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MIXED, PRIVATE, AND PUBLIC EDUCATIONAL FINANCING REGIMES: ECONOMIC GROWTH AND INCOME INEQUALITY EFFECTS

ABSTRACT: *The issue of mixed educational financing is rarely evoked in the literature, although the financial contribution of parents in the public educational system can be significant. This paper presents a comparative analysis of the mixed system and public and private 'extreme' systems in terms of economic growth and social disparity. For developing countries and for heterogeneous individuals, the mixed system is widely preferred. For homogeneous agents the public and private systems cannot lead to better economic performance than the mixed system. The public system always reduces social inequality, in contrast to the mixed and private systems, which generate the same level of inequality.*

KEY WORDS: *economic growth; mixed, private, and public educational financing; educational systems; social inequality.*

JEL CLASSIFICATION: I22, O15, O47.

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1. INTRODUCTION

For several decades, economists have focused on the economic and social benefits of human capital. Economists and policymakers advocate investment in education as the main component of the accumulation of human capital because it contributes significantly to the improvement of individual and collective well-being. For this reason there is a massive demand for education in developed and developing countries.

In many countries, education is provided and financed by the public authorities in order to ensure fair and equal access. However, the shortage of public resources and their misallocation mean that public sector financing is not always the best solution. Faced with this situation, many researchers have tried to identify other educational resources for increasing the availability of education, which will provide benefits in terms of economic growth and social well-being and will in turn reduce these financial constraints.

There is extensive research examining the impact of different modes of educational funding on economic growth and social inequality. In the context of the debate on the comparative merits of the public and private educational systems, Glomm and Ravikumar (1992) show that in terms of economic performance, private education is more efficient than public education. Benabou (1995, 1996) also considers this issue, using a model with an infinite life horizon. He shows that the private system generates more economic growth in the short-term but the public system fares better in the long-term. Cardak (1999) confirms these results with the hypothesis of the heterogeneity of educational preferences[1].

A second series of studies is concerned with the educational structure where public and private educational systems coexist in the same economy and individuals choose between them (Glomm and Ravikumar 1998). However, the idea of mixed financing within the same educational system is rarely mentioned in the economic literature. In reality, in countries that adopt a pure public system the parental contribution to education funding is not negligible but is

1 This hypothesis implies that parents do not attribute the same importance to the education of their children.

unnoticed[2]. This finding implies that educational financing cannot be completely public or completely private. In fact, these two modes of financing are complementary rather than alternatives (Blankenau and Simpson 2004).

The main objective of this study is to analyze the impact of different educational systems – mixed, public, and private – on economic growth and social dispersion. It is inspired by Glomm and Ravikumar's (1992) model, which presents a comparative analysis of public and private educational financing. However, it considers the notion of rational altruism (Zhang 1996), which considers the utility of the child rather than the 'legs' provided as educational expenses[3]. As in many models (Kaganovich and Zilcha 1999; Glomm and Ravikumar 1992, 2001; Cardak 2004), the accumulation of human capital includes time spent on education, the quality of publicly and privately financed education, and parents' level of human capital. In this study, and contrary to other works (Kaganovich and Zilcha 1999; Cardak 2005), the tax rate is considered endogenous and determined by a majority vote.

This paper is organized as follows. The second section presents the model and determines the equilibrium of the economy in the presence of mixed, public, and private educational systems. The third section examines the impact of these different ways of financing education on economic growth and social inequality, considering assumptions of the homogeneity and heterogeneity of individuals. The last section concludes.

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2 For example, in 2012 the government share of the total spending on education is about 69 percent in Portugal and 100 percent in Sweden, Finland and Luxemourg. The private resources represent more than 10 percent of the total educational spending in sixteen EU countries (for which data is available). This share is rising to 20 percent in nine EU countries and is about 25 percent in the United Kingdom and Cyprus. Source: Educational Expenditures Statistics Eurostat 2016.

3 For Glomm and Ravikumar (1992), parents consider in their utility function only the legs attributed to their children which is the educational spending (ad hoc altruism). For Zhang (1996), parents include in their utility function the preferences of their children rather than the legs (rational altruism).

