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On the political economy of compulsory education

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Abstract

We consider an economy with two categories of agents: entrepreneurs and workers. In *laissez-faire*, the former gain from having their children educated, while the latter, although they may profit from their own education, have no interest in sending their children to school. We first characterise the preferred education policy-cum-redistributive taxation for the two groups, and find that entrepreneurs favour a compulsory education policy while workers prefer a purely redistributive taxation. Each group would like the policy to be entirely financed by the other group. Then, we introduce a political process with probabilistic voting and verify that an equilibrium with both a compulsory education policy and some redistribution may exist in which the workers are constrained but the entrepeneurs, who benefit from hiring educated workers, are not.

Keywords: Education Policy, Redistributive taxation, Probabilistic voting.

JEL Classification: H42, H52.

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I Introduction

It is an historical fact that education policy was conceived in terms of free and mandatory public schooling (financed by public funds) when it was introduced in the West (Germany, France and later UK and US); and free and mandatory schooling is still at the basis of our educational systems today. Several motives have been identified for the introduction of compulsory education (Fyfe, 2005). In Prussia, where such a system was first introduced in 1763, the protestant religious motive seem to have prevailed (on this see also Becker and Woessman, 2010). In France and Italy compulsory education laws, dating back to 1881 and 1861 respectively, are mainly seen as a part of the construction of a national state (see also Cipolla 1969). In Japan, it was the desire for modernization that drove the introduction of mandatory schooling after the opening to the West in 1886. Also the UK and the US, by far the most industrialized countries at the time, passed compulsory education laws at the end of the XIX century (1880 in the UK, from 1885 to 1918 depending on the States, in the US). This slight delay might come as a surprise; the reason for it has been identified as the need for cheap child labour – for example, Galor (2006) suggests that education was made compulsory only when a literate workforce was needed because of technological progress. As far as the US are concerned, Bandiera et al. (2018) also stress a nation-building motive aimed at instilling civic values to migrants during the "Age of Mass Migration" going from 1850 to 1914. This is not in contrast with the industrialization motive, that is found to operate in addition to the nation-building one.

In any case, the lenght of mandatory schooling and the enforcement of the attendance prescriptions were relatively limited, especially in South European countries, and generally in the countryside where children were seasonally employed in agricolture.

While the motives for the introduction of such systems seem to differ across countries, one single reason seem to have prompted the expansion of compulsory education that took place in Europe after the Second World War. Murtin and Viarengo (2011) show that there has been a strong convergence in the lenght of mandatory schooling in fifteen western European countries during the period from 1950 to 2000. At the end of the 1930s the years of compulsory education ranged from three in Portugal to nine in the UK. After

the reforms that occured in the second half of the XX century, the range was reduced to nine-twelve years. According to Murtin and Viarengo (2011), the convergence in the lenght of compulsory education is to be traced to the decreasing returns to educational investments, and to the related fact that all countries have reached approximately the same level of profitability. This is reinforced by globalization. Higher competitivity in the global markets can only be faced with a more educated workforce.

In summary, motives based on technological and industrialization needs as well as motives based on nation-building and, more generally, on social capital building in democratic societies[1] are recognized as crucial for setting up a compulsory education system financed by tax-payers. Another important reason is the need to provide incentives to send children to school for parents who may profit from their children labour or contribution to home production (Balestrino *et al.*, 2017; Cigno, 2013). As to the subsidization of such systems, the literature on public finance also points out the role that subsidies may play in remeding the distortion in individual educational decisions due to the introduction of income taxation (see e.g. Bovenberg and Jacobs, 2005).

Nowadays, compulsory education is an issue in developing countries, where public and free education is not always guaranteed. This however seems to be one of the main prerequisites for development not only from an economic perspective but also in terms of democratization and human rights. In this perspective, besides being an object in itself, education is a primary tool in the fight against child labour. Elementary education should be made compulsory according to art. 26 of Universal Declaration of Human Rights (1948) and such principle has been reaffirmed in a number of conventions and treaties up to Goal 4 of the UNDP Sustainable Development Goals, which calls for achieving inclusive and quality education for all, and more specifically "ensures that all girls and boys complete free primary and secondary schooling by 2030".

Of course, economists are always suspicious towards policy interventions that seem to thwart individual freedom or consumer sovereignty. Now, it is always possible to

[1] That there is a correlation between education and social and political participation is a well established result. In particular Dee (2004) and Milligan *et al.* (2004) point out a causal effect from education to participation in voting and civic engagement for the US.

argue in favour of compulsory education in normative terms, e.g. because of horizontal equity requirements (Balestrino *et al.* 2017). However, speaking from a positive, rather than normative viewpoint, there must have been a reason why compulsory schooling has become an indispensable part of the modern educational policy package. If we take the political economy view that policies are designed according to voters preferences by office- or policy-motivated politicians, then it follows that someone's interests must be furthered by the presence of a mandatory education period. What we require, therefore, is an argument showing that education policy, quite independently from being normatively desirable, is likely to be part of a winning policy scheme in a political context. In our contribution, we will seek to provide one such argument.

To elaborate on this point, let us stress that the fact that a policy intervention is desirable from a social welfare maximisation perspective does not make it automatically likely to be implemented in practice. We therefore investigate the question whether there might be a social group who is interested in introducing compulsory schooling as part of the equilibrium policy and is endowed with sufficient political power to actually do so.[2] In our model, agents are classified into two occupational groups, entrepreneurs and workers.[3] One of the implications of the division of society in the present model is that entrepreneurs have a stronger interest in education policy than workers. However, the rationale for this is not that entrepreneurs want their children to be well-educated, because they will tend to provide the required education anyway; the point is that they want the children of their workers to be educated, in order to enjoy a better work-force one generation ahead.

[2] See Bourguignon and Verdier (2000) for a paper showing under which conditions a minority oligarchic group may have an incentive to subsidise the education of the poors who are the majority in the society, and thus to favour the emergence of a middle class and a democratic transition.

[3] A model where both entrepreneurs and workers have a say on education policy through their voting behaviour may not be a suitable representation of a number of countries where compulsory education was first introduced (e.g. Prussia in 1763), since at the time workers did not have the right to vote. However, we will assume that the probability of participation is lower for workers (more details later); therefore the historical case could be seen as a limiting one theoretically. Moreover, such a model could appropriately represent relatively recent introductions or expansions of the compulsory education system. It is interesting to note that in several countries mandatory schooling and universal suffrage were simultaneously introduced (Brazil, 1988; South Korea, 1948; India, 1950) .

For this reason, entrepreneurs favour compulsory schooling, financed by the tax system; such a scheme should then prevail at the political equilibrium if the entrepreneurs are able to impose their preferred policy. We therefore explore the industralization motive, rather than the nation-building one.

The paper is structured as follows. Section II presents the model and illustrates the nature of the free-market equilibrium, while section III introduces the policy instruments and discusses the policy preferences of the agents. Section IV expounds the political equilibrium achieved *via* a probabilistic voting process. Finally, Section V concludes.

II The model

We consider an overlapping generations economy in which agents live three periods, $i = 0, 1, 2$. In period 0, however an agent has only a passive role: she receives an education and supplies the time not absorbed by the educational process for the production of a domestically produced service. We refer to agents in period 0 as "children", in period 1 as "young adults" and in period 2 as "mature adults": these are the periods where economically relevant decisions are taken and carried out. Agents cease to exist at the end of period 2. For our purposes, then, there are two economically active generations that overlap in each period of the economy, young adults, y, and mature adults, m.

Agents live in households, each made of one parent and one child; in turn, this child will grow up to become a parent; and so on and so forth. There are two social groups, entrepreneurs and workers, who perpetuate themselves generation after generation (no interclass mobility). Kids are born in period 1, when the parents are young adults; in the same period, the parent decides how much education her child should receive. Education requires a money input (out-of-pocket expenditure) as well as a time input (opportunity cost); the time that the kid does not spend in education is combined with the parent's time and employed to provide a household public good. Notice that it is important to characterize the educational process in such a way that the kid's time allocation is explicitly accounted for: indeed, it is exactly because the parents may wish to rely on their children's time for the provision of the household public good that they may also

wish to reduce or ban altogether school's attendance.

