

ECONOMIC ANNALS, Volume LVIII, No. 197 / April – June 2013
UDC: 3.33 ISSN: 0013-3264

DOI:10.2298/EKA1397007Z

*Alleiddine AYED ZAMBAA**
*Lobna BEN HASSEN***

EDUCATION FINANCING AND GROWTH USING AN OVERLAPPING GENERATIONS MODEL: A THEORETICAL PERSPECTIVE

.....

ABSTRACT: *This paper proposes an overlapping generations model along the lines of the papers by Glomm and Ravikumar (1997). Its aim is to provide a theoretical extension in which we establish, in an original framework, a comparison of public and private educational financing systems in terms of economic growth. The*

results provide a critique of the literature that suggests that private expenditure will inevitably lead to greater economic growth than a policy of public education.

KEY WORDS: *Educational finance, economic growth, overlapping generations*

JEL CLASSIFICATION: I22, O47

* Faculty of Economics and Management of Sfax, Tunisia; E-mail: az_alleiddine@yahoo.fr

** Faculty of Economics and Management of Sfax, Tunisia

1. INTRODUCTION

Faced with the inability of government to overcome certain economic problems, a wave of economists called for total withdrawal of the government and the need to adopt privatization policies. These allow the economy to function better, resulting in higher economic growth. However, an OECD study (2002) showed that the massive application of privatization in European countries led to a decline in growth from 2.4% in 1990 to 1.8% in 2002. The question that has to be asked is where we should stop the privatization process. In other words, do we have to substitute a private effort for the public effort and thus neglect the role of the state in all sectors?

In this paper we focus on the education sector, the financing of which has been the subject of a polemical debate. Faced with the advantages of privatization, a set of economists supplied various economic models to try to confirm that private education is better than public education in terms of economic growth; for example, Cox and Jimenez (1990) and Epple and Romano (1997). However, the different analytical frameworks considered retain extremely diagrammatic representations of the economy (Glomm and Ravikumar (1992)), which leads us to question the established results concerning the superiority of the private system in the field of education. This review does not aim to reject the policy of private education but underlines that productive and quality public spending can doubtless improve the economic growth, especially as in some economic sectors such as education and health, total disengagement of the state can only widen social gaps, with a potential negative impact on economic growth.

Like Glomm and Ravikumar (1992), in this paper we focus on the comparison between the two policies of public and private education in terms of growth. We retain a frame analysis similar to the paper by Glomm and Ravikumar (1997). However, Glomm and Ravikumar (1997) ignored the role of private education expenditure on economic growth. For this reason, we assume that parents agree to pay for their children to be educated in private schools and establish a trade balance between consumption and expenditure on the education of their children in the first period of life on the one hand, and consumption in the second period of life on the other. We show that, contrary to Glomm and

Ravikumar (1992), a policy of public education is more favourable to economic growth than a policy of privatization.

Our paper is organized as follows. First, we provide a summary of the literature related to the issue of education policies and their effects on growth. Next, we present our model. The last section presents our contribution to the comparison of the two educational regimes in term of economic growth.

2. THE PUBLIC / PRIVATE DEBATE

A vast literature has focused on the importance of human capital investment in stimulating economic growth. Indeed, education is an essential element of economic and social development, establishing a means of directly increasing the welfare of the population and promoting economic growth in the long-term (Lucas 1988). This subject is accompanied by a set of works that try to determine how various policies affect human capital investment and therefore growth. Thus, many contributions have moved forward the debate on the socio economic consequences of public versus private education policies.

Using World Bank data, Jimenez et al (1991) analyzed whether the privatization of the education system in Tanzania and Thailand caused more economic growth over time compared to the public education system. Furthermore, Khan and Kumar (1997) showed that the effects on economic growth of private and public education financing were significantly different in a sample of 95 developing countries over the period 1970-1990. They found that private financing of education is consistently more productive than public financing of education.

In the context of the overlapping generations models, almost all studies conclude that the private system is more efficient than the public system in terms of economic growth. For example, Glomm and Ravikumar (1992) consider an overlapping generations model in which the accumulation of human capital depends on the length of training as well as education spending. They consider two systems of education. The first is purely private in which the education expenditure is individually assured by the parents. The second is

public, where the government finances education through a tax rate resulting from a majority voting system carried out by parents. They show that the first system leads to a significant accumulation of human capital and a higher economic growth rate than the second. Similarly, Bénabou (1996) exploits an overlapping generations model in his work. He shows that private financing of education results in more economic growth through the generations than the public financing of education.