2. THE MODEL

We consider a model of overlapping generations, where each individual lives two periods. During the first period the young individual devotes all her/his time to her/his education and thus to the accumulation of human capital, or to leisure. During the second period the agent becomes an adult that divides her/his time between work (l_t), his/her children's education (e_t), and leisure (z_t). S/he receives a salary (y_t) proportional to the level of her/his human capital (h_t) and to the time devoted to the production of goods (l_t). A part of this income is used to finance consumption (C_t). The population is constant and the individual gives birth to a single child.

The quality of education (q_t) is measured by the expenditure allocated by the parents and the government. In this model we consider three educational systems: mixed, public, and private. Two complementary sources are used to finance education in a mixed system: 'ordinary' parents' private expenditure (registration fee, support courses, school supplies, etc.) and government resources collected as income tax (teachers' salaries, school investments, libraries, etc.). The private system is totally financed by parents, who decide on the amount through a programme that maximizes their utility function. In the public system, investment in education is guaranteed by the government and financed by income tax at a rate of (τ).

Glomm and Ravikumar (1992) adopt a log-linear utility function with ad hoc altruism. In our model we retain a form of rational altruism (Zhang 1996) where the agents integrate the direct utility of their children (U_{t+1}) in their preferences function and not the 'legs' that they have allocated to them. It is also assumed that these agents have the same preferences.

$$U_t = \text{Log } C_t + \text{Log } z_t + \rho\, U_{t+1} \qquad 0 < \rho < 1 \tag{1}$$

The parameter ρ is the parents' degree of altruism towards their children.

The human capital accumulation is given by this expression:

$$h_{t+1} = A\, e_t^{\alpha}\, q_t^{\beta}\, h_t^{\delta}\, H_t^{1-\beta-\delta} \qquad (\alpha, \beta \text{ and } \delta \in [0, 1]^3) \tag{2}$$

where A, e_t , q_t, h_t and H_t are respectively the innate ability of individuals ($A > 0$), the time spent by parents on their children's education, educational expenditure, the level of human capital inherited from parents, and the level of social or the average human capital.

We assume that the average level of human capital follows a lognormal distribution:

$$H_t = \int h_t \, dF(h_t) \tag{3}$$

$F(h_t)$ is the human capital distribution function at time t. The variable Log H_t follows a lognormal distribution where μ_t and σ_t^2 are respectively the mean and the variance that is a measure of social inequality.

$$H_t = \exp(\mu_t + \sigma_t^2/2) \tag{4}$$

2.1 The mixed system

The objective of agents is to determine the optimal allocation of their income and their timing provision to maximize their utility. Their disposable income $((1-\tau)y_t)$ is distributed between their consumption (C_t) and the share of their children's educational expenses (θq_t). Their budget constraint is given by:

$$C_t = (1-\tau)\, y_t - \theta q_t \tag{5}$$

The government finances the rest of the educational expenditure $((1-\theta)q_t)$ using income tax. The public budget is balanced when public spending equals the amount of collected taxes.

$$(1-\theta)\, q_t = \tau_t\, y_t = \tau_t\, l_t\, h_t \tag{6}$$

Each individual, during the period t, seeks to solve the following maximization programme:

$$\text{Max } U_t(h_t, \tau, H_t) = Log\, C_t + Log\, z_t + \rho\, U_{t+1}(h_{t+1}, \tau, H_{t+1})$$

$$y_t = l_t\, h_t$$

$C_t = (1-\tau_t)\, y_t - \theta q_t$

$e_t + z_t + l_t = 1$

$(1-\theta)\, q_t = \tau_t y_t = \tau_t l_t h_t$

$h_{t+1} = A\, e_t^{\alpha} q_t^{\beta} h_t^{\delta} H_t^{1-\beta-\delta}$

Considering the logarithmic form of the utility function $U_t\,(h_t, \tau, H_t)$[4]:

$$U_t\,(h_t,\tau, H_t) = B + D \operatorname{Log} h_t + E \operatorname{Log} H_t \tag{7}$$