Incomes and utility functions

The sources of income for the individuals in the two groups are, as we shall see, quite different; for simplicity, we keep the income distribution fixed and exogenous.

A worker gets, in each active period, a salary from her employment according to the following rule:

$$w_{\omega}^{i,t}\left(e_{\omega}^{t}, d_{\omega}^{t}\right) = \underline{w} + x\left(e_{\omega}^{t}, d_{\omega}^{t}\right), \ i = 1, 2, \tag{1}$$

where the subscript ω denotes a variable pertaining to a worker; the superscripts i and t denote the period and the generation, respectively; $\underline{w} > 0$ is the fixed income earned by an uneducated worker; $x(\cdot)$ is an earning function which depends on e_{ω}^{t} which represents the amount of educational expenditure bestowed upon, and d_{ω}^{t} which denotes the time spent in education by, a worker of generation t in period 0 (where 1 is the total time available and $1 - d_{\omega}^{t}$ is the time devoted to the production of the household public good). In particular, $x(\cdot)$ is an increasing and strictly concave earning function satisfying

$$x\left(0, d_{\omega}^{t}\right) = x\left(e_{\omega}^{t}, 0\right) = 0; \qquad \frac{\partial^2 x}{\partial e_{\omega}^{t} \partial d_{\omega}^{t}} = \frac{\partial^2 x}{\partial d_{\omega}^{t} \partial e_{\omega}^{t}} > 0. \tag{2}$$

In words, we assume that e and d are technological complements (the more time you spend on education, the more effective is the money you spend on it and *viceversa*), and that both time and money are essential to generate income. Assuming a perfect credit market with zero interest rate, a worker thus earns lifetime income

$$w_{\omega}^{t} = 2\left[\underline{w} + x\left(e_{\omega}^{t}, d_{\omega}^{t}\right)\right]. \tag{3}$$

Entrepreneurs' incomes are given by the profits generated by the firms they own. The ownership structure is thus specified: each young adult entrepreneur co-owns the firm with her parent, and they share the profits; one period ahead, the same agent, now a mature adult, will share ownership and earnings with her own child (again, this is just for simplicity, and without loss of generality). Monetary earnings are not the only objective of an entrepreneur who also cares about his reputation as a successful manager of the firm. Since the actions of the entrepreneur display part of their effect after the latter's death,

we assume that the entrepreneur will take it into account when making her decisions. Each firm produces a share of the only good that exists in the economy, whose price is unity. There are n entrepreneurs ($n/2$ young and $n/2$ mature adults); each firm employs $2s$ workers, $s \geq 1$, half of which are young adults and half mature adults,[4] so that we globally have $S = sn \geq n$ workers. Also, labour is the only input and there are constant returns to scale. Each worker supplies a fixed amount of labour, the same for all, and produces $\underline{y} + y\left(e_\omega^t, d_\omega^t\right)$ units of the good, where $y\left(\cdot\right)$ is an increasing and strictly concave function satisfying

$$y\left(0, d_\omega^t\right) = y\left(e_\omega^t, 0\right) = 0; \qquad \frac{\partial^2 y}{\partial e_\omega^t \partial d_\omega^t} = \frac{\partial^2 y}{\partial d_\omega^t \partial e_\omega^t} > 0; \tag{4}$$

that is, both inputs into the educational process are essential in order to produce more than the minimum level, $\underline{y}$, and they exhibit technological complementarity. The agent's non-working time, which is clearly also fixed, is employed in the production of a household public good (which can be anything from companionship to housework). We can define per-worker profit in each period as

$$\pi^{i,t}\left(, e_\omega^t, d_\omega^t\right) = \underline{y} + y\left(e_\omega^t, d_\omega^t\right) - w_\omega^{i,t}\left(e_\omega^t, d_\omega^t\right), \ i = 1, 2. \tag{5}$$

Each entrepreneur earns lifetime income

$$w_\eta^t = w_\eta^{1,t}\left(e_\omega^{t-1}, d_\omega^{t-1}, e_\eta^{t-1}, d_\eta^{t-1}, e_\omega^t, d_\omega^t, e_\eta^t, d_\eta^t\right) + w_\eta^{2,t}\left(e_\omega^t, d_\omega^t, e_\eta^t, d_\eta^t, e_\omega^{t+1}, d_\omega^{t+1}, e_\eta^{t+1}, d_\eta^{t+1}\right), \tag{6}$$

where the subscript η denotes a variable pertaining to an entrepreneur and

$$\begin{aligned} &w_\eta^{1,t}\left(e_\omega^{t-1}, d_\omega^{t-1}, e_\eta^{t-1}, d_\eta^{t-1}, e_\omega^t, d_\omega^t, e_\eta^t, d_\eta^t\right) = \\ &= \alpha\left\{\left[\pi^{1,t}\left(e_\omega^t, d_\omega^t\right) + \pi^{1,t-1}\left(e_\omega^{t-1}, d_\omega^{t-1}\right)\right] s + g\left(e_\eta^{t-1}, d_\eta^{t-1}\right) + g\left(e_\eta^t, d_\eta^t\right)\right\}; \end{aligned} \tag{7}$$

$$\begin{aligned} &w_\eta^{2,t}\left(e_\omega^t, d_\omega^t, e_\eta^t, d_\eta^t, e_\omega^{t+1}, d_\omega^{t+1}, e_\eta^{t+1}, d_\eta^{t+1}\right) = \\ &= (1-\alpha)\left\{\left[\pi^{2,t+1}\left(e_\omega^{t+1}, d_\omega^{t+1}\right) + \pi^{2,t}\left(e_\omega^t, d_\omega^t\right)\right] s + g\left(e_\eta^t, d_\eta^t\right) + g\left(e_\eta^{t+1}, d_\eta^{t+1}\right)\right\}, \end{aligned} \tag{8}$$

where α $(1-\alpha)$ is the share of earning accruing to a young (mature) adult; $g\left(\cdot\right)$ is an increasing and concave function converting, for both co-owners of the firm and in each

[4] This is of course just an innocuous simplification; the model works with any share of young to mature adults employed in each firm.

period, the educational inputs received into income – such a function might therefore represent the returns to entrepreneurial ability as mediated by the investments in human capital. Mirroring the preceding assumptions on $x(\cdot)$ and $y(\cdot)$, we posit

$$g\left(0, d_{\eta}^{t}\right) = g\left(e_{\eta}^{t}, 0\right) = 0; \qquad \frac{\partial^2 g}{\partial e_{\eta}^{t} \partial d_{\eta}^{t}} = \frac{\partial^2 g}{\partial d_{\eta}^{t} \partial e_{\eta}^{t}} > 0. \tag{9}$$

Also mirroring the assumptions made on the workers' time allocation, we assume that each entrepreneur supplies a fixed amount of time for management, the same for all, and that the remaining fixed leisure time is employed along with the kid's non-educational time to produce a household public good.

As a final remark, we notice that, presumably, it will be the case that

$$w_{\omega}^{t} < w_{\eta}^{t}, \ \forall t. \tag{10}$$

Turning now to the agent's preferences, we posit full selfishness on the agents' part.[5] Thus, for the workers we specify the following additive utility function

$$U_{\omega} = u\left(c_{\omega}^{1,t}\right) + v\left(c_{\omega}^{2,t}\right) + f\left(1 - d_{\omega}^{t+1}\right), \tag{11}$$

where $f(\cdot)$ represents the utility from the production of the household public good that we mentioned above. Since the parent's leisure is fixed, however, we write the sub-utility directly as a function of the kid's domestic time only (with the provision that $f(0) > 0$ – i.e. that only parental time is essential to the production of the household public good). The generation index t is not present because the utility function is taken not to vary across generations.