The aim of this paper is to propose a comparison of the two policies of private and public education in terms of economic growth. This problem is borrowed from Glomm and Ravikumar (1992) who concluded in favour of a private education system. Our contribution consists in adopting a different frame work, similar to that of Glomm and Ravikumar (1997), to establish completely different results. We adopt the overlapping generations model as an instrument of economic analysis. This type of modeling taking into account inter and intra generational interactions, is an interesting way to study the questions of human capital accumulation. It can also deal with macroeconomic issues without neglecting the microeconomic foundation.

3. THE MODEL

3.1. Characteristic of the population

Following the example of Glomm and Ravikumar (1997), we consider an overlapping generations economy where individuals live through two periods. Each period is normalized in one. In every period a fixed continuum of agent is born. The size of the population is constant and it is normalized in one. In the first period of life, the agents dedicate their time to work and receive in return a wage proportional to their human capital endowment. In the second period, individuals retire and their consumption is ensured by their savings from the previous period.

3.2. Production

The production is assured by means of the human capital (h_t) and physical capital (k_t) according on the technology production of Cobb-Douglas following:

$$Y_t = Ak_t^\alpha (h_t)^{1-\alpha} \quad (1)$$

A is a parameter of productivity

α is the elasticity of physical capital

$1 - \alpha$ is the elasticity of human capital.

Moreover, the accumulation of physical capital is described by the following dynamic equation: $k_{t+1} = I_t + (1 - \delta_k)k_t$, with δ_k a the rate of capital depreciation. As in the model of Glomm and Ravikumar, we suppose that the depreciation of the physical capital is total, returning us to the following equality: $k_{t+1} = I_t$

3.3. Policy of public education

Following the example of Glomm and Ravikumar (1997), we suppose that the decisions of every agent consist in establishing the optimal division between the consumption of the first period and the consumption of the second period of life. That's why, the function of intertemporal utility of the representative agent is of log linear type and it is given by the following expression:

$$U(c_t, c_{t+1}) = Inc_t + \beta Inc_{t+1} \quad (2)$$

$0 < \beta < 1$ indicates the preference for this agent

c_t is the level of consumption in the first period of life

c_{t+1} is the level of consumption in the second period of life

The government takes a tax τ to finance public expenditure on education. Thus, the two budget constraints of the agents are written as follows:

$$c_t + s_t = (1 - \tau)w_t h_t \quad (3)$$

$$c_{t+1} = (1 + (1 - \tau)r_{t+1})s_t \quad (4)$$

w_t is the wage per unit of effective labor.

s_t is the level of savings.

The accumulation of human capital depends primarily on two factors. The first factor is the cultural heritage that allows everyone to benefit from the human capital of its ascendancy. The second factor represents the public spending in education. Thus, the human capital accumulation is represented as follows:

$$h_t = H(h_{t-1}, E_{t-1}) = B h_{t-1}^\mu E_{t-1}^{1-\mu} \quad (5)$$

B is a technological or productivity parameter .

h_{t-1} corresponds to the cultural heritage.

E_{t-1} represent the public spending on education.

μ corresponds to the elasticity of the cultural heritage.

The balance of the state budget implies equality between revenue collection and provided education expenditure. Hence, the following equation:

$$\tau(w_t h_t + r_t k_t) = E_t$$

The objective of the individual is to maximize its intertemporal utility and to choose the equilibrium distribution of net income between the savings that serve for consumption during retirement and consumer spending in the first period. The resolution of the programme of the representative agent allows us then to write the expression of the savings as follows:

$$s_t = \frac{\beta(1 - \tau)w_t h_t}{(1 + \beta)} \quad (6)$$

We denote γ_{public} the growth rate of capital $\frac{k_{t+1}}{k_t}$

Proposition 1: Growth factor converges to a constant. We show that this constant is given by:

$$\gamma_{public} = \frac{\beta(1-\alpha)A(1-\tau)}{1+\beta} \times \left(\frac{B\tau^{1-\mu}(1+\beta)}{\beta(1-\tau)(1-\alpha)A^\mu} \right)^{\frac{1-\alpha}{1-\alpha\mu}} \quad (7)$$

The proof is presented in the appendix.

