JOURNAL OF PUBLIC ECONOMIC THEORY
Department of Economics 415 Calhoun Hall Vanderbilt University Nashville, TN 37235 USA (615) 343-8495 (fax)

Submission Number: PED11-11-00037

Public Expenditures, Growth and Distribution in a Mixed Regime of Education with a Status Motive

Frederic Tournemaine
UTCC

Christopher Tsoukis
Department of Economics, London Metropolitan University

Abstract

This paper tackles the issue of growth, distribution and the provision of public services in a growth model with human capital accumulation where heterogeneous individuals decide whether to attend a publicly funded education regime or a privately funded one. Heterogeneity of individuals is introduced via their status-motivation which is shown to affect their choice of education. In such a framework, we obtain an inverted-U shaped relationship between growth and the size of the public education sector. In contrast with the general wisdom, we show that a larger public education sector is compatible with both a reduction of inequalities and an increase of long-term growth. Although we demonstrate that in a majoritarian system every individuals agree on a lower size of the public education regime than that which maximises growth, our analysis also highlights the tension between the direct beneficiaries and non-beneficiaries from the public regime.

We would like to thank Nattavudh Powdthavee and the seminar at the Brunel Macroeconomic Research Centre (BMRC) and Quantitative and Qualitative Analysis in Social Sciences (QASS) Annual Conference 2010, primarily Sugata Ghosh, for their useful comments and suggestions.
Submitted: March 28, 2011.

Public Expenditures, Growth and Distribution in a Mixed Regime of Education with a Status Motive*

Frederic Tournemaine†
School of Economics
University of the Thai Chamber of Commerce

Christopher Tsoukis‡
Department of Economics, London Metropolitan University

March 28, 2011

Abstract

This paper tackles the issue of growth, distribution and the provision of public services in a growth model with human capital accumulation where heterogeneous individuals decide whether to attend a publicly funded education regime or a privately funded one. Heterogeneity of individuals is introduced via their status-motivation which is shown to affect their choice of education. In such a framework, we obtain an inverted-U shaped relationship between growth and the size of the public education sector. In contrast with the general wisdom, we show that a larger public education sector is compatible with both a reduction of inequalities and an increase of long-term growth. Although we demonstrate that in a majoritarian system every individuals agree on a lower size of the public education regime than that which maximises growth, our analysis also highlights the tension between the direct beneficiaries and non-beneficiaries from the public regime.

JEL Classification: E10, O41, Z13.

Keywords: status, educational choice, growth, distribution.

---

*We would like to thank Nattavudh Powdthavee and the seminar at the Brunel Macroeconomic Research Centre (BMRC) and Quantitative and Qualitative Analysis in Social Sciences (QASS) Annual Conference 2010, primarily Sugata Ghosh, for their useful comments and suggestions.

†Address: 126/1 Vibhavadee-Rangsit Road, Dindaeng, Bangkok, 10400, Thailand. Fax: +66 (0)2692 3168; E-mail: frederic.tournemaine@uc-utcc.org

‡Address: Dept. of Economics, London Metropolitan University, 84 Moorgate, London EC2M 6SQ, UK. E-mail: c.tsoukis@londonmet.ac.uk

1 Introduction

Following the work of Lucas (1988), the growth literature concentrated on the connection between human capital and economic growth to establish that education, as a prime component of human capital,[1] is a strong candidate to explain long term growth and economic development. Empirical evidence on this mechanism has been presented by a number of authors such as Barro (1991), Mankiw, Romer and Weil (1992). Beside, the notion that education can reduce inequalities, and that the government can play a crucial role in this respect, has been established at length several decades ago by Schultz (1961, 1963, 1964). By providing free access to public education, the government allows the poorest, who would not have the necessary resources to invest in education otherwise, to acquire knowledge and skills. Several authors such as Glomm and Ravikumar (1992), Saint-Paul and Verdier (1993), Zhang (1996) and Sylwester (2002) analyzed the relationship between inequality and education and validated this claim from a theoretical and empirical point of view. Intuitively, as education is uniformly provided, it smooths inequalities, and thus is egalitarian. The primary concern of these papers, however, is the analysis of the effect of different education alternatives such as public versus private education on subsequent inequality. Moreover, although the choice of educational system is endogenous and made via a majority voting system, the fact remains that only one system of education prevails in equilibrium.