The optimal solutions are given by:

$$l_t = l = \frac{1-\rho\delta}{2-\rho\left(2\delta+\beta-\alpha\right)} \tag{8}$$

$$e_t = e = \frac{\rho\alpha}{2-\rho\left(2\delta+\beta-\alpha\right)} \tag{9}$$

$$C_t = \left(1-\tau\right)\left[\frac{1-\rho\left(\delta+\beta\right)}{2-\rho\left(2\delta+\beta-\alpha\right)}\right] h_t \tag{10}$$

$$q_t = \left[\frac{\rho\beta(1-\tau)+\tau(1-\rho\delta)}{2-\rho(2\delta+\beta-\alpha)}\right] h_t = X_{mix} h_t$$

$$where\ X_{mix} = \left[\frac{\rho\beta(1-\tau)+\tau(1-\rho\delta)}{2-\rho(2\delta+\beta-\alpha)}\right] \tag{11}$$

The human capital accumulation equation during the period *t + 1* for the agent born at time *t* is given by:

$$h_{t+1} = A\, e_t^{\alpha} X_{mix}^{\beta}\, h_t^{\beta+\delta} H_t^{1-\beta-\delta} \tag{12}$$

[4] The parameters *B, D*, and *E* are to be determined. The optimal solutions are determined by deriving the utility function with respect to (h_t) and replacing it by its expression ($D/\ h_t$) in the first order conditions.

The average level of human capital (H_t) follows a lognormal distribution:

$Log\ H_t = \mu_t + \sigma_t^2/2$

$$\mu_{t+1} = \text{Log } A + \alpha \text{ Log } e_t + \beta \text{ Log } X_{mix} + \mu_t + (1- \beta - \delta)\ \sigma_t^2/2 \tag{13}$$

$$\sigma_{t+1}^2/2 = (\beta+\delta)^2 \sigma_t^2/2 \tag{14}$$

Proposition 1

Under a mixed educational system, the optimal tax rate (τ^*) and the share of income spent by individuals on the education of their children (θ) are given by:

$$\tau^* = \frac{\rho^2\beta(1-\beta-\delta)}{(1-\rho\delta)(1-\rho)}$$

$$\theta = \frac{\rho\beta\left(1-\tau^*\right)}{\rho\beta\left(1-\tau^*\right)+\tau^*\left(1-\rho\delta\right)}$$

Proof: The tax rate is determined from the derivative of the function $B\ (\tau)$ relative to τ. $B'(\tau)= 0$.

The parameters B, D, and E are given by:

$$B(\tau)=\frac{1}{(1\text{-}\rho)}\left[Log(1\text{-}\tau)+2Log\left[\frac{1\text{-}\rho(\delta+\beta)}{2\text{-}\rho(2\delta+\beta\text{-}\alpha)}\right]\right]+$$

$$\frac{\rho}{(1\text{-}\rho)^2}\left[LogA+\beta Log\left[\frac{\rho\beta(1\text{-}\tau)+\tau(1\text{-}\rho\delta)}{2\text{-}\rho(2\delta+\beta\text{-}\alpha)}\right]+\alpha Log\left[\frac{\rho\alpha}{2\text{-}\rho(2\delta+\beta\text{-}\alpha)}\right]\right]$$

$$-\frac{\rho^2}{(1-\rho)^2}\left[\frac{1\text{-}\beta\text{-}\delta}{1\text{-}\rho(\beta+\delta)}\right]\left[(\beta+\delta)(1\text{-}\beta\text{-}\delta)\right]\sigma_t^2/2$$

$$D=\frac{1}{1-\rho(\beta+\delta)}$$

$$E = \frac{\rho(1-\beta-\delta)}{(1-\rho)\left[1-\rho(\beta+\delta)\right]}$$

The results prove that the utility function depends on the tax rate (τ) via parameter *B*.

Contrary to Glomm and Ravikumar's (1992) model where the tax rate is constant, in this model the obtained tax rate depends on the altruism degree towards children (ρ), the elasticity of human capital towards the educational quality (β) and the human capital of parents (δ). However, the altruism degree (ρ) presents ambiguous effect but the parameters (β) and (δ) have negative effects in the sense that educational expenditure improvement and the inherited human capital performance can increase the private financing and reduce the tax burden.

In addition, the private contribution to the education is negatively related to the tax rate which means that parents are less motivated to finance schooling if tax is high. However, the parameters (ρ), (β) and (δ) affect positively this private financing. In reality, altruistic parents who present high educational investment performance are more willing to accord a considerable part of their revenue to schooling their children.

Proposition 2

The mixed system improves the level of human capital and consequently the level of per capita income.