Therefore, public expenditure on education have has positive effects in the short- and long- term. Under the overlapping generations model, this means that public expenditure on education has resulted in psitive intra effects among individuals born in the same period. In addition, public spending on education accounted for favorable long-term effects, which means that there is an intergenerational effect. Indeed, public expenditure on education plays the role of a positive externality in the economy over time and thus stimulates economic growth.

Proposition 2: The maximum growth rate is reached when the tax rate is equal to the elasticity of human capital relative to production that is to say that $\tau = 1 - \alpha$.

The proof is presented in the appendix.

3.4. Private education policy

In this section, we deal with private education policy, according to which parents, motivated by altruism, undertake to finance the learning of their descendants. So, the decisions of every individual consist in establishing a balance between his/her consumption in the first period and the spending on his/her children's education on the one hand, and consumption in the second period of life on the other. Therefore, the intertemporal utility function of the representative individual is:

$$U = Inc_t + \beta Inc_{t+1} + Ine_{t+1} \quad (8)$$

where e_t represents private spending on education made by parents for their children.

In this new context, budget constraints come down to the following two equations:

$$c_t + s_t + e_t = w_t h_t \quad (9)$$

$$c_{t+1} = (1 + r_{t+1})s_t \quad (10)$$

Thus, the optimization programme of the agent and the new first order conditions allow us to achieve the following equilibrium equations:

$$e_t = \frac{1}{2 + \beta} w_t h_t$$

$$c_t = \frac{1}{2 + \beta} w_t h_t$$

$$s_t = \frac{\beta}{2 + \beta} w_t h_t$$

Finally, the human capital accumulation is performed as follows:

$$h_t = H(h_{t-1}, e_{t-1}) = B h_{t-1}^\mu e_{t-1}^{1-\mu} \quad (11)$$

We follow the same approach as in the previous section and we determine that the expression of the growth rate from the report $\frac{k_{t+1}}{k_t}$ is to be noted $\gamma_{private}$.

Proposition 3: A Growth rate converges towards a constant. After taking everything into account, we show that:

$$\gamma_{private} = \frac{\beta(1-\alpha)A}{(2+\beta)} \times \left(\frac{B(2+\beta)^\mu}{\beta A^\mu (1-\alpha)^\mu} \right)^{\frac{1-\alpha}{1-\alpha\mu}} \quad (12)$$

The proof is presented in the appendix.

4. COMPARISON OF TWO EDUCATIONAL POLICIES

We distinguish two economies which start with the same economic characteristics. The first is characterized by a system of public education. The government is responsible for collecting taxes from households to fund the education system. The second is characterized by a withdrawal of government, and therefore by a system of private education. It is assumed that the production technology of education is equivalent from one system to another. The issue here is to compare the two education policies in terms of economic growth. For this, we establish a comparison between the two growth rates presented by equations (7) and (12). We then calculate the ratio $\frac{\gamma_{public}}{\gamma_{private}}$

Proposition 4:

For α, β and μ (between 0 and 1) given, the economy described above with a public education policy results in more economic growth than that with a private education policy.

The proof is presented in the appendix.

So, public spending plays the role of a positive externality in the economy and contributes to economic growth. The intervention of the government through public spending on education reduces the cost of training opportunities, makes education more attractive, and results in a greater incentive for education. In addition, it helps to promote capital accumulation, so that economic is higher in the long run. Therefore, our contribution provides a critique of previous results in the literature that consider private spending to have a greater effect on economic growth than government spending.

5. CONCLUSIONS

We propose an overlapping generations model with both human capital and physical capital. The accumulation of human capital is a function of cultural heritage as well as expenses incurred by the State or by parents for education. The accumulation of human capital is a function of cultural heritage as well as educational spending by the government or parents. If spending on education is provided by parents (supposed to be altruistic), then the system of education is private. Otherwise, the government agrees to fund education and it is question of public policy.

Almost all theoretical models existing in the literature attempt to show that private education policies are more favourable to economic growth than public education policies.