The utility function of the entrepreneurs still depends on consumption and on the provision of the household public good but also on their concern for the future profitability

[5] This is of course an extreme assumption, and we adopt it mainly because it simplifies the reasoning quite radically. It has to be remembered, however, that while the verdict on whether altruism or egoism prevails within a family is possibly still open, the assumption of egoism seems to be more robust to empirical scrutiny (see e.g. Cigno *et al.* 1998, 2006). Morever, our results would carry over to a setting with altruism, as long as the market equilibrium yields a less-than-optimal amount of acquired education, and Balestrino *et al.* (2017) show that even with full altruism there can be inefficiency in the provision of education due to comparative advantage issues.

of the firm. For simplicity we capture such reputational effect by directly introducing a fraction β, $0 < \beta < 1$, of future profits in the utility function:

$$U_\eta = u\left(c_\eta^{1,t}\right) + v\left(c_\eta^{2,t}\right) + f\left(1 - d_\eta^{t+1}\right) + \beta w_\eta^{3,t}\left(e_\omega^{t+1}, d_\omega^{t+1}, e_\eta^{t+1}, d_\eta^{t+1}, e_\omega^{t+2}, d_\omega^{t+2}, e_\eta^{t+2}, d_\eta^{t+2}\right), \tag{12}$$

where

$$\begin{aligned} &w_\eta^{3,t}\left(e_\omega^{t+1}, d_\omega^{t+1}, e_\eta^{t+1}, d_\eta^{t+1}, e_\omega^{t+2}, d_\omega^{t+2}, e_\eta^{t+2}, d_\eta^{t+2}\right) = \\ &= \left[\pi^{3,t+1}\left(e_\omega^{t+1}, d_\omega^{t+1}\right) + \pi^{3,t+2}\left(e_\omega^{t+2}, d_\omega^{t+2}\right)\right] s + g\left(e_\eta^{t+1}, d_\eta^{t+1}\right) + g\left(e_\eta^{t+2}, d_\eta^{t+2}\right), \end{aligned} \tag{13}$$

is the profit generated in the period following the death of the entrepreneur.

We start by describing the *laissez-faire* economy; government interventions will be considered later on.

Agent optimisation in a free market

Each worker maximises (11) by choosing her consumption basket and the composition of her kid's educational process subject to

$$c_\omega^{1,t} + c_\omega^{2,t} + e_\omega^{t+1} = 2\left[\underline{w} + x\left(e_\omega^t, d_\omega^t\right)\right]; \tag{14}$$

$$d_\omega^{t+1} \leq 1, \tag{15}$$

plus non-negativity constraints for all the choice variables. Since e_ω^{t+1} does not appear in the utility function, and d_ω^{t+1} appears as a bad, it is clear that $e_\omega^{t+1} = d_\omega^{t+1} = 0$ at the optimum for all workers of all generations. Thus, the problem reduces to

$$\text{Max } u\left(c_\omega^{1,t}\right) + v\left(2\underline{w} - c_\omega^{1,t}\right), \tag{16}$$

where the budget constraint (14) has been substituted into the utility function. The FOC w.r.t. $c_\omega^{1,t}$ is, quite simply,

$$u' = v'. \tag{17}$$

Workers smooth their consumption over time. Since no worker gains from sending her child to school, however, the workers never get an education.

As for the entrepreneurs, they maximise (12) subject to

$$c_\eta^{1,t} + c_\eta^{2,t} + e_\eta^{t+1} =$$
$$= w_\eta^{1,t}\left(e_\omega^{t-1}, d_\omega^{t-1}, e_\eta^{t-1}, d_\eta^{t-1}, e_\omega^t, d_\omega^t, e_\eta^t, d_\eta^t\right) + w_\eta^{2,t}\left(e_\omega^t, d_\omega^t, e_\eta^t, d_\eta^t, , e_\omega^{t+1}, d_\omega^{t+1}, e_\eta^{t+1}, d_\eta^{t+1}\right); \tag{18}$$

$$d_\eta^{t+1} \leq 1. \tag{19}$$

Letting λ denote the Lagrange multiplier for the budget constraint, the FOCs w.r.t. $c_\eta^{1,t}$, $c_\eta^{2,t}$, e_η^{t+1}, and d_η^{t+1} are

$$u' = \lambda;\ v' = \lambda;\ \lambda\left[(1-\alpha)\frac{\partial g}{\partial e_\eta^{t+1}} - 1\right] + \beta\frac{\partial g}{\partial e_\eta^{t+1}} = 0;\ \left[\lambda(1-\alpha)+\beta\right]\frac{\partial g}{\partial d_\eta^{t+1}} \geq f', \tag{20}$$

respectively, so that the budget allocation is ruled by

$$u' = v' = \left[\lambda(1-\alpha)+\beta\right]\frac{\partial g}{\partial e_\eta^{t+1}}. \tag{21}$$

Again, consumption will be smoothed over the two periods; however, as far as the entrepreneurs are concerned, each of them gains from having her kid educated, because in the next two periods that kid will own part of the firm, and will contribute her managerial skills to the production process and thus first to the earnings and then to the reputation of the entrepreneur. Therefore, children belonging to this class are educated, and might indeed go to school full-time ($d_\eta^{t+1} = 1$).

Characteristics of the free market equilibrium

In the *laissez-faire* equilibrium, some agents (the entrepreneurs) educate their children while others (the workers) don't. Notice that the reason why workers are not educated is that educational expenses must be paid by the parent, but the latter does not obtain any return from her child's education. *Not only, but the time devoted to education is subtracted from the production of the household public good.* The entrepreneurs, instead. in addition to the gain they get from educating their children, may also take advantage from having an educated work force. This may open the way for policies that oblige parents to send their kids to school.

III Agent optimisation and policy preferences

In order to investigate whether a compulsory education policy could gain the support of the majority of voters, we must first assess whether such a measure can actually improve the welfare either of the entrepreneurs, or of the workers or of both categories. As far as the policy tools are concerned, we are going to consider a linear income tax/subsidy to be employed for redistributive purposes, as well as a compulsory education package. We let τ_ω and τ_η denote the group-specific marginal income tax rates (possibly negative),[6] while $\overline{e}$ represents the minimum expenditure on a child's education that is imposed upon households and $\overline{d}$ the minimum amount of time that a child must spend in school. Consequently e and d will now represent the amounts of money and time that are freely allocated to education by households on top of the prescribed levels. Notice that, since the time allocation for the parent is fixed, τ_ω and τ_η are not distortionary, and basically equivalent to lump-sum transfers.

Agent optimisation in the presence of an active policy

Let's take the workers. A worker per-period after tax income is

$$(1-\tau_\omega)w_\omega^{i,t} \equiv (1-\tau_\omega)\left(\underline{w} + x\left(\overline{e}+e_\omega^t, \overline{d}+d_\omega^t\right)\right), \tag{22}$$

and the budget constraint is

$$c_\omega^{1,t} + c_\omega^{2,t} + \overline{e} + e_\omega^{t+1} = 2(1-\tau_\omega)\left(\underline{w} + x\left(\overline{e}+e_\omega^t, \overline{d}+d_\omega^t\right)\right) + \overline{e}; \tag{23}$$

we must also consider the time constraint:

$$d_\omega^{t+1} \leq 1-\overline{d}. \tag{24}$$

Just as in the free-market equilibrium, e_ω^{t+1} does not appear in the utility function, and d_ω^{t+1} appears as a bad, therefore $e_\omega^{t+1} = d_\omega^{t+1} = 0$ at the optimum for all workers of all generations. Thus, the problem reduces to

$$\text{Max } u\left(c_\omega^{1,t}\right) + v\left(2(1-\tau_\omega)\left(\underline{w} + x\left(\overline{e},\overline{d}\right)\right) - c_\omega^{1,t}\right) + f\left(1-\overline{d}\right). \tag{25}$$

[6] Assuming that the gross incomes of the two groups are different, as in (10), this is a rough representation of a two-bracket income tax system.