Proof:

Considering equation (11), it is easy to verify that $\frac{\partial X_{mix}}{\partial \tau_{mix}} > 0$. Equations (8) and (9) imply that $\frac{\partial e_{mix}}{\partial \tau_{mix}} = \frac{\partial l_{mix}}{\partial \tau_{mix}} = 0$ because these variables are constants and are independent of the tax rate (τ_{mix}).

Given the levels of h_t and H_t, $\frac{\partial h_{t+1}}{\partial \tau_{mix}} > 0$.

According to these results, it is clear that the relationship between the per capita income (y_t) and the tax rate (τ_{mix}) is positive $\frac{\partial y_t}{\partial \tau_{mix}} > 0$ because $y_t = l_t\, h_t$

In this system, agents assign more resources to finance their children's education, to the detriment of their consumption. This improves the levels of human capital and income of future generations. They believe that improving the quality of education in terms of time and spending can generate significant future gains. The beneficial effect expressed at the level of accumulated human capital and per capita income is transferred from one generation to another.

2.2 The public system

In this system, education is provided entirely by the public sector (Glomm and Ravikumar 1992). Children enjoy the same quality of education, which is financed by tax collected on parents' income. The government's constraint is given by:

$$q_t = \tau\, l_t\, H_t \tag{15}$$

The agent's maximization programme is:

$$Max\ U_t(h_t, \tau, H_t) = Log\, C_t + Log\, z_t + \rho\, U_{t+1}\,(h_{t+1}, \tau, H_{t+1})$$

$$y_t = l_t\, h_t$$

$$C_t = (1-\tau_t)\, y_t$$

$$e_t + z_t + l_t = 1$$

$$q_t = \tau_t\, y_t = \tau_t\, l_t\, H_t$$

$$h_{t+1} = A\, e_t^{\alpha}\, q_t^{\beta}\, h_t^{\delta}\, H_t^{1-\beta-\delta}$$

The first-order conditions and the logarithmic form of the utility function lead to the following results:

$$l_t = l = \frac{1 - \rho\delta}{2 - \rho(2\delta - \alpha)} \tag{16}$$

$$e_t = e = \frac{\rho\alpha}{2 - \rho(2\delta - \alpha)} \tag{17}$$

$$C_t = (1 - \tau)\left[\frac{1 - \rho\delta}{2 - \rho(2\delta - \alpha)}\right] h_t \tag{18}$$

$$q_t = \left[\frac{\tau(1 - \rho\delta)}{2 - \rho(2\delta - \alpha)}\right] H_t = X_{pub} H_t$$

$$where\ X_{pub} = \left[\frac{\tau(1 - \rho\delta)}{2 - \rho(2\delta - \alpha)}\right] \tag{19}$$

$$h_{t+1} = A\, e_t^{\alpha}\, X_{pub}^{\beta}\, h_t^{\delta} H_t^{1-\delta} \tag{20}$$

The mean (μ_{t+1}) and the variance ($\sigma_{t+1}{}^2$), determined by the human capital accumulation equation, are:

$$\mu_{t+1} = \text{Log } A + \alpha \text{ Log } e_t + \beta \text{ Log } X_{pub} + \mu_t + (1 - \delta)\, \sigma_t^2/2 \tag{21}$$

$$\sigma_{t+1}{}^2/2 = \delta^2 \sigma_t^2/2 \tag{22}$$

Proposition 3

*In a public system, the maximum tax rate (τ *) is given by:*

$$\tau^* = \frac{\rho\beta}{(1 - \rho(1 - \beta))}$$

Proof: The tax rate is determined by the derivative of the expression $B\ (\tau)$ according to τ. $B'\ (\tau) = 0$.

The parameters *B*, *D*, and *E* of the logarithmic form of the utility function are:

$$B(\tau) = \frac{1}{(1-\rho)}\left[Log\,(1-\tau) + 2Log\left[\frac{1-\rho\delta}{2-\rho(2\delta-\alpha)}\right]\right] +$$

$$\frac{\rho}{(1-\rho)^2}\left[LogA + \beta Log\left[\frac{\tau(1-\rho\delta)}{2-\rho(2\delta-\alpha)}\right] + \alpha Log\left[\frac{\rho\alpha}{2-\rho(2\delta-\alpha)}\right]\right]$$

$$-\frac{\rho^2}{(1-\rho)^2}\left[\frac{\delta(1-\delta)^2}{1-\rho\delta}\right]\sigma_t^2 / 2$$

$$D = \frac{1}{1-\rho\delta}$$

$$E = \frac{\rho(1-\delta)}{(1-\rho)[1-\rho\delta]}$$

In contrast to the Glomm and Ravikumar's, (1992) result where the tax rate is constant, in this model the tax rate is endogenous and independent of the educational time (α) and the inherited human capital (δ) elasticities which is plausible because the educational quality is a government decision. However, persons are willing to pay higher tax rate when their degree of altruism (ρ) and the performance of educational public spending (β) are relatively important.

