal rate of substitution  $U'_h/U'_c$  is equal to a function  $F(h_{it+1}/c_{it})$  with  $F'(\cdot) \leq 0$ . We note  $\phi(\cdot) = F^{-1}(\cdot)$  and we assume that  $-x\phi'(x)/\phi(x) \geq 1$ .<sup>3</sup>

People differ in the sense that their endowment in human capital is different across individuals, and this is the only source of income inequality. Human capital comes partly from human capital inherited from parents, and partly from public education. More specifically, we assume

$$h_{it+1} = (1-z)\delta h_{it} + g_t, \quad (1)$$

where  $1-z$  is the constant, exogenous fraction of time devoted to the transmission of human capital from one individual to his child;  $h_{it}$  is dynasty  $i$ 's human capital at time  $t$ , and  $g_t$  the level of public education at time  $t$ .  $\delta$  is a coefficient of productivity of human capital inheritance.<sup>4</sup>  $\delta$  is supposed to be larger than 1, which means there is a cumulative effect in the transmission of human capital. One unit of a parent's human capital gives more than one efficient labor unit for his child. This type of effect has been much emphasized as a source of perpetual positive growth in the endogenous growth literature.

It should be noticed that  $g_t$  is *not* a public good. Rather, we assume, quite realistically, that public education is supplied in an egalitarian way, so that each individual is given the same level of it. Given the normalization, the aggregate level of education  $g_t$  is also the one provided to each individual.

We assume an aggregate production function of the following form:

$$Y_t = H_t,$$

<sup>2</sup>This specification of altruism comes from the 'joy of giving' motive for bequest. It has the advantage of simplicity. Moreover it states that parents can care about some aspects they think important for their offspring's welfare (education here) without knowing a priori how this offspring would value himself those aspects.

<sup>3</sup>This assumption is a sufficient condition on the rate of substitution between consumption and bequests that ensures that poor people will vote for more redistribution than rich people. It is similar to a condition stating that substitution effects are larger than income effects (see note 5 below).

<sup>4</sup>Becker and Tomes (1979) study also in a similar model the impact of the endogenous determination of  $z$ . In Saint Paul and Verdier (1992a) we show that all the results obtained here remain for a model with endogenous  $z$  as far as nobody in the economy is at a corner solution in terms of privately provided education. Corner solutions introduce problems of non-single-peakedness in the tax rate [see Saint Paul and Verdier (1992b)].



where  $Y_t$  is total output of the consumption good and  $H_t$  the aggregate level of human capital actually used in production:

$$H_t = z \int_0^1 h_{it} di = z\bar{h}_t.$$

This implies that the wage per unit of human capital supplied to the production system will be one in each period, so that the income of individual  $i$  at time  $t$  is  $h_{it}z$ .

We assume that public education can be produced from the consumption good and/or human capital in a way such that the productivity is the same in public and private education. This will be so if  $g_t = \delta h'_t$ , where  $h'_t$  is the amount of resources devoted to the production of public education. This assumption and eq. (1) imply that a social planner who only cares about efficiency would be indifferent as to which share of education should be publicly provided.

Finally education is financed by a proportional income tax, and there is majority voting on the tax rate  $\tau_t$  of every period. Hence consumption  $c_{it}$  is equal to  $h_{it}z(1 - \tau_t)$ .

### 3. The political equilibrium

Individual  $i$ 's preferred tax rate will be determined by the maximization of ( $U$ ) with respect to  $\tau_t$ , that is to say

$$\tau_{it}^* = \arg \max U(h_{it}z(1 - \tau_t), (1 - z)\delta h_{it} + g_t),$$

$$\text{s.t. } g_t = \delta \tau_t z \bar{h}_t \quad \text{and} \quad \tau_t \geq 0.$$

The first-order condition of this maximization problem gives

$$\frac{U'_h[h_{it}z(1 - \tau_t), (1 - z)\delta h_{it} + \delta \tau_t z \bar{h}_t]}{U'_c[h_{it}z(1 - \tau_t), (1 - z)\delta h_{it} + \delta \tau_t z \bar{h}_t]} \leq \frac{h_{it}}{\delta \bar{h}_t} \quad \text{and} \quad \tau_t \geq 0.$$

From this and using the homothetic property of  $U$ , one has immediately

$$\tau_{it}^* = \max \{0, \tau(h_{it}/\bar{h}_t)\}, \tag{2}$$

with  $\tau(h_{it}/\bar{h}_t)$  the solution of

$$\frac{U'_h[h_{it}/\bar{h}_t z(1 - \tau), (1 - z)\delta h_{it}/\bar{h}_t + \delta \tau z]}{U'_c[h_{it}/\bar{h}_t z(1 - \tau), (1 - z)\delta h_{it}/\bar{h}_t + \delta \tau z]} = \frac{h_{it}}{\delta \bar{h}_t}. \tag{3}$$

Given our assumptions on  $U$ ,  $\tau(h_{it}/\bar{h}_t)$  is a decreasing function of  $h_{it}/\bar{h}_t$ .<sup>5</sup> Because of the redistributive character of public education, relatively poorer people will prefer a higher tax rate. Since the objective function is concave in  $\tau$ , preferences are single-peaked, and since the preferred tax rate is monotonically decreasing in the relative position in income distribution, the actual tax rate will be that desired by the median agent in the income distribution.