However, this paper reaches a different result, based on the work of Glomm and Ravikumar (1997) but maintaining a generational approach to compare the two regimes of private and public education in terms of growth. We show that public spending can have the largest macroeconomic consequences at intergenerational and intragenerational levels. The result is mainly due to the choice of an imposition rate corresponding to the elasticity of human capital. Therefore, the choice of tax rates promotes the efficiency of the public educational system and leads to better growth. Thus, our contribution leads to a result different from the work of Glomm and Ravikumar (1992) and Bénabou (1996), in which the public financing of education generates more economic growth than private financing.

APPENDIX

Proof of proposition 1

$$\gamma^{public} = \frac{k_{t+1}}{k_t} = \frac{\beta(1-\tau)(1-\alpha)Ak_t^\alpha h_t^{1-\alpha}}{1+\beta} = \frac{\beta(1-\tau)(1-\alpha)Ak_t^{\alpha-1}h_t^{1-\alpha}}{1+\beta}$$

$$\gamma_{public} = \frac{\beta(1-\alpha)A}{1+\beta}(1-\tau)\left(\frac{h_t}{k_t}\right)^{1-\alpha}$$

$$\frac{h_{t+1}}{k_{t+1}} = \frac{Bh_t^\mu(\tau Ak_t^\alpha h_t^{1-\alpha})^{1-\mu}}{\beta(1-\tau)(1-\alpha)Ak_t^\alpha h_t^{1-\alpha}} = \frac{Bh_t^\mu \tau^{1-\mu}(1+\beta)(Ak_t^\alpha h_t^{1-\alpha})^{-\mu}}{\beta(1-\tau)(1-\alpha)}$$

$$\frac{h_{t+1}}{k_{t+1}} = \frac{B\tau^{1-\mu}(1+\beta)}{\beta(1-\tau)(1-\alpha)A^\mu} \left(\frac{h_t}{k_t}\right)^{\alpha\mu}$$

When this ratio converges to a steady state so we obtain:

$$\frac{h}{k} = \frac{B\tau^{1-\mu}(1+\beta)}{\beta(1-\tau)(1-\alpha)A^\mu} \left(\frac{h}{k}\right)^{\alpha\mu}$$

$$\left(\frac{h}{k}\right)^{1-\alpha\mu} = \frac{B\tau^{1-\mu}(1+\beta)}{\beta(1-\tau)(1-\alpha)A^\mu}$$

$$\frac{h}{k} = \left(\frac{B\tau^{1-\mu}(1+\beta)}{\beta(1-\tau)(1-\alpha)A^\mu}\right)^{\frac{1}{1-\alpha\mu}}$$

Substituting the expression of this equation into the equation of the growth rate leads us to write the growth rate as follows:

$$\gamma_{public} = \frac{\beta(1-\alpha)A(1-\tau)}{1+\beta} \times \left(\frac{B\tau^{1-\mu}(1+\beta)}{\beta(1-\tau)(1-\alpha)A^\mu}\right)^{\frac{1-\alpha}{1-\alpha\mu}}$$

Proof of proposition 2

$$\gamma_{public} = \frac{\beta(1-\alpha)A(1-\tau)}{1+\beta} \times \left(\frac{B\tau^{1-\mu}(1+\beta)}{\beta(1-\tau)(1-\alpha)A^\mu}\right)^{\frac{1-\alpha}{1-\alpha\mu}}$$

$$\ln \gamma = \ln \frac{\beta(1-\alpha)A}{1+\beta} + \ln(1-\tau) + (1-\alpha) \ln \left(\frac{B\tau^{1-\mu}(1+\beta)}{\beta(1-\tau)(1-\alpha)A^\mu} \right)^{\frac{1}{1-\alpha\mu}}$$

$$\ln \gamma = \ln \frac{\beta(1-\alpha)A}{1+\beta} + \ln(1-\tau) + (1-\alpha) \left[\frac{1}{1-\alpha\mu} \ln \frac{B(1+\beta)}{\beta(1-\alpha)A^\mu} + \frac{1-\mu}{1-\alpha\mu} \ln \tau + \frac{1}{1-\alpha\mu} \ln \frac{1}{1-\tau} \right]$$