2.3 The private system

The financing of this educational system is entirely provided by parents. The individual's maximization programme is given by:

$$Max\ U_t(h_t, \tau = 0, H_t) = Log\, C_t + Log\, z_t + \rho\, U_{t+1}(h_{t+1}, \tau = 0, H_{t+1})$$

$$y_t = l_t\, h_t$$

$$C_t = y_t - q_t$$

$$e_t + z_t + l_t = 1$$

$$h_{t+1} = A\, e_t^{\alpha} q_t^{\beta} h_t^{\delta} H_t^{1-\beta-\delta}$$

The following results:

$$l_t = l = \frac{1\text{-}\rho\delta}{2-\rho(2\delta+\beta\text{-}\alpha)} \tag{23}$$

$$e_t = e = \frac{\rho\alpha}{2-\rho(2\delta+\beta-\alpha)} \tag{24}$$

$$C_t = \left[\frac{1-\rho(\delta+\beta)}{2-\rho(2\delta+\beta-\alpha)}\right] h_t \tag{25}$$

$$q_t = \left[\frac{\rho\beta}{2-\rho(2\delta+\beta-\alpha)}\right] h_t = X_{priv} h_t$$

$$where\ X_{priv} = \left[\frac{\rho\beta}{2-\rho(2\delta+\beta-\alpha)}\right] \tag{26}$$

$$h_{t+1} = A\ e_t^{\alpha}\ X_{priv}^{\beta}\ h_t^{\delta+\beta} H_t^{1\text{-}\beta\text{ - }\delta} \tag{27}$$

The mean (μ_{t+1}) and the variance ($\sigma_{t+1}{}^2$) are given by:

$$\mu_{t+1} = \text{Log } A + \alpha \text{ Log } e_t + \beta \text{ Log } X_{priv} + \mu_t + (1\text{-}\ \beta\text{ - }\delta)\ \sigma_t^2/2 \tag{28}$$

$$\sigma_{t+1}{}^2/2 = (\beta+\delta)^2 \sigma_t^2/2 \tag{29}$$

3. THE EFFECT OF THE DIFFERENT EDUCATIONAL SYSTEMS ON ECONOMIC GROWTH AND SOCIAL INEQUALITY

The different educational systems are compared in terms of economic performance and social gaps through a comparison of economic growth rate and inequality in the cases of individuals' heterogeneity (H ≠ h) and homogeneity (H = h).

Proposition 4

The tax rate envisaged by a mixed educational system is lower than that of a public system.

$\tau_{pub} > \tau_{mix}$

Proof: It is easy to verify that

$$\tau_{pub} = \frac{\rho\beta}{\left(1-\rho\left(1-\beta\right)\right)} > \tau_{mix} = \frac{\rho^2\beta\left(1-\beta-\delta\right)}{\left(1-\rho\delta\right)\left(1-\rho\right)} \text{ with } \frac{\tau_{pub}}{\tau_{mix}} > 1.$$

Proposition 5

In the case where individuals are heterogeneous (H ≠ h)*:*

- *The mixed system leads to a higher growth rate than the private system. It can also be higher than the public system if the returns on educational expenditure (β) and inherited human capital (δ) are significant.*
- *The private system may be preferred to the public system if the returns on educational expenditure (β) and inherited human capital (δ) are high.*

Proof:

We consider the case where the agents are heterogeneous ($H_t \neq h_t$). The economic growth rates (H_{t+1}/H_t) envisaged by three economies that adopt different educational systems are given by:

$$\left(\frac{H_{t+1}}{H_t}\right)^{mix} = exp\left[LogA + \alpha Loge_t + \beta LogX_{mix} - \left(\beta+\delta\right)^{2t+1}\left(1-\beta-\delta\right)\sigma_0^2 / 2\right]$$

$$\left(\frac{H_{t+1}}{H_t}\right)^{pub} = exp\left[LogA + \alpha Loge_t + \beta LogX_{pub} - \left(\delta\right)^{2t+1}\left(1-\delta\right)\sigma_0^2 / 2\right]$$

$$\left(\frac{H_{t+1}}{H_t}\right)^{priv} = exp\left[LogA + \alpha Loge_t + \beta LogX_{priv} - \left(\beta+\delta\right)^{2t+1}\left(1-\beta-\delta\right)\sigma_0^2 / 2\right]$$

The comparison between the different regimes needs to determine the sign of these relations:

$$sign\ of \left(\frac{H_{t+1}}{H_t}\right)^{mix} - \left(\frac{H_{t+1}}{H_t}\right)^{priv} = sign\ of \left[\alpha\ Log\left[\frac{e_{mix}}{e_{priv}}\right] + \beta\ Log\left[\frac{X_{mix}}{X_{priv}}\right]\right] \quad \text{(I)}$$

$$sign\ of \left(\frac{H_{t+1}}{H_t}\right)^{mix} - \left(\frac{H_{t+1}}{H_t}\right)^{pub} =$$
$$sign\ of \left[\alpha\ Log\left[\frac{e_{mix}}{e_{pub}}\right] + \beta\ Log\left[\frac{X_{mix}}{X_{pub}}\right] - \left[\frac{(\beta+\delta)^{2t+1}}{(1-\beta-\delta)-\delta^{2t+1}(1-\delta)}\right]\sigma_0{}^2/2\right] \quad \text{(II)}$$

$$sign\ of \left(\frac{H_{t+1}}{H_t}\right)^{priv} - \left(\frac{H_{t+1}}{H_t}\right)^{pub} =$$
$$sign\ of \left[\alpha\ Log\left[\frac{e_{priv}}{e_{pub}}\right] + \beta\ Log\left[\frac{X_{priv}}{X_{pub}}\right] - \left[\frac{(\beta+\delta)^{2t+1}}{(1-\beta-\delta)-\delta^{2t+1}(1-\delta)}\right]\sigma_0{}^2/2\right] \quad \text{(III)}$$

Equation (I) implies that $\left(\frac{H_{t+1}}{H_t}\right)^{mix} > \left(\frac{H_{t+1}}{H_t}\right)^{priv}$*. This result is verified because* $e_{mix} = e_{priv}$ *and* $X_{mix} > X_{priv}$.

The sign of equation (II) is positive $\left(\frac{H_{t+1}}{H_t}\right)^{mix} > \left(\frac{H_{t+1}}{H_t}\right)^{pub}$ *only if the return on educational expenditure* (β) *and human capital* (δ) *are high ((*$\beta+\delta$*) tends to 1). The sign of this equation is ambiguous when these returns are weak.*

For equation (III), $\left(\frac{H_{t+1}}{H_t}\right)^{pub} < \left(\frac{H_{t+1}}{H_t}\right)^{priv}$ *if the returns on educational expenditure and human capital inherited from parents (*$\beta+\delta$*) are high. It is also verified that* $e_{priv} > e_{pub}$ *and* $X_{priv} > X_{pub}$*. The sign of this equation becomes ambiguous if these returns are weak.*

The result of the extremes systems (public and private) comparison is also largely confirmed by the literature (Glomm and Ravikumar, 1992) where in contrary to the public system, the private system improves the economic performance. This finding is explained by the fact that parents are willing to attribute more time and resources to the education of their children which can increase its quality.

Proposition 6

In developing countries characterized by high levels of social inequality, it is desirable to adopt a mixed education system in order to improve economic growth.

Proof: The proof of Proposition 5 shows that a mixed educational system is more beneficial than the other systems when a high level of social inequality is present. Thus, if initial social inequality and elasticity β and δ are high, the gap between the economic growth rates of the mixed system and the public system is more important.

For developing countries with high social dispersion,[5] the mixed system is more favourable for the accumulation of human capital than the pure public and the pure private systems. In the mixed system the tax effect is less extreme than in the case of the public[6] regime, due to the lower tax rates. At the same time the parents' contribution to educational financing is likely to reduce the budget deficit of the government and improve the quality of education compared to the public system. This mixed educational policy also alleviates segregation within the educational system,[7] unlike private education, which can accentuate it.