To complete the characterization of the politico-economic equilibrium of this model, one needs to describe how the actual tax rate of the economy will evolve. To obtain this, notice that income distribution will change according to eq. (1), and that it defines a rank-preserving transformation. Therefore, the median voter's child will also be the median voter of the next period. Hence the tax rate of the economy  $\tau_t$  will be defined by

$$\tau_t = \tau_{mt}^* = \max \{0, \tau(h_{mt}/\bar{h}_t)\}, \quad (4)$$

where  $m$  is the median voter and  $h_{mt}$  is determined by

$$h_{mt+1} = (1-z)\delta h_{mt} + \delta z \tau_t \bar{h}_t. \quad (5)$$

#### 4. Income distribution and growth dynamics

Aggregating eq. (1) over individuals, one gets

$$\bar{h}_{t+1} = \delta[1-z + \tau_t z] \bar{h}_t. \quad (6)$$

This defines the growth rate of the economy,  $\gamma_t = \delta(1-z + \tau_t z)$  which is increasing in the tax rate. It is then easy to see how income distribution evolves in this model. Take any agent  $i$  and substitute (6) into (1) to obtain

$$h_{it+1}/\bar{h}_{t+1} = \alpha_t (h_{it}/\bar{h}_t) + (1-\alpha_t), \quad (7)$$

where  $\alpha_t = (1-z)/(1-z + \tau_t z) > 0$ . Therefore, as long as  $\tau_t > 0$ ,  $\alpha_t < 1$  and income dispersion is shrinking. Because of the egalitarian aspect of public education, and because of the persistence of its effects through human capital, there is a tendency towards homogenization of incomes: dynasties

<sup>5</sup>Eliminating  $\tau$  the problem of an agent  $i$  could be restated as

$$\max_h U[c_{it}, h_{it+1}], \quad \text{s.t.} \quad \frac{c_{it}}{h_{it}} + \frac{h_{it+1}}{\delta \bar{h}_t} = z + \frac{h_{it}}{\bar{h}_t} (1-z).$$

In this framework,  $h_{it}/\delta \bar{h}_t$  can be interpreted as the relative price of  $h_{it+1}$  to  $c_{it}$ . Noting  $x_{it} = h_{it}/\bar{h}_t$  and using homothetic assumption, one gets at the optimum  $h_{it+1}/c_{it} = \phi(x_{it}/\delta)$  with  $\phi' \leq 0$ . Hence

$$\tau(x_{it}) = 1 - \frac{c_{it}}{zh_{it}} = 1 - \frac{z + x_{it}(1-z)}{z(1 + (x_{it}/\delta)\phi(x_{it}/\delta))}.$$

It is easy to see that a sufficient condition for  $\tau(h_{it}/\bar{h}_t)$  to be decreasing in  $h_{it}/\bar{h}_t$  is that  $-x\phi'(x)/\phi(x) \geq 1$ .



being poorer than the mean at time  $t$  will see their stock of human capital grow faster than the economy and conversely for dynasties being richer than the mean. Note that this process will be faster, the larger the spending share on education. This will also be associated with higher growth rates, according to eq. (6). On the other hand, if  $\tau_t = 0$ , income distribution has a unit root and is thoroughly transmitted to future generations. If  $\tau_t = 0$  is a political equilibrium at date  $t$ , it will remain so at date  $t + 1$  since the relative income position of the median voter will be unchanged.

To complete the characterization, we study what happens in a democracy where income distribution has the usual profile that the median voter is poorer than the mean and suppose that initially the median wants some spending on education. Then as time evolves inequality shrinks, the median voter gets closer to the mean and the political support for education diminishes. This is associated with lower spending and a deceleration of growth. What will be the final outcome of this process? From eq. (3), an egalitarian society ( $h_m = \bar{h}$ ) will spend a positive amount on education as long as

$$\frac{U'_h(1, (1-z)\delta/z)}{U'_c(1, (1-z)\delta/z)} \geq 1/\delta. \quad (8)$$

If this inequality is satisfied, which means a relatively low level of investment in private education, then the economy will converge towards full equality and a tax rate equal to  $\tau_\infty$  defined by

$$\frac{U'_h(z(1-\tau_\infty), (1-z)\delta + \delta\tau_\infty z)}{U'_c(z(1-\tau_\infty), (1-z)\delta + \delta\tau_\infty z)} = 1/\delta,$$

the growth rate will steadily decline towards  $\gamma_\infty = \delta(1-z + \tau_\infty z)$ .