The FOC w.r.t. $c_{\omega}^{1,t}$ is as before

$$u' = v', \tag{26}$$

leading again to consumption smoothing. But now the worker is obliged to have the kid spend $\overline{d}$ as study time. He will also spend $\overline{e}$ on her child's education but this would be financed by the government.

Let us now consider the entrepreneurs: the budget constraint of an entrepreneur is

$$c_{\eta}^{1,t} + c_{\eta}^{2,t} + \overline{e} + e_{\eta}^{t+1} = (1 - \tau_{\eta}) \left(w_{\eta}^{1,t} + w_{\eta}^{2,t} \right) + \overline{e}. \tag{27}$$

Since $e_{\omega}^{t} = d_{\omega}^{t} = 0$ for the reasons given above, from (7) and (8), we have:

$$w_{\eta}^{1,t} \left(\overline{e}, \overline{d}, e_{\eta}^{t-1}, d_{\eta}^{t-1}, e_{\eta}^{t}, d_{\eta}^{t} \right) =$$

$$= \alpha \left\{ \left[\pi^{1,t} \left(\overline{e}, \overline{d} \right) + \pi^{1,t-1} \left(\overline{e}, \overline{d} \right) \right] s + g \left(\overline{e} + e_{\eta}^{t-1}, \overline{d} + d_{\eta}^{t-1} \right) + g \left(\overline{e} + e_{\eta}^{t}, \overline{d} + d_{\eta}^{t} \right) \right\}; \tag{28}$$

$$w_{\eta}^{2,t} \left(\overline{e}, \overline{d}, e_{\eta}^{t}, d_{\eta}^{t}, e_{\eta}^{t+1}, d_{\eta}^{t+1} \right) =$$

$$= (1 - \alpha) \left\{ \left[\pi^{2,t+1} \left(\overline{e}, \overline{d} \right) + \pi^{2,t} \left(\overline{e}, \overline{d} \right) \right] s + g \left(\overline{e} + e_{\eta}^{t}, \overline{d} + d_{\eta}^{t} \right) + g \left(\overline{e} + e_{\eta}^{t+1}, \overline{d} + d_{\eta}^{t+1} \right) \right\}; \tag{29}$$

$$w_{\eta}^{3,t} \left(\overline{e}, \overline{d}, , e_{\eta}^{t+1}, d_{\eta}^{t+1}, e_{\eta}^{t+2}, d_{\eta}^{t+2} \right) =$$

$$= \left[\pi^{3,t+1} \left(\overline{e}, \overline{d} \right) + \pi^{3,t+2} \left(\overline{e}, \overline{d} \right) \right] s + g \left(e_{\eta}^{t+1}, d_{\eta}^{t+1} \right) + g \left(e_{\eta}^{t+2}, d_{\eta}^{t+2} \right)]. \tag{30}$$

The entrepreneurs maximise

$$U_{\eta} = u \left(c_{\eta}^{1,t} \right) + v \left(c_{\eta}^{2,t} \right) + f \left(1 - \overline{d} - d_{\eta}^{t+1} \right) + \beta w_{\eta}^{3,t}, \tag{31}$$

by choice of $c_{\eta}^{1,t},\ c_{\eta}^{2,t},\ e_{\eta}^{t+1}$ and d_{η}^{t+1} subject to the budget constraint (27) and the additional constraint that

$$d_{\eta}^{t+1} \leq 1 - \overline{d}. \tag{32}$$

Since it will become clear in the next subsection that there cannot exist a political equilibrium where both entrepreneurs and workers are constrained, we only consider interior solutions for e_{η}^{t+1} and d_{η}^{t+1}. The FOCs then are

$$u' = \lambda;\ v' = \lambda;\ \lambda \left[(1 - \tau_{\eta}) (1 - \alpha) \frac{\partial g}{\partial e_{\eta}^{t+1}} - 1 \right] + \beta \frac{\partial g}{\partial e_{\eta}^{t+1}} = 0;$$

$$\left[\lambda (1 - \tau_{\eta}) (1 - \alpha) + \beta \right] \frac{\partial g}{\partial d_{\eta}^{t+1}} = f'. \tag{33}$$

Policy preferences

We now have to check which of the possible constellations of policy tools is preferred by the agents. Let us begin by writing the government revenue constraint under the assumption that the educational expenditure ration $\overline{e}$ is paid for by the governement:

$$\tau_\omega \left(\underline{w} + x^{t-1} + \underline{w} + x^t\right) \frac{S}{2} + \tau_\eta \left(w_\eta^{1,t} + w_\eta^{2,t-1}\right) \frac{n}{2} = \frac{(n+S)}{2}\overline{e}, \tag{34}$$

where we dropped the arguments in x^t, x^{t-1}, $w_\eta^{1,t}$ and $w_\eta^{2,t-1}$ to avoid clutter. For future use, we write the budget in *per-capita* terms and we express it in terms of $\tau_\omega(\tau_\eta, \overline{e}, \overline{d})$:

$$\tau_\omega(\tau_\eta, \overline{e}, \overline{d}) = \frac{\overline{e} - \tau_\eta \left(w_\eta^{1,t} + w_\eta^{2,t-1}\right)(1-\sigma)}{\left(2\underline{w} + x^t + x^{t-1}\right)\sigma}, \tag{35}$$

where $\sigma = S/(n+S)$. Next, we compute:

$$\frac{\partial \tau_\omega}{\partial \tau_\eta} = -\frac{(1-\sigma)}{\left(2\underline{w} + x^t + x^{t-1}\right)\sigma} < 0, \tag{36}$$

$$\frac{\partial \tau_\omega}{\partial \overline{e}} = \frac{1}{\left(2\underline{w} + x^t + x^{t-1}\right)\sigma} > 0, \tag{37}$$

$$\frac{\partial \tau_\omega}{\partial \overline{d}} = \frac{-\tau_\eta \left(\frac{\partial w_\eta^{1,t}}{\partial \overline{d}} + \frac{\partial w_\eta^{2,t-1}}{\partial \overline{d}}\right)(1-\sigma)\left(2\underline{w} + x^t + x^{t-1}\right)\sigma - 2\frac{\partial x}{\partial \overline{d}}\sigma(\overline{e} - \tau_\eta \left(w_\eta^{1,t} + w_\eta^{2,t-1}\right)(1-\sigma))}{\left(\left(2\underline{w} + x^t + x^{t-1}\right)\sigma\right)^2}. \tag{38}$$

Notice that here x represents the earning function from the education level of the *parents* and the *grandparents* while the possible increase in education prescribed by the policy would affect the earnings of the *children*. Similarly the current revenue of the entrepreneurs is not affected by a change in $\overline{d}$. Consequently,

$$\frac{\partial x^{t-1}}{\partial \overline{d}} = \frac{\partial x^t}{\partial \overline{d}} = \frac{\partial w_\eta^{1,t}}{\partial \overline{d}} = \frac{\partial w_\eta^{2,t-1}}{\partial \overline{d}} = 0, \tag{39}$$

which in turn implies

$$\frac{\partial \tau_\omega}{\partial \overline{d}} = 0. \tag{40}$$

Let the indirect utility, written as a function of the policy instruments, be denoted by

$$V_\iota = V_\iota \left(\tau_\eta, \overline{e}, \overline{d}\right), \ \iota = \omega, \eta_y, \eta_m, \tag{41}$$

where η_y denotes a young entrepreneur and η_m denotes a mature entrepreneur. The derivatives w.r.t. the policy instruments for the workers are

$$\frac{\partial V_\omega}{\partial \tau_\omega} = -2\left(\underline{w} + x^t\right) v' < 0; \tag{42}$$

$$\frac{\partial V_\omega}{\partial \overline{e}} = (1-\tau_\omega)\, 2\frac{\partial x^t}{\partial \overline{e}} v'; \ \frac{\partial V_\omega}{\partial \overline{d}} = \left((1-\tau_\omega)\, 2\frac{\partial x^t}{\partial \overline{d}}\right) v' - f'; \tag{43}$$

where, again,

$$\frac{\partial x^t}{\partial \overline{e}} = \frac{\partial x^t}{\partial \overline{d}} = 0, \tag{44}$$

as far as the parents' and grandparents' income is concerned. Therefore,

$$\frac{\partial V_\omega}{\partial \overline{e}} = 0; \ \frac{\partial V_\omega}{\partial \overline{d}} = -f' < 0. \tag{45}$$