$$\ln \gamma = \ln \frac{\beta(1-\alpha)A}{1+\beta} + \frac{\alpha-\alpha\mu}{1-\alpha\mu} \ln(1-\tau) + (1-\alpha) \left[\frac{1}{1-\alpha\mu} \ln \frac{B(1+\beta)}{\beta(1-\alpha)A^\mu} + \frac{1-\mu}{1-\alpha\mu} \ln \tau \right]$$

$$\begin{aligned} \frac{d \ln \gamma}{d \tau} &= -\frac{1}{1-\tau} \frac{\alpha-\alpha\mu}{1-\alpha\mu} + \frac{(1-\alpha)(1-\mu)}{\tau(1-\alpha\mu)} = 0 \\ &= \frac{(-\alpha+\alpha\mu)\tau + (1-\alpha)(1-\mu)(1-\tau)}{\tau(1-\tau)(1-\alpha\mu)} = 0 \end{aligned}$$

So that when this report is cancelled it is necessary that $(-\alpha+\alpha\mu)\tau + (1-\alpha)(1-\mu)(1-\tau) = 0$

$$\tau(\alpha-\alpha\mu) = (1-\alpha)(1-\tau)(1-\mu)$$

$$\tau\alpha(1-\mu) = (1-\alpha)(1-\tau)(1-\mu)$$

$$\tau\alpha = (1-\alpha)(1-\tau)$$

$$\tau\alpha - 1 + \tau + \alpha - \tau\alpha = 0$$

Hence $\tau = 1 - \alpha$

Proof of proposition 3

$$\gamma_{private} = \frac{k_{t+1}}{k_t} = \frac{\frac{\beta(1-\alpha)Ak_t^\alpha h_t^{1-\alpha}}{2+\beta}}{k_t} = \frac{\beta(1-\alpha)A}{2+\beta} \left(\frac{h_t}{k_t} \right)^{1-\alpha}$$

$$\frac{h_{t+1}}{k_{t+1}} = \frac{Bh_t^\mu \left(\frac{w_t h_t}{2+\beta} \right)^{1-\mu}}{\frac{\beta(1-\alpha)Ak_t^\alpha h_t^{1-\alpha}}{2+\beta}} = \frac{Bh_t^\mu ((1-\alpha)Ak_t^\alpha h_t^{1-\alpha})^{1-\mu}}{(2+\beta)^{1-\mu}} \times \frac{2+\beta}{\beta(1-\alpha)Ak_t^\alpha h_t^{1-\alpha}}$$

$$\frac{h_{t+1}}{K_{t+1}} = \frac{(2 + \beta)^\mu B}{\beta A^\mu (1 - \alpha)^\mu} \left(\frac{h_t}{k_t}\right)^{\alpha\mu}$$

When this ratio converges to a steady or stationary state, we obtain the following expression:

$$\frac{h}{k} = \frac{(2 + \beta)^\mu B}{\beta A^\mu (1 - \alpha)^\mu} \left(\frac{h}{k}\right)^{\alpha\mu}$$

$$\left(\frac{h}{k}\right)^{1-\alpha\mu} = \frac{(2 + \beta)^\mu B}{\beta A^\mu (1 - \alpha)^\mu}$$

$$\frac{h}{k} = \left(\frac{(2 + \beta)^\mu B}{\beta A^\mu (1 - \alpha)^\mu}\right)^{\frac{1}{1-\alpha\mu}}$$

Therefore

$$\gamma_{private} = \frac{\beta(1 - \alpha)A}{(2 + \beta)} \times \left(\frac{B(2 + \beta)^\mu}{\beta A^\mu (1 - \alpha)^\mu}\right)^{\frac{1}{1-\alpha\mu}})^{1-\alpha} = \frac{\beta(1 - \alpha)A}{(2 + \beta)} \times \left(\frac{B(2 + \beta)^\mu}{\beta A^\mu (1 - \alpha)^\mu}\right)^{\frac{1-\alpha}{1-\alpha\mu}}$$