In this paper, our objective is to investigate the relation between government expenditures in education, growth and distribution. Our point of departure is similar to Chen (2005) who argues that the structure of the educational system is an important determinant of growth and inequality. Our basic premise is that the same applies to the effects of government spending, i.e. those effects would be different under, say, systems of pure public good provision, pure private provision, or a mixed economy. Our contribution is two-fold: Firstly, we advance the above literature by introducing a mixed regime of education whereby publicly-provided education coexists with private education, and individuals make a choice between them. Secondly, and in contrast with Chen (2005) who focuses on the influence of financial development on economic growth, we stress the role of social interactions to explain the structure of the educational system and analyse how the size of the public education sector affects growth, inequality and their relation. This is indeed a relevant issue as it has been recognised for some time that, in addition to individual consumption postulated by standard theory, an agent's utility function may also depend on the individual's position in the distribution. Such a dependence, which is empirically sup-

[1] Health can be considered as another component of human capital which participates to economic growth (see, e.g., Grossman, 1972; van Zon and Muysken, 2001).

ported (see, e.g., Clark and Oswald, 1996; McBride, 2001; Choudhary *et al.*, 2007; Maurer and Meier, 2008), is often thought to be captured by the individual's relative consumption, and has been variously termed "keeping up with the Joneses" or "status-seeking" (see, e.g., Abel, 1990; Corneo and Jeanne, 1997; Ljungqvist and Uhlig, 2000; Tournemaine and Tsoukis, 2008). It is by now widely thought that such motives may have important effects related to both growth and distribution (see, e.g., Futagami and Shibata, 1998; Corneo and Jeanne, 1999; Pham, 2005; Tournemaine and Tsoukis, 2010). We argue that there is an important interplay between the choice of education regime and the structure of social interactions, which we term "the status motive", and this effect epitomises our contribution.

The notion that "status" considerations affect the level of education of individuals has been investigated in the literature by Fershtman, Murphy and Weiss (1996) and Tournemaine and Tsoukis (2009). In the first paper, the authors analyse the consequences of social esteem being related to human capital. The idea is that education is a means for people to choose between a wider range of jobs and to reach a social position in society. In the latter paper, the authors build on this idea to analyse the effects of "status jobs" (measured by relative human capital) on growth and distribution. In these papers, however, the idea of a choice between private and public education and its consequences on growth and distribution is overlooked. Moreover, in the present article, we highlight the role of status-seeking not only as a source of externalities, but in addition as a source of heterogeneity across individuals. This corresponds to the every day notion that individuals can be more or less "driven", i.e. respond differently to the need to catch up or even forge ahead of others. Like Pham (2005), we capture this effect via an idiosyncratic parameter measuring the taste of individuals for social status. As is well known, the preferences of individuals for social status induce a greater work effort, whereby each individual's greater hours of work and consumption advancement lead to a loss of status – drop in utility – to others who in turn respond in a similar manner. Ceteris paribus, introducing heterogeneity in "status seeking" allows us to generate income inequalities across individuals which, in turn, has implications regarding their choice of educational regime, long-term growth and distribution.

Our main results can be summarized as follows. In contrast with Chen (2005) who finds a monotonic relationship between growth and the size of the public education system, we obtain an inverted-U relationship. Thus, in contrast with Glomm and Ravikumar (1992), Saint-Paul and Verdier (1993), Zhang (1996), we show that a higher level of growth and lower inequalities can be mutually compatible when the government promote public education.[2] The rationale behind our result is similar to that in Barro (1990): Due to productive

[2] De la Croix and Doepke (2004) also show that higher expenditures in public education promotes

public services, higher government spending benefits growth when the economy is starved of such services; gradually, however, as diminishing returns set in, the tax-related disincentives from such policies begin to dominate. In our model, more particularly, we consider the educational spillover, namely that a larger public sector boosts growth, as individuals benefiting from a better public education are more productive; on the other hand, a larger public education sector slows growth as it is achieved at the cost of less resources allocated to private education.[3] Considering a model with heterogeneous individuals, however, allows us to depart significantly from a Barro-type analysis: we can indeed raise political economy issues which is another contribution of this paper.