Regarding the entrepreneurs, we must distinguish between the young and the mature ones. For the *young*, we have:

$$\frac{\partial V_{\eta_y}}{\partial \tau_\eta} = -\left(w_\eta^{1,t} + w_\eta^{2,t}\right)\lambda < 0. \tag{46}$$

As to the derivatives with respect to $\overline{e}$ and $\overline{d}$, we have

$$\frac{\partial V_{\eta_y}}{\partial \overline{e}} = (1-\tau_\eta)\frac{\partial w_\eta^{2,t}}{\partial \overline{e}}\lambda + \beta\frac{\partial w_\eta^{3,t}}{\partial \overline{e}} > 0; \quad \frac{\partial V_{\eta_y}}{\partial \overline{d}} = (1-\tau_\eta)\frac{\partial w_\eta^{2,t}}{\partial \overline{d}}\lambda + \beta\frac{\partial w_\eta^{3,t}}{\partial \overline{d}} > 0, \tag{47}$$

where we have considered that

$$\frac{\partial w_\eta^{1,t}}{\partial \overline{e}} = \frac{\partial w_\eta^{1,t}}{\partial \overline{d}} = 0, \tag{48}$$

because education affects only next-period profits. Notice that the per period entrepreneurs' income is made of four elements – see (28) and (29). Given that the entrepreneurs are not constrained, the compulsory education policy does not induce any change in returns to period two and three entrepreneurial activity $(1-\alpha)\, g$, but it creates more income *via* increases in per-worker profits $\pi^{2,t}$ and $(1-\tau_\eta)\,\pi^{3,t}$. This means that we can be certain that

$$\frac{\partial w_\eta^{2,t}}{\partial \overline{e}} > 0; \ \frac{\partial w_\eta^{2,t}}{\partial \overline{d}} > 0; \frac{\partial w_\eta^{3,t}}{\partial \overline{e}} > 0; \ \frac{\partial w_\eta^{3,t}}{\partial \overline{d}} > 0. \tag{49}$$

Consequently the sign of the derivatives of (47) is positive. In fact the policy measure has no impact on the amount of time and money invested in the education of an entrepreneur's child. The increase in the compulsory components of e and d will in fact be

counterbalanced by a reduction of the same amount in the time and money used to top up the compulsory amounts. As a consequence the entrepreneurs will benefit from the increase of the education of their work-force without incurring in any distorsion of their own educational choices.

The *mature* entrepreneurs will incur in the cost of education without obtaining any monetary return, but obtaining instead a benefit in terms of reputation. For them, we have

$$\frac{\partial V_{\eta_m}}{\partial \tau_\eta} = -\left(w_\eta^{2,t-1}\right)\lambda < 0;\ \frac{\partial V_{\eta_m}}{\partial \overline{e}} = \beta \frac{\partial w_\eta^{3,t-1}}{\partial \overline{e}};\ \frac{\partial V_\eta}{\partial \overline{d}} = \beta \frac{\partial w_\eta^{3,t-1}}{\partial \overline{d}}. \tag{50}$$

The preferred policies can be found by using (35) to replace τ_ω in (41) and then choosing $\tau_\eta,\ \overline{e}$ and $\overline{d}$ so as to maximise:

$$V_\omega = V_\omega((\tau_\omega(\tau_\eta, \overline{e}, \overline{d}), \overline{e}, \overline{d}), \tag{51}$$

$$V_{\eta_j} = V_{\eta_k}(\tau_\eta, \overline{e}, \overline{d});\ k = y, m, \tag{52}$$

for the workers and the entrepreneurs, respectively, under non-negativity constraints for $\overline{e}$ and $\overline{d}$ and the constraints that

$$\tau_\iota \leq 1,\ \iota = \omega, \eta;\ \overline{d} \leq 1, \tag{53}$$

For the workers, the FOCs are:

$$\frac{dV_\omega}{d\tau_\eta} = \frac{\partial V_\omega}{\partial \tau_\omega}\frac{\partial \tau_\omega}{\partial \tau_\eta} = 2\left(\underline{w} + x^t\right) v' \frac{(1-\sigma)}{2\left(\underline{w} + x^t\right)\sigma} = v' \frac{(1-\sigma)}{\sigma} > 0; \tag{54}$$

$$\frac{dV_\omega}{d\overline{e}} = \frac{\partial V_\omega}{\partial \tau_\omega}\frac{\partial \tau_\omega}{\partial \overline{e}} = -2\left(\underline{w} + x^t\right) v' \frac{1}{2\left(\underline{w} + x^t\right)\sigma} = -\frac{1}{\sigma} v' < 0; \tag{55}$$

$$\frac{dV_\omega}{d\overline{d}} = -f' + \frac{\partial V_\omega}{\partial \tau_\omega}\frac{\partial \tau_\omega}{\partial \overline{d}} = -f' < 0, \tag{56}$$

implying that the optimal tax rate is $\tau_\eta = 1$ while $\overline{e}$ and $\overline{d}$ should be optimally set to zero.

For the *young* entrepreneurs, the FOCs are:

$$\frac{\partial V_{\eta_y}}{\partial \tau_\eta} = -\left(w_\eta^{1,t} + w_\eta^{2,t}\right)\lambda < 0; \tag{57}$$

$$\frac{\partial V_{\eta_y}}{\partial \overline{e}} = (1-\tau_\eta)\frac{\partial w_\eta^{2,t}}{\partial \overline{e}} + \beta \frac{\partial w_\eta^{3,t}}{\partial \overline{e}} > 0; \tag{58}$$

$$\frac{\partial V_{\eta_y}}{\partial \overline{d}} = (1-\tau_\eta)\frac{\partial w_\eta^{2,t}}{\partial \overline{d}}\lambda + \beta \frac{\partial w_\eta^{3,t}}{\partial \overline{d}} > 0. \tag{59}$$

The FOCs for the *mature* ones are instead:

$$\frac{\partial V_{\eta_m}}{\partial \tau_\eta} = -\left(w_\eta^{2,t-1}\right)\lambda < 0; \tag{60}$$

$$\frac{\partial V_{\eta_m}}{\partial \overline{e}} = \beta \frac{\partial w_\eta^{3,t-1}}{\partial \overline{e}} > 0; \tag{61}$$

$$\frac{\partial V_{\eta_m}}{\partial \overline{d}} = \beta \frac{\partial w_\eta^{3,t-1}}{\partial \overline{d}} > 0. \tag{62}$$

We know from our previous analysis that in this case both $\partial V_{\eta_y}/\partial \overline{e}$ and $\partial V_{\eta_y}/\partial \overline{d}$ are positive because of a positive indirect effect as the compulsory education policy creates more income *via* increases in the after-tax per-worker next-period profits $(1-\tau_\eta)\,\pi^{2,t}$ – see (47) and because of the positive reputational effect. The latter is also present in the case of the mature entrepreneurs.