Proof of proposition 4

$$\begin{aligned} \frac{\gamma_{public}}{\gamma_{private}} &= \frac{\frac{\beta(1 - \alpha)A(1 - \tau)}{1 + \beta}}{\frac{\beta(1 - \alpha)A}{2 + \beta}} \times \frac{\left(\frac{B\tau^{1-\mu}(1 + \beta)}{\beta(1 - \tau)(1 - \alpha)A^\mu}\right)^{\frac{1-\alpha}{1-\alpha\mu}}}{\left(\frac{B(2 + \beta)^\mu}{\beta A^\mu (1 - \alpha)^\mu}\right)^{\frac{1-\alpha}{1-\alpha\mu}}} \\ &= \frac{(1 - \tau)(2 + \beta)}{(1 + \beta)} \times \left(\frac{\tau^{1-\mu}(1 + \beta)(1 - \alpha)^\mu}{(1 - \tau)(1 - \alpha)(2 + \beta)^\mu}\right)^{\frac{1-\alpha}{1-\alpha\mu}} \end{aligned}$$

We replace the tax rate τ by $1 - \alpha$ in this report and we obtain:

$$\begin{aligned}
 \frac{\gamma_{public}}{\gamma_{private}} &= \frac{\alpha(2 + \beta)}{(1 + \beta)} \times \left(\frac{(1 - \alpha)(1 + \beta)}{\alpha(1 - \alpha)(2 + \beta)^\mu} \right)^{\frac{1 - \alpha}{1 - \alpha\mu}} \\
 &= \frac{\alpha(2 + \beta)}{(1 + \beta)} \times \left(\frac{(1 + \beta)}{\alpha(2 + \beta)^\mu} \right)^{\frac{1 - \alpha}{1 - \alpha\mu}} \\
 &= \frac{\alpha(2 + \beta)}{(1 + \beta)} \times \frac{(1 + \beta)^{\frac{1 - \alpha}{1 - \alpha\mu}}}{\alpha^{\frac{1 - \alpha}{1 - \alpha\mu}} (2 + \beta)^{\frac{\mu - \alpha\mu}{1 - \alpha\mu}}} \\
 &= \frac{\alpha(2 + \beta)(1 + \beta)^{\frac{1 - \alpha}{1 - \alpha\mu}}}{(1 + \beta)\alpha^{\frac{1 - \alpha}{1 - \alpha\mu}} (2 + \beta)^{\frac{\mu - \alpha\mu}{1 - \alpha\mu}}} \\
 &= \frac{\alpha^{\frac{\alpha - \alpha\mu}{1 - \alpha\mu}} (2 + \beta)^{\frac{1 - \mu}{1 - \alpha\mu}}}{(1 + \beta)^{\frac{\alpha - \alpha\mu}{1 - \alpha\mu}}}
 \end{aligned}$$

Whatever the parameters α , β and μ which are included between 0 and 1, we always have the term $\alpha^{\frac{\alpha - \alpha\mu}{1 - \alpha\mu}} (2 + \beta)^{\frac{1 - \mu}{1 - \alpha\mu}}$ upper in $(1 + \beta)^{\frac{\alpha - \alpha\mu}{1 - \alpha\mu}}$

REFERENCES

- • • • •
- Bénabou, R. (1996) “Heterogeneity, Stratification, and Growth: Macroeconomic Implications of Community Structure and School Finance” *American Economic Review* 86 (3).
- Cox, D., and Jimenez, E. (1990) “The relative effectiveness of private and public schools” *Journal of Development Economics* 34, 99-121.
- Epple, D., and Romano, E. (1998) “Competition Between Private and Public Schools, Vouchers, and Peer-Group Effects” *American Economic Review* 88 (1), 33-62.
- Glomm, G., and Ravikumar, B. (1992) “Public versus Private Investment in Human Capital Endogenous Growth and Income Inequality” *Journal of Political Economy* 100, 818-834
- Glomm, G., and Ravikumar, B. (1997) “Productive government expenditures and long-run Growth” *Journal of Economic Dynamics and Control* 21, 183-204.
- Glomm, G. (1997) “Parental choice of human capital investment” *Journal of Development Economics* 53, 99-114.
- Jimenez E., Lockheed M. and Paqueo V. (1991) “The relative efficiency of private and public schools in developing countries” *The World Bank Research Observer* 6, 205-218.
- Khan M. and Kumar M. (1997) “Public and Private Investment and the Growth Process in Developing Countries” *Oxford Bulletin of Economics and Statistics* (50), 69- 88.
- Lucas, R. (1988) “On the mechanics of economic development” *Journal of Monetary Economics* 22, 3-42.

Received: October 18, 2013

Accepted: June 17, 2013