Proposition 7

For homogeneous individuals, the public and private systems are never better than the mixed system. The comparison between the extreme systems (public and private) shows that the private educational system is more favourable to human capital accumulation.

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5 Inequality is high in Sub-Saharan Africa (Nigeria 43.3 in 2010) and Latin America (all the countries present a Gini level above 40; for example, Peru is 45 (2010) and Brazil is about 52 (2009)). These inequalities are less intense in East and South East Asia (In 2012 the Gini was 39.4 in Indonesia). North Africa's countries are in an intermediate position between these groups of countries (the Gini in Tunisia equalled 41.4 in 2005). Data Source: United Nations University (UNU-WIDER), World Income Inequality Database 3.3, 2013.

6 The tax rate in the mixed system is less important than in the public system ($\tau_{mix} < \tau_{pub}$).

7 School segregation happens when rich parents decide to enroll their children in private schools of their choice, but parents from poor backgrounds are forced to send their children to public schools.

Proof:

By adopting the hypothesis of the homogeneity of agents ($H_t=h_t$), the economic growth rates are given by:

$$\left(\frac{h_{t+1}}{h_t}\right)^{mix} = Ae_{mix}^{\alpha}X_{mix}^{\beta}$$

$$\left(\frac{h_{t+1}}{h_t}\right)^{priv} = Ae_{priv}^{\alpha}X_{priv}^{\beta}$$

$$\left(\frac{h_{t+1}}{h_t}\right)^{pub} = Ae_{pub}^{\alpha}X_{pub}^{\beta}$$

Given that $e_{mix} = e_{priv} > e_{pub}$ and $X_{mix} > X_{priv} > X_{pub}$, we can verify that the economic growth rate for the mixed system is higher than for the public and private systems.

$$\left(\frac{h_{t+1}}{h_t}\right)^{mix} > \left(\frac{h_{t+1}}{h_t}\right)^{priv} > \left(\frac{h_{t+1}}{h_t}\right)^{pub}.$$

These results, obtained under the assumption of the individual's homogeneity, can be justified by the fact that the realized growth rates are constant and are determined by the quality of education and the time allocated to the accumulation of knowledge. Thus, the more important these investments (financial and time), the higher the economic performance.

Proposition 8 compares these three systems in terms of social inequality.

Proposition 8

In the long term, mixed and private education systems lead to the same levels of social inequality, which depend on the elasticity factors of the human capital accumulation function. In the public educational system, social dispersion decreases over time.

Proof: In the public system and from equation (22):

$\sigma_{t+1}^2/2 = \delta^2\sigma_t^2/2$. It is simple to show that $\sigma_{t+1}^2/2 < \sigma_t^2/2$ because $\delta < 1$.

For the mixed and the private educational systems (Equations (14) and (29)), social inequality arises in the long term, with the same level:

$\sigma_{t+1}^2/2 = (\beta + \delta)^2\ \sigma_t^2/2.$

The evolution of income inequality in the long term depends on the elasticity of the educational quality measured by expenditure (β) and level of human capital inherited from parents (δ):

- If $\beta + \delta = 1$, income inequality is constant in the long-term ($\sigma_{t+1}^2 = \sigma_t^2$).
- If $\beta + \delta < 1$, income inequality is absorbed, but at a slower pace than in the case of a public system.
- If $\beta + \delta > 1$, social dispersion increases over time.

This proposition proves that the social disparity decreases over time for the public system (Glomm and Ravikumar, 1992 and Sylwester, 2002) and only if the educational expenditure performance and the inherited human capital present decreasing returns for the mixed and the private system. This result can be attributed to the differences of educational quality between systems which can be a cause of income inequality (Jallade, 1978 and Souza, 1994). The benefit of the public education investment on income equality is explained by the fact that governments try to assure the same quality of education to all the children without any discrimination which contributes to reduce the income gap between the different social classes.

4. CONCLUSION

This paper presents a model with overlapping generations where the accumulation of human capital is the only source of economic growth. Thus, all policies that target educational financing lead to a higher level of human capital, and hence improve economic growth. This paper joins the literature that compares educational systems in terms of their impact on economic performance and social inequality (Glomm and Ravikumar (1992); Basdevant and Wigniolle (1993); Zhang (1996), Cardak (1999)). However, this paper extends this literature by considering mixed education financing in addition to the 'extreme' educational systems of the pure public and the pure private regimes. This mixed system reflects the reality of many developed and developing countries, where educational expenses are usually provided in part by the government and in part by parents.