Therefore, the entrepreneurs would prefer to face a zero marginal tax rate while at the same time having positive values for $\overline{e}$ and $\overline{d}$ (indeed, entrepreneurs would *always* favour pushing each ration to its upper limit). This implies that the workers should face a positive tax rate in order to finance education expenditure. The upper limit for $\overline{d}$ is clearly unity, while for $\overline{e}$ can be deduced from observing that, given the preferred tax rates, the maximum level of $\overline{e}$ can be achieved when $\tau_\omega(\tau_\eta, \overline{e}, \overline{d}) = 1$, implying $\overline{e} = (2\underline{w} + x^t + x^{t-1})\,\sigma$.

While the results are possibly too sharp to be taken literally, their qualitative intrepretation is clear: the workers do not perceive any benefit from compulsory education but would favour a redistributive income taxation, whereas entrepreneurs gain from compulsory education but would like to shift the entire cost on the workers.

IV Political equilibrium

Let us now focus on the voting process through which an educational policy package is chosen in the political arena.

To perform our analysis, we consider a probabilistic voting model with a two-candidate electoral competition – see e.g. Lindbeck and Weibull (1987). In this setup, candidates are uncertain on whether citizens will participate in voting: they could abstain, maybe

because they cannot clearly perceive the distance between the proposed platforms. Consequently, the candidates are uncertain on how citizens will vote for any given political proposal. Following a standard approach, we suppose that the voters' decisions depend on the differences in the expected utilities from the candidates' different platforms, and that the candidates perceive the probability that a voter will participate in voting and support a platform as a function of the distance between her own platform and that proposed by the rival candidate. Politicians are assumed to be opportunistic, i.e. they are purely office-motivated, and thus aim at maximising their vote share. No credibility issues may arise, because it is also assumed that politicians can make binding commitments to policy platforms proposed during the electoral campaign.[7]

To sum up, the sketch of the electoral procedure is thus the following. Two candidates simultaneously propose their policy platforms, that is their educational policy packages plus their redistributive policy platform. Then, citizens vote for their preferred candidate. Finally, the candidate that is elected implements the policy she promised during the electoral campaign.

Each candidate selects her policy platform in order to maximise her share of total votes, that depends on the probabilities that each voter will vote for her, taking the rival candidate platform as given. Now, let the probability perceived by candidate $j,\ j = A, B$ that an agent votes for her be $\gamma_\iota^j,\ \iota = \omega, \eta_y, \eta_m$ where we distinguish between young and mature entrepreneurs because they have different policy preferences.[8] The expected vote share of a candidate will then be:

$$p^j = \sigma\gamma_\omega^j + \frac{(1-\sigma)}{2}\left(\gamma_{\eta_y}^j + \gamma_{\eta_m}^j\right),\ j = A, B. \tag{63}$$

[7]Notice that, since politicians are office- rather than policy-motivated, it does not matter whether they are workers or entrepeneurs. It would of course matter if we were to take the route of the so-called citizen-candidate models - see e. g. Osborne and Slivinsky (1996) and Besley and Coate (1997).

[8]We assume that the probability of voting is the same whithin each social group. The model could be extended to the case where the probability varies whithin each group for example because of an individual bias towards one of the candidates. If we adhere to the common assumption that biases are uniformely distributed, then the formal structure of our model continues to hold (see fn. 11).

As usual, we posit

$$\gamma_{\iota}^{j} = \Gamma_{\iota}\left[V_{\iota}\left(\tau_{\eta}^{j}, \tau_{\omega}^{j}\left(\tau_{\eta}^{j}, \overline{e}^{j}, \overline{d}^{j},\right), \overline{e}^{j}, \overline{d}^{j}\right) - V_{\iota}\left(\tau_{\eta}^{-j}, \tau_{\omega}^{-j}\left(\tau_{\eta}^{-j}, \overline{e}^{-j}, \overline{d}^{-j}\right), \overline{e}^{-j}, \overline{d}^{-j}\right)\right],$$
$$\iota = \omega, \eta_y, \eta_m;\ j = A, B, \tag{64}$$

where Γ_{ι} is a smooth, continuous and increasing function varying between 0 and 1.

The assumption that agents will show up at elections with a certain positive probability is of course standard in probabilistic voting models; also standard is it to assume that this probability varies with the agent's type and, more precisely, that each individual's voting behaviour is affected by her own ideological attachment to a party (usually represented by an idiosyncratic taste shock which is a random variable with a density function taken to be symmetric around zero). However, we wish to highlight here a different mechanism, namely the positive relationship between income and voting participation: active participation in public life, including active voting, is indeed usually found to be positively related to income at the individual level and, relatedly, negatively associated with income inequality at the aggregate level – see for example Green and Nikolaev (1999), Benabou (2000), Horn (2011).[9]

Therefore, we assume that the probability of an individual participating in voting is positively related to her income. In our framework, this means that the entrepreneurs are more active than workers in the voting process, i.e. their abstension probability is lower. We take it that $\Gamma_w(\Delta V_{\iota}) < \Gamma_{\eta_k}(\Delta V_{\iota})$ $k = y, m$, for any value of the difference in the utility from the two platforms.

Each candidate maximises (63) by choosing her own policy platform $\tau_{\eta}^{j}, \overline{e}^{j}, \overline{d}^{j}$ while taking the other candidate's platform as given; in a Nash equilibrium in which the candidates announce their policies simultaneously, the resulting equilibrium policies will be identical. As is well-known, then, the objective function of a candidate, that is (63), in a probabilistic voting model coincides with a generalised utilitarian social welfare function.

In what follows, we will assume that for τ_{η}^{j} we always have interior solutions at the political equilibrium. In other words we assume that the abstension rate of the workers

[9] Political economy models in line with this literature include Anderberg and Balestrino (2007), where the probability of abstension has been linked to the level of income, and Bourguignon and Verdier (2000), where the turnout in elections is determined by the level of education.

(who outnumber the entrepreneurs) is such as to guarantee an interior solution.[10] As far as the education package is concerned, notice that there cannot exist an equilibrium in which both the workers and the entrepreneurs are constrained. If that were the case, one of the candidates could easily improve the outcome for both groups by simultaneously reducing the ration and the tax rates. For each candidate, the FOCs are:

$$\frac{\partial p^j}{\partial \tau_\eta^j} = \sigma \frac{\partial \Gamma_\omega}{\partial V_\omega}\frac{\partial V_\omega}{\partial \tau_\eta^j} + \frac{(1-\sigma)}{2}\frac{\partial \Gamma_{\eta_y}}{\partial V_{\eta_y}}\frac{\partial V_{\eta_y}}{\partial \tau_\eta^j} + \frac{(1-\sigma)}{2}\frac{\partial \Gamma_{\eta_m}}{\partial V_{\eta_m}}\frac{\partial V_{\eta_m}}{\partial \tau_\eta^j} = 0, \tag{65}$$

$$\frac{\partial p^j}{\partial \overline{e}^j} = \sigma \frac{\partial \Gamma_\omega}{\partial V_\omega}\frac{\partial V_\omega}{\partial \overline{e}^j} + \frac{(1-\sigma)}{2}\frac{\partial \Gamma_{\eta_y}}{\partial V_{\eta_y}}\frac{\partial V_{\eta_y}}{\partial \overline{e}^j} + \frac{(1-\sigma)}{2}\frac{\partial \Gamma_{\eta_m}}{\partial V_{\eta_m}}\frac{\partial V_{\eta_m}}{\partial \overline{e}^j} \geq 0, \tag{66}$$

$$\frac{\partial p^j}{\partial \overline{d}^j} = \sigma \frac{\partial \Gamma_\omega}{\partial V_\omega}\frac{\partial V_\omega}{\partial \overline{d}^j} + \frac{(1-\sigma)}{2}\frac{\partial \Gamma_{\eta_y}}{\partial V_{\eta_y}}\frac{\partial V_{\eta_y}}{\partial \overline{d}^j} + \frac{(1-\sigma)}{2}\frac{\partial \Gamma_{\eta_m}}{\partial V_{\eta_m}}\frac{\partial V_{\eta_m}}{\partial \overline{d}^j} \geq 0, \tag{67}$$

where the derivatives of the indirect utility functions w.r.t. the policy parameters are given by (54)-(56) and (57)-(59).