Our framework can be related to the large literature initiated by Alesina and Rodrik (1994) which focuses on the distributive conflict between individuals and the resulting relationship between growth and inequalities. Among the recent contributions, we can cite Kempf and Rossignol (2005, 2007) who have extended the basic AK model of endogenous growth developed by Alesina and Rodrik (1994) to address issues such as: the decision of people to vote in favour or against the integration of their country in a union; or to study the trade-off between growth and environment protection.[4] While Alesina and Rodrik (1994) point out the potential conflicts on the size of the public sector between capitalists and workers who benefit from public expenditures, in our framework the conflicts arise between the beneficiaries and non-beneficiaries from public education. Those who benefit from the public education system prefer a larger public sector (i.e. more tax), while those who attend the private education system prefer a lower size. The noteworthy somewhat interesting result, though, is that the rich individuals who attend the private education system agree to support public education (i.e. they choose a strictly positive size of the public education system) even if they do not use it. The reason is that they benefit indirectly form the knowledge accumulated in this regime via a spillover effect. Moreover, in light of the results we derive, we can argue that there is no trade-off between growth and equity. In a majority voting system whereby individuals vote for the size of the public education system, we show that all individuals agree on a tax level which is lower than the one which maximises growth. Ceteris paribus, in this scenario, any change in the size of the public sector would lead to an increase of the level of long-term growth and a reduction

growth. In their framework, this outcome arises when inequality is high, and is due to a reduction in fertility differentials not formlised in this paper.

[3]See also Blankenau and Simpson (2004) who obtain an inverted-U shaped relationship between the amount of government expenditure in public education and growth. In their model, however, they do not distinguish between public and private education systems: they specify a single technology of human capital accumulation which depends on private and public investments.

[4]See also the influential work of Alesina and Tabellini (1990) on the choice of individuals in respect to the government's profile of public spendings.

of inequalities. The intuition is that a larger public education sector is synonymous of a higher level of tax, i.e. it induces short-run welfare losses as it takes resources away which could alternatively be used for consumption. Thus, all individuals prefer less tax and implicitly choose a lower long-run level of growth and lower equality than those which are possible to achieve.

The remainder of the paper is structured as follows. We introduce the model in Section 2. In Section 3, we derive the equilibrium conditions for a given individual opting for public or private education and analyse the properties of a mixed regime of education in respect to growth, distribution and the size of the public education regime. We conclude in Section 4.

2 Model

We consider a closed economy in continuous time populated by a mass $[0, 1]$ of infinitely-lived individuals.[5] Time, denoted by t goes from zero to infinity. For simplicity, we assume that there are two groups of identical individuals denoted by k, $k = 1, 2$. Group 1 has a size p and group 2 has a size $1 - p$. Each individual is initially endowed with T units of labour-time and $H_{0k} > 0$ units of human capital. Each individual engages in the production of an output, Y_{kt}, that can be consumed, C_{kt}, or allocated to fund schooling activities in order to acquire new units of human capital, H_{kt}.

There are two types of education: a public (publicly funded) one, and a private (privately funded) one. Everybody pays an income tax at rate $\tau > 0$ which is used to fund public education. For simplicity we assume that the budget constraint of the government is balanced at each moment. That is, the amount spent in public education matches exactly the amount of funds collected at each moment (see below). All individuals can benefit from the public educational system. Individuals, however, who attend the private educational system must pay additional educational expenses in the form of a fraction of their income: $\varepsilon_{kt} > 0$. It is worthwhile to mention that ε_{kt} is a parameter of choice for individuals who are in private education, and who still pay the tax rate τ. Obviously, $\varepsilon_{kt} = 0$ for individuals who are in public education. Thereby, the level of human capital of people depends on their choice of education (private or public).

In what follows, we borrow the technology of public education set by Glomm and Ravikumar (1992). We implicitly assume that the level of human capital of individuals who opt for the publicly funded educational system evolves across time but is common across all participants in that system: $H_{kt} = H_t^{pub}$ for any individual in public education.

[5] Because of the unit mass assumption, throughought the paper, average and aggregate quantities coincide.

In contrast, for individuals who are in the private educational system, the level of human capital is determined by the level of expenditures, $\varepsilon_{kt}Y_{kt}$. As we will see, the human capital obtained in private education is in general larger than that obtained under public education ($H_{kt}^{pri} > H_t^{pub}$). This is an intuitive outcome: if this was not the case, individuals would never make additional expenditures on education (in addition to the tax that they pay regardless). Therefore, each individual has to solve two optimisation problems: maximising lifetime utility under each system (public/private), and choosing the one that gives them highest utility.