The comparison of these three educational systems reveals that the tax rate obtained by a majority vote in an economy with mixed educational financing is lower than the tax rate in a system with publicly financed education. In the case of heterogeneous individuals, the mixed system ensures a higher level of economic growth than the private system. However, the educational choice between public and private systems depends on the initial level of social inequality and on the performance of the financial investment in education and the human capital of the parents. A comparison of the growth rates of these three economies shows that the mixed system is preferable for a developing country characterized by strong social dispersion. Nevertheless, on the assumption that all individuals are identical, the mixed system ensures the best economic performance.

The evolution of social dispersion shows that the public system provides the lowest level and this inequality tends to dissipate in the long term. However, economies with mixed public and private education funding realize a similar pattern of inequality. The income gap created by these two education systems is particularly important when the returns to human capital inherited from parents and education expenditure are high. This result is obvious, since children from families whose parents are educated are more likely to attend school and to accumulate knowledge quickly. This can lead to a widening of the income gap between rich and poor in the society. Similarly, the effectiveness of education spending can influence social inequality. Thus, in an economy where parents choose the same system, the educational level varies little between different individuals and therefore social dispersion will be less strong. Alternatively, in an economy where school segregation is important, those who have a better education will have higher income levels than those who receive a worse education.

REFERENCES

Basdevant, O. & B. Wigniolle (1993). Education publique ou privée, inégalité sociale et croissance économique : un modèle de reference. Mimeo MAD Université de Paris I.

Benabou, R. (1995). Unequal Societies. NBER N°5583.

Benabou, R. (1996). Heterogeneity, Stratification and Growth: Macroeconomic Implications of Community Structure and School Finance. *American Economic Review*, 86, 3, p.584-609.

Blankenau, W.F. & N.B. Simpson (2004). Public Education Expenditures and Growth. *Journal of Development Economics*, 73, p. 583-605.

Cardak, B.A. (1999). Heterogeneous Preferences, Education Expenditures and Income Distribution. *Economic Record*, 75, 228, p. 63-76.

Cardak, B.A. (2004). Education Choice, Neoclassical Growth and Class Structure. *Oxford Economic Papers*, 56, p. 643-666.

Cardak, B.A. (2005). Education Vouchers, Growth and Income Inequality. *Macroeconomic Dynamics*, 9, p. 98-121.

Educational Expenditures Statistics Eurostat 2016: http://ec.europa.eu/eurostat/statistics-explained/index.php/Educational_expenditure_statistics

Glomm, G. & B. Ravikumar (1992). Public Versus Private Investment in Human Capital: Endogenous Growth and Income Inequality. *Journal of Political Economy*, 100, 4, p. 818-834.

Glomm, G. & B. Ravikumar (1998). Opting out of publicly provided services: a majority voting result. *Social Choice and Welfare*, 15, p. 187-199.

Glomm, G. & B. Ravikumar (2001). Human Capital Accumulation and Endogenous Public Expenditures. *Canadian Journal of Economics*, 34, 3, p. 807-826.

Gradstein, M. & M. Justman (1997). Democratic Choice of an Education System: Implications for Growth and Income Distribution. *Journal of Economic Growth*, 2, 2, p. 83-169.

Jallade. J. P. (1978). Financing Higher Education: The Equity Aspects. Comparative Education Review, June, p.209-325.

Kaganovich, M. & I. Zilcha (1999). Education, Social Security and Growth. *Journal of Public Economics*, 71, p. 289-309.

Souza, A. M. (1994). Educational policies: efficiency and equity issues. Revista Brasileira de Economia, 48, 4, p. 411-420.

Sylwester. K. (2002). Can Education Expenditures Reduce Income Inequality. *Economics of Education Review*, 21, p. 43-52.

Zhang, J. (1996). Optimal Public Investments in Education and Endogenous Growth. *Scandinavian Journal of Economics*, 98, 3, p. 387-404.

United Nations University (UNU-WIDER) World Income Inequality Database 2.0, June 2005.

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