Substituting for $\partial V_\omega/\partial \tau_\eta^j$ and $\partial V_{\eta_k}/\partial \tau_\eta^j$, $k = y, m$, from the preferred policies, (65) becomes:

$$\sigma \frac{\partial \Gamma_\omega}{\partial V_\omega} v' \frac{1-\sigma}{\sigma} - \frac{1-\sigma}{2}\lambda \left[\frac{\partial \Gamma_{\eta_y}}{\partial V_{\eta_y}} \left(w_\eta^{1,t} + w_\eta^{2,t} \right) + \frac{\partial \Gamma_{\eta_m}}{\partial V_{\eta_m}} w_\eta^{2,t-1} \right] = 0, \tag{68}$$

$$\frac{\partial \Gamma_\omega}{\partial V_\omega} v' = \frac{\lambda}{2} \left[\frac{\partial \Gamma_{\eta_y}}{\partial V_{\eta_y}} \left(w_\eta^{1,t} + w_\eta^{2,t} \right) + \frac{\partial \Gamma_{\eta_m}}{\partial V_{\eta_m}} w_\eta^{2,t-1} \right].$$

In words, the marginal tax rates are set so as to equalise the marginal utilities of income weighted by the sensitivity of the two citizen types' vote to the candidate's proposal at the equilibrium point, that is when there is no difference in the proposed platforms (see Mueller 2003, ch. 12). Notice, however, that for the entrepreneurs the term in square bracket is the average of the sensitivity of the young and the mature ones.

The intuition behind these results is the following. Let us suppose, for example, that $\partial \Gamma_{\eta_k}/\partial V_{\eta_k}$, $k = y, m$, is for any given value of the difference between the utilities in (64) larger than $\partial \Gamma_\omega/\partial V_\omega$, meaning that entrepreneurs respond with a higher increase in the probability of voting for the candidate if the latter marginally differentiates her proposed platform in their favour; then, τ_η will be set in such a way that the marginal utility

[10] Corner solutions with $\tau_\eta^j = 1$, $\tau_\omega^j < 0$ are implausible in a democracy (as well as those with $\tau_\eta^j = 0$, $\tau_\omega^j > 0$).

of income for the entrepreneurs, λ, is lower than the marginal utility of income for the workers, v'. That is, the policy favours the citizen whom the candidate perceives as more likely to vote for her as a consequence of such a favour.[11]

In (68) we consider interior solutions for τ_η. Notice, however, that the characteristics of the solution depend on the abstension rate of the workers. Considering that there are more workers than entrepreneurs, in general τ_ω cannot be positive unless the workers' abstension rate is particularly high even for large differences in the utility they can obtain from the two candidates' platforms,

$$V_\iota\left(\tau_\eta^j, \tau_\omega^j\left(\tau_\eta^j, \overline{e}^j, \overline{d}^j,\right), \overline{e}^j, \overline{d}^j\right) - V_\iota\left(\tau_\eta^{-j}, \tau_\omega^{-j}\left(\tau_\eta^{-j}, \overline{e}^{-j}, \overline{d}^{-j}\right), \overline{e}^{-j}, \overline{d}^{-j}\right). \tag{69}$$

The educational policy must usually be paired with a redistributive taxation in favour of the workers because the latter suffer from a reduction in the household public good. This scenario can arise if the entrepreneurs' benefits coming from the workers' education are sufficiently high to compensate both the cost of the compulsory education package and the restributive policy. Clearly, such a cost would be lower if the workers attached positive value to their children's education. In that case, less redistribution is needed for the workers to accept the compulsory education policy. If education were highly valued by the workers, the equilibrium policy could even prescribe positive values for τ_ω.

When workers do not attach any value to their children's education, we have

$$-\frac{\partial \Gamma_\omega}{\partial V_\omega} v' + \\ + \frac{1-\sigma}{2}\left\{\frac{\partial \Gamma_{\eta_y}}{\partial V_{\eta_y}}\left[(1-\tau_\eta)\frac{\partial w_\eta^{2,t}}{\partial \overline{e}} + \beta \frac{\partial w_\eta^{3,t}}{\partial \overline{e}}\right] + \frac{\partial \Gamma_{\eta_m}}{\partial V_{\eta_m}} \beta \frac{\partial w_\eta^{3,t-1}}{\partial \overline{e}}\right\} \geq 0; \ (\overline{e}) \tag{70}$$

$$-\sigma\frac{\partial \Gamma_\omega}{\partial V_\omega} f' + \\ + \frac{1-\sigma}{2}\left\{\frac{\partial \Gamma_{\eta_y}}{\partial V_{\eta_y}}\left[(1-\tau_\eta)\frac{\partial w_\eta^{2,t}}{\partial \overline{d}}\lambda + \beta \frac{\partial w_\eta^{3,t}}{\partial \overline{d}}\right] + \frac{\partial \Gamma_{\eta_m}}{\partial V_{\eta_m}} \beta \frac{\partial w_\eta^{3,t-1}}{\partial \overline{d}}\right\} \geq 0. \ \left(\overline{d}\right) \tag{71}$$

[11] In the case where the voting probability varies whithin each social group because of a uniformely distributed individual bias towards one of the candidates, the sensitivity $\partial \Gamma_\iota / \partial V_\iota$ represents the height of the distribution. Such height will be higher, the lower is the range over which the bias is distributed. Consequently, the sensitivity is higher the more concentrated is the distribution, implying that the policy will favour the group whose probability of voting is less dispersed (see Mueller 2003, ch. 12).

substituting from (65) we obtain

$$\frac{\partial \Gamma_{\eta_y}}{\partial V_{\eta_y}}(1-\sigma)\left((1-\tau_\eta)\frac{\partial w_\eta^{2,t}}{\partial \overline{e}}+\beta\frac{\partial w_\eta^{3,t}}{\partial \overline{e}}\right)+\frac{\partial \Gamma_{\eta_m}}{\partial V_{\eta_m}}(1-\sigma)\beta\frac{\partial w_\eta^{3,t-1}}{\partial \overline{e}}\geq$$
$$\frac{\partial \Gamma_{\eta_y}}{\partial V_{\eta_y}}\lambda\left(w_\eta^{1,t}+w_\eta^{2,t}\right)+\frac{\partial \Gamma_{\eta_m}}{\partial V_{\eta_m}}\lambda w_\eta^{2,t-1};\ (\overline{e}) \tag{72}$$

$$\frac{\partial \Gamma_{\eta_y}}{\partial V_{\eta_y}}(1-\sigma)\left((1-\tau_\eta)\frac{\partial w_\eta^{2,t}}{\partial \overline{d}}\lambda+\beta\frac{\partial w_\eta^{3,t}}{\partial \overline{d}}\right)+\frac{\partial \Gamma_{\eta_m}}{\partial V_{\eta_m}}(1-\sigma)\beta\frac{\partial w_\eta^{3,t-1}}{\partial \overline{d}}\geq$$
$$\frac{\partial \Gamma_{\eta_y}}{\partial V_{\eta_y}}\sigma\lambda\frac{f'}{v'}\left(w_\eta^{1,t}+w_\eta^{2,t}\right)+\frac{\partial \Gamma_{\eta_m}}{\partial V_{\eta_m}}\sigma\lambda\frac{f'}{v'}w_\eta^{2,t-1}.\ \left(\overline{d}\right) \tag{73}$$

On the l.h.s. of (72) we have a measure of the marginal benefit of educational expenditure, for the young and the mature entrepreneurs weighted by the respective vote sensitivities to the candidates' proposals; on the r.h.s., we have the weighted marginal cost, expressed in utility terms for $\overline{e}$. Similarly on the l.h.s. of (73) we have a measure of the weighted marginal benefit of school time while on the r.h.s. we have the weighted marginal cost expressed as an opportunity cost for $\overline{d}$.