To conduct the analysis, we assume that output is produced with a linear technology: $Y_{kt} = AL_{kt}H_{kt}$, where $A > 0$ is a productivity parameter and L_{kt} is the labour-time an individual allocates to the production of output. The budget constraint of individual k is given by

$$C_{kt} = (1 - \varepsilon_{kt} - \tau)AL_{kt}H_{kt}, \tag{1}$$

where $\varepsilon_{kt} = 0$ if $H_{kt} = H_t^{pub}$ and $\varepsilon_{kt} > 0$ if $H_{kt} = H_{kt}^{pri}$.

The individual technology of human capital in the public sector is given by

$$\overset{\bullet}{H}{}_t^{pub} = \phi\tau\overline{Y_t}, \tag{2}$$

where $\phi > 0$ is a productivity parameter and $\overline{Y_t}$ is the average level output output in the economy. For technical simplicity, as in Abel (2005), we apply a standard geometric sum aggregation rule. We assume: $\overline{Y_t} = (Y_{1t})^p (Y_{2t})^{1-p}$.

The law of motion of individual human capital in the private education sector is given by:

$$\overset{\bullet}{H}{}_{kt}^{pri} = \phi\left(\varepsilon_{kt}Y_{kt}\right)^{1-\varphi}\left(\overline{H_t}\right)^{\varphi}, \tag{3}$$

where $0 < \varphi < 1$ is the weight of existing human capital, $\overline{H_t} = (H_{1t})^p (H_{2t})^{1-p}$, relative to material resources (degree of spillover effect).

Comments are in order here. First of all, recall that the government levies an amount τY_t from individuals which is entirely used at each instant to fund public education, where Y_t represents the aggregate level of income. In the technology (2), we consider that individual human capital produced in the public education regime accumulates depending on the percentage of average income levied on individuals, $\tau\overline{Y_t}$, rather than its level, τY_t. This specification allows us to account implicitly for a spillover effect of human capital which acts through average output, $\overline{Y_t}$, and to avoid the (potential) problems of scale effects: this is the average amount of knowledge which creates the externality, $\overline{H_t}$, not the aggregate amount, H_t.

Introducing spillover effects in the form of an average human capital as implicitly specified in (2) (and explicitly in (3)), is common in the growth literature. Beside the technical argument given above, another reason to introduce such spillover effects is that they are shown to be crucial for human capital convergence (Tamura, 1991; de la Croix and Doepke, 2004) and have empirical support (Alonso-Carrera, 2001). Observe that it would be possible to specify a more general technology of education in the public sector, such as: $\overset{\bullet}{H}{}_t^{pub} = \phi\left(\tau\overline{Y_t}\right)^{1-\varphi}\left(\overline{H_t}\right)^{\varphi}$. Though this formalisation appears as the counterpart of (3) as individuals get a kind of share of total output (this share being determined by the level of the tax rate, τ), it would complicate the analysis without modifying our main results. Intuitively, as output is linear with respect to human capital ($Y_{kt} = AL_{kt}H_{kt}$), at the aggregate level, $\overline{Y_t}$ necessarily depends linearly on average education $\overline{H_t}$. Thus, technology (2) is used for tractability and must be taken as a short-cut.[6]

Finally, note that there is no labour in the production function of either type of education. The existence of teachers is only implicitly assumed, but they are not explicitly modelled. Educational improvement depends on two factors: (i) the fraction of material resources devoted to education and (ii) the average educational level of teachers in the form of an external spillover effect, $\overline{H_t}$. The resources devoted to education are the factor that distinguishes public education from the private one. In public education, these are given by the tax rate, τ, whereas in private education, this is given by individual expenditure ε_{kt} times the income of individual k.

Preferences of any individual k are represented by,

$$U_{kt} = \int_0^{\infty} \left[\log\left(C_{kt}\right) + \delta_k \log\left(C_{kt}/\overline{C_t}\right) + \eta\left(T - L_{kt}\right)\right] e^{-\rho t} dt, \tag{4}$$

where $\rho > 0$ is the rate of time preferences, $\eta > 0$ denotes the constant-marginal disutility of work and $\delta_k \log\left(C_{kt}/\overline{C_t}\right)$ represents the preference of an individual regarding social status, where the average $\overline{C_t} = \left(C_{1t}\right)^p \left(C_{2t}\right)^{1-p}$ is taken as given (see below for more details).[7] A notable feature in (4) is that the "status function" is specific to the individual k, i.e. the functional form of the status function (not only the argument inside) differs between individuals. In that sense, δ_k captures the idea that some individuals are more motivated for status, or antagonistic, or rivalrous, others less so. Throughout the paper, we assume that $\delta_1 < \delta_2$ so that individuals of group 2 are more motivated than individuals of group 1. Before proceeding to the characterisation of the equilibrium, let us mention that in this simple model with two kinds of individuals, the motivation ratio, δ_1/δ_2, is an indicator of heterogeneity: a higher value of δ_1, for instance, means a lower heterogeneity in motivation, while a higher value of δ_2 means a greater heterogeneity.