If, on the other hand (8) is not satisfied (i.e., if there is enough investment in private education, then the income equalization process will stop as soon as  $\tau(h_{mt}/\bar{h}_t) \leq 0$ . That is

$$\frac{h_{mt}}{\bar{h}_t} \geq \delta \frac{U'_h(1, (1-z)\delta/z)}{U'_c(1, (1-z)\delta/z)}.$$

As soon as this equality level is reached, the economy will no longer spend resources on public education; income distribution will reproduce itself indefinitely; and the growth rate will be  $\delta(1-z)$ .

#### *Impact of larger initial inequality*

With the median poorer than the mean, more inequality is associated with a lower initial  $h_m/\bar{h}$ . Hence, according to eq. (4) this will also be associated



with higher spending on education. Therefore, for given political rights, countries starting with more inequality will grow faster. They will eventually converge towards the same asymptotic growth rates, spending levels and inequality. However, they will attain a permanently higher income level and the speed of income equalization will be faster.

### *Impact of political rights*

If there is some minimal wealth level (a franchise) required to be eligible to vote, the median voter will be relatively well-off compared to full democracy. According to eq. (4), (6) and (7), this will imply lower spending, a lower growth rate, and a lower pace of equalization than full democracy. If the decisive voter is still poorer than the mean, the dynamics are analogous to the above paragraph. If the decisive voter is richer than the mean, two cases are possible. First the initial value of the tax rate is greater than zero and the characteristics of the convergence path are reversed compared to the previous analysis: increased support for public education, an increasing tax rate and an increasing growth rate, as well as convergence towards full equality. Furthermore, increased inequality will *lower*, not increase political support for education. The second possibility is that the franchise is so high that there is no spending on public education, income distribution will reproduce itself for ever without any tendency for equalization, and the growth rate will be  $\delta(1-z)$ , less than under full democracy.

It should be clear that conversely, democratization and extensions of political rights in the society will just produce the opposite results namely more redistribution, larger spending on public education and a boost on growth and equalization of income.

### *The role of immigration*

An interesting application of the analysis concerns the role of immigration for the dynamics of education, income distribution and growth. Suppose that immigrants are relatively poorer than the natives (results are reversed if new immigrants have more human capital than the natives). Assume also that they are likely to have reduced or no political rights, whereas their children, as natives, will have full political rights (in the absence of racial discrimination). This implies that when the first generation of immigrants comes in, the median voter is unchanged, income inequality increases, and the country's human capital per capita decreases. The median voter's relative position in income distribution,  $h_{mt}/\bar{h}_t$  improves, implying less taxation and lower growth per capita than before the immigration inflow. However, when the second generation of immigrants comes to vote, the median voter is changed and his relative position deteriorates. Depending on how effective



redistribution was during the immigration period, he may be either poorer or richer, in relative terms, than before immigration took place. If he is poorer, the spurt in growth will be so big that the economy will grow faster than before immigration. In any case, the economy grows faster, at this stage, than if immigration had not taken place. Therefore, this model suggests that immigration may depress growth in the short run but stimulate it in the long run (of course, this may be difficult to test since growth itself encourages immigration).

## 5. Conclusion

We have presented a model where voting, education, growth and income distribution all evolve endogenously. We show in particular that democratization is likely to foster growth. More importantly, in *democratic* societies, increased inequalities may well be good for growth, *provided they imply more support for public education*. It is quite possible, however, that this may not hold if poverty is correlated with non-participation in the electoral process. In such a world, increased inequality may well produce less support for education (in our model, it would be associated with reduced political rights in practice), in which case our model predicts that it would have a negative impact on growth. Contrary to other models in the literature of growth and distribution, the tax system used here to finance educational spending is nondistortionary. It is easy to see, however, how the results would be modified with distortionary taxation [Saint-Paul and Verdier (1992a)]. Distortions will dampen the positive effect of redistribution through public education on growth. More precisely one will find an inverted U-shape relationship between growth and taxes and comparative dynamics about initial inequality and liberalization of political rights will then have to be amended to take into account the fiscal burden of redistribution on growth.

Our model seems, however, broadly consistent with the observation that in the last two centuries, western democracies have enjoyed sustained growth associated with an evening of inequalities and a widening of political rights and that democratization in western democracies in the nineteenth century, far from having been a factor of stagnation as models based on the expropriation of capital would tend to predict, has fostered growth and has contributed to maintain political support for education. An historically suggestive example is the case of the strong promotion of public education in France at the end of the nineteenth century. This occurred at the same time as the creation of the Third Republic which could be seen as a major liberalization of political rights after the Second Empire of Napoleon III. Typically the main objectives of the politicians of the Third Republic were not only to diminish the religious influence and power of the Church in France but also to satisfy a political demand for more social mobility and



less inequality in the French society. This helped to build up an important class of middle-income and white-collar people having less incentive for further revolutions or high redistributive social struggle.

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