Then, as long as marginal benefits exceed or equal marginal costs, a solution in which a certain level of compulsory education is enforced emerges. We have then the interesting result that a compulsory education policy may be implemented at the political equilibrium, despite the fact that one of the two groups of which the society is composed would not educate the children in a free-market equilibrium. The driving force behind this result is the fact that the entrepreneurs gain from having an educated workforce.[12]

V Conclusions

Over the years, there have been several contributions to the political economy of education. However, their focus seems to have been mostly on secondary or tertiary education. Also, typically, the main driving force behind the results has been the presence of income dispersion. Consider for example, the work by Epple and Romano (1996b). In their model, a publicly provided private good, which could be education, is financed through

[12] As we said, we regard this as the most plausible setup; also, it seems to reflect the historical situation in which compulsory education was first established, roughly at the time of the second industrial revolution.

a flat-rate income tax and policy is determined by majority rule; agents differ by their fixed incomes. At the political equilibrium, the private good is publicly provided as long as it is possible to top it up; interestingly, for some preference configurations, the political equilibrium is of the "ends-against-the-middle" variety, i.e. low- and high-income agents favour low levels of public provision whereas the middle-income agents favour high levels of public provision (see also Epple and Romano, 1996a). Another well-established result is that post-compulsory education policies are at least partially regressive, redistributing income from the lower income groups to middle- and high income groups (see e.g. Fernandez and Rogerson 1995).

We have taken a different route here, paying attention specifically to the question whether primary education should be made compulsory or not. We considered an economy with two categories of agents: entrepreneurs and workers. The type of occupation, rather than the income dispersion, plays a crucial role in the analysis. In *laissez-faire*, the former gain from having their children educated, while the latter have no interest in sending their children to school. We characterised the preferred education policy-cum-redistributive taxation for the two groups, and find that entrepreneurs favour a compulsory education policy while workers prefer a purely redistributive taxation scheme (in both cases, the policy should preferably be financed entirely by the other group). Then, we introduced a political process with probabilistic voting and verified that an equilibrium with both a compulsory education policy and some redistribution may exist in which the workers are constrained but the entrepeneurs, who benefit from hiring educated workers, are not.

To the best of our knowledge, the literature on this topic, at least if we consider the political economy line of work, is limited and follows different approaches from ours. As an example of these alternative views, consider the contribution by Gradstein (2000), whose elegant argument is based on the idea of time inconsistency. He argues that private financing of education can be an inferior public choice if the current government representing the parents is unable to precommit the next generation to a restrained redistributive policy. He observes that public education, relative to private education, generates a more equal income distribution for the children, and therefore suggests that

in the future the government will have to implement a relatively moderate redistributive policy, as chosen by the median voter. This reduces the incentive to underinvest in the children's education, incentive that instead would be large in case the parents expected a more aggressive redistribution policy. Thus, human capital should be accumulated at a faster pace under a public education regime, and this would make it preferable for a majority of parents to the alternative of a private education regime.

Clearly, ours is an entirely different line of reasoning, not in contradiction, but certainly based on other foundations and moreover focused specifically on whether education should be made compulsory or not, rather than on whether it should be financed by the State or not (which is of course a somewhat different issue). In our model, income disparity plays a part, in particular by supporting the assumption that entrepeneurs are not constrained by compulsory education, but what really drives our result on the desirability of compulsory education at the political equilibrium is the difference in occupation, i.e. the different role that education plays for the entrepreneurs as opposed to the workers. Redistribution, however, by compensating workers for the loss of their children's production, plays a role in that it makes workers accept the presence of compulsory education at the political equilibrium.

References

Anderberg, D., Balestrino, A., 2007, Non-Cooperative Households and the Size and Composition of Public Expenditure, *Economics of Governance*, 8, 61-81.

Balestrino, A., Grazzini, L., Luporini, A., 2017. A Normative Justification of Compulsory Education, *Journal of Population Economic* 30, 537–567.

Bandiera, O., Mohnen, M., Rasul, I., Viarengo, M., 2018, Nation-building through Compulsory Schooling during the Age of Mass Migration, The Economic Journal, 128,1-48.

Benabou, R., 2000. Unequal Societies: Income Distribution and the Social Contract, *American Economic Review* 90, 96-129.

Becker, S. and Woessmann L., 2010, The Effect of Protestantism on Education before the Industrialization: Evidence from 1816 Prussia, *Economic Letters* 107 (2), 224-228.

Besley, T., Coate, S., 1997. An Economic Model of Representative Democracy, *Quarterly Journal of Economics* 112, 85-114.

Bourguignon, F., Verdier, T., 2000. Oligarchy, Democracy, Inequality and Growth, *Journal of Development Economics* 62, 285-313.

Bovenberg, A.L., Jacobs, B., 2005. Redistribution and Education Subsidies are Siamese Twins, *Journal of Public Economics*, 89, 2005-2035.

Cigno, A., 2013. How to Deal with Covert Child Labor and Give Children an Effective Education, in a Poor Developing Country. *World Bank Economic Review*, 26, 61-67.

Cigno, A., Giannelli, G. and Rosati, F., 1998. Voluntary Transfers among Italian Households: Altruistic and Non-Altruistic Explanations. *Structural Changes and Economic Dynamics* 4, 435-53.

Cigno, A., Giannelli, G., Rosati, F. and Vuri, D., 2006. Is there Such a Thing as a Family Constitution? A Test Based on Credit Rationing. *Review of the Economics of the Household* 4, 183-204.

Cipolla, C.M., 1969, Literacy and Development in the West, Harmondsworth: Penguin.

Dee, T., 2004, Are there Civic Returns to Education?, *Journal of Public Economics*, 89, 1697-720.

Epple, D. and Romano, R., 1996a, Ends against the Middle: Determining Public Service Provision when there Are Private Alternatives, *Journal of Public Economics* 62, 297-325.

Epple, D. and Romano, R., 1996b, Public Provision of Private Goods, *Journal of Political Economy* 104, 57-84.

Fyfe, A., 2005, Compulsory Education and Child Labour: Historical Lessons, Contemporary Challenges and Future Directions, ILO Working Draft.

Fernandez, R., and Rogerson, R., 1995. On the Political Economy of Education Subsidies, *The Review of Economic Studies* 62, 249-262.

Galor, O., 2006, From Stagnation to Growth: a Unified Growth Theory, in P. Aghion and S. Durlauf (eds.), *Handbook of Economic Growth*, Amsterdam: North Holland.

Gradstein, M., 2000. An Economic Rationale for Public Education: The Value of Commitment, *Journal of Monetary Economics* 45, 463-474.

Greene, K. and Nikolaev, O., 1999, Voter participation and the redistributive state, *Public*

Choice 98, 213-26.

Horn, D., 2011, Income Inequality and Voter Turnout, GINI Discussion Paper no. 16.

Lindbeck, A. and Weibull, J., 1987, Balanced-budget Redistribution as the Outcome of Political Competition, *Public Choice* 52, 273-297.

Milligan, K., Moretti, E., Oreopoulus, P., 2004, Does Education improve Citizenzenship?Evidence from the United States and the United Kingdom", *Journal of Public Economics*, 88, 1667-95.

Mueller, D., 2003, *Public Choice III*, Cambridge University Press, Cambridge (UK).

Murtin F. and Viarengo, M., 2011, The Expansion and Convergence of Compulsory Schooling in Western Europe, 1950-2000, *Economica* 78, 501-522.

Osborne, M.J., Slivinski, A., 1996. A Model of Political Competition with Citizen-Candidates, *Quarterly Journal of Economics* 111, 65-96.