[6] A formal proof that such a change would not affect the main results is given in the appendix.

[7] Tsoukis (2007) discusses the possibilities for modelling the status function, but here the "multiplicative" formulation (individual as a ratio over average consumption) is assumed for tractability.

3 Equilibrium

In this section, we solve two optimisation problems, for the typical individual in public education and private education, respectively. Then, we determine which type of educational regime each individual chooses. To avoid complexity, we focus on the steady-state outcome and relegate the analysis of the transitional dynamics in the appendix. The analysis of the transitional dynamics shows that the equilibrium is a saddle point which is stable around the steady-state.

To proceed, we assume that agents build status-seeking in consumption, as analysed, into their optimality conditions, taking the averages as given. In doing so, they are also assumed to be able to accurately forecast the relevant aggregate statistics (mean consumption) one instant ahead.[8] The outcome of this process is a Nash equilibrium, whereby agents respond optimally to aggregate outcomes and, in so doing, reproduce them (or the distributions from which aggregate statistics are drawn). The assumption of an (infinitesimal) lag between the time on which information is based and the realisation of outcomes allows us to avoid explicit game-theoretic considerations (that is, following Pollack, 1976, p. 310; and the "catching up" model of Abel, 1990).

3.1 Public education

If an individual participates in public education, she gets the standard education output: H_t^{pub}. Thus, the problem of such individual reduces to the choice of consumption, C_{kt}, and labour-time devoted to output production, L_{kt}, that maximise (4) subject to the budget constraint given by (1) where $\varepsilon_{kt} = 0$. After some manipulation, we obtain:[9]

$$\eta = \frac{1 + \delta_k}{L_k}, \tag{5}$$

Equation (5) says that the marginal benefit of an additional unit of labour allocated to the production of good equals its marginal cost in utility terms. The marginal benefit comprises two components: the direct benefit from an additional unit of consumption plus the indirect gain due to the improvement in social status, δ_k. Note from equation (5) that the quantity of labour-time spent in the production of output is constant. Moreover, since the degree of status-seeking, δ_k, induces a greater work effort, it becomes synonymous to motivation.

[8] This is the assumption of "rational myopic foresight", which is a standard hypothesis in macroeconomics, see, e.g., Turnovsky, (1996, Ch. 3) for more discussion.

[9] Throughout the paper, we use the usual convention of dropping the index of time for constant variables in steady-state.

For future reference, we compute the growth rate of human capital attainable in public education. From equation (2), we obtain:

$$g^{pub} = \phi A\tau \left(L_{1t}\right)^{p} \left(L_{2t}\right)^{1-p} \frac{\overline{H_t}}{H_t^{pub}}. \tag{6}$$

3.2 Private education

Individuals who are in the private education regime choose consumption, C_{kt}, labour-time spent in output production, L_{kt}, but also the share of income to devote to education, ε_{kt}, and the path for human capital, H_{kt}. The current value Hamiltonian of this problem is: $CVH_{kt} = \log[(C_{kt})\left(C_{kt}/\overline{C_t}\right)^{\delta_k}] + \eta(T - L_{kt}) + \mu_{kt}\phi(\varepsilon_{kt}AL_{kt}H_{kt})^{1-\varphi}\left(\overline{H_t}\right)^{\varphi}$, where μ_{kt} is the co-state variable associated to the law of motion of human capital (3) and $C_{kt} = (1 - \varepsilon_{kt} - \tau)AL_{kt}H_{kt}$ (see (1)). The first order conditions are $\partial CVH_{kt}/\partial L_{kt} = 1/L_{kt} - \eta + \mu_{kt}(1-\varphi)\dot{H}_{kt}^{pri}/L_{kt} = 0$, $\partial CVH_{kt}/\partial\varepsilon_{kt} = -(1+\delta_2)/(1-\varepsilon_{kt}-\tau) + \mu_{kt}(1-\varphi)\dot{H}_{kt}^{pri}/\varepsilon_{kt} = 0$, $\partial CVH_{kt}/\partial H_{kt} = (1+\delta_2)/H_{kt} + \mu_{kt}(1-\varphi)\dot{H}_{kt}^{pri}/H_{kt} = -\dot{\mu}_{kt} + \rho\mu_{kt}$. The transversality condition is: $\lim_{t\to\infty}\mu_{kt}H_{kt}e^{-\rho t} = 0$.

Under the assumption that the economy is in steady-state, simple manipulations of the first order conditions yield:

$$\frac{1+\delta_k}{L_k}\frac{1-\tau}{1-\tau-\varepsilon_k} = \eta, \tag{7}$$

$$\frac{1-\tau-\varepsilon_k}{\varepsilon_k} = \frac{1}{G_k}, \tag{8}$$

where

$$G_k \equiv \frac{(1-\varphi)g_k^{pri}}{\varphi g_k^{pri} + \rho}, \tag{9}$$

and, from equation (3), the growth rate of human capital of individual k in private education is:

$$g_k^{pri} = \phi\left(\varepsilon_k AL_k\right)^{1-\varphi}\left(\frac{\overline{H_t}}{H_{kt}}\right)^{\varphi}. \tag{10}$$

In analogy with the problem under public education, equation (7) states that the marginal benefit of an additional unit of labour allocated to the production of the consumption good equals its marginal cost in utility terms on the right hand side. We note that (7) coincides with (5) for $\varepsilon_k = 0$. The main difference between the two problems comes from an additional equilibrium condition under private education (equation (8)) and the level of the growth rate (equation (10)). The reason is that in the problem under public education individuals take the path of education as given. In contrast, under the private educational system individuals take an active part in the formation of their own level of education. Such a choice is summarised by equation (8) which is the outcome between the Euler condition determining the path of accumulation of human capital and the choice of investments in private education, $\varepsilon_k > 0$.

We gain more insight if we express the labour supply as:

$$L_k = \frac{1+\delta_k}{\eta} \frac{1-\tau}{1-\tau-\varepsilon_k}. \tag{11}$$

Comparison between (5) and (11), with $\varepsilon_k > 0$, readily reveals that for a given level of ambition δ_k, an individual attending the private regime of education allocates a greater amount of hours to output production than if she opts for the public regime. It is the effect of switching educational regime (a kind of structural break) evident by the non-negative education expenditure: individuals attending the private regime of education compensate the additional expenditures on education (in addition to the tax that they pay regardless) through additional hours worked to raise their income level.

3.3 Choice of education regime

Having set out the optimisation of each type of individual conditional on the choice of the education regime, we now determine what type of education an individual chooses in the first place. To do so, we compare the level of utility attained under the two regimes for a "marginal" or "cutoff" individual, i.e. one who would be indifferent between public and private education. This will allow us to determine a threshold level of ambition, $\widetilde{\delta}$. Then, comparing the actual level of ambition of an individual k, given by δ_k, $k = 1, 2$, to $\widetilde{\delta}$, we will be able to determine which type of education an individual chooses in the first place. To proceed, we assume that the choice of education regime is made once and for all at the beginning of the planning horizon ($t = 0$) for all individuals; this presupposes perfect foresight, an assumption in line with the deterministic nature of our model.

Under the assumption that the economy is in steady-state, a noteworthy feature is that the level of the growth rates must be common across individuals: we have $g^{pri} = g^{pub} = g$ for all individuals (we recall that the transitional dynamics is relegated in the appendix). This outcome results from the presence of the human capital spillover, $\overline{H_t}$, in the technology of production of human capital (2) and (3): This implies that, as the level of human capital in private education forges ahead of the average, it acts to slow down its growth rate. As said before, this is likely to bring a convergence of human capital to common growth rates, as found in the literature (see Section 2). It thus results that the expenditure ratio is the same across individuals who opt for private education. Using (8) and (9) we have:

$$\varepsilon = \frac{(1-\tau)G}{(1+G)}, \tag{12}$$

where $G = (1-\varphi)g/(\varphi g + \rho)$ (see equation (9)). A noteworthy feature here is that the expenditure ratio, ε, is the same across individuals. Obviously, this result is due to the fact that in the steady state, the growth rates are identical across individuals as discussed above.

We now characterise the level of ambition of the marginal individual, i.e. the one who is indifferent between public and private education. Let us denote by $\widetilde{\delta}$ the level of ambition of that individual. Using the utility function (4), $\widetilde{\delta}$ verifies:

$$\int_0^\infty \left[\left(1+\widetilde{\delta}\right) \log\left(\frac{\widetilde{C}_t^{pri}}{\widetilde{C}_t^{pub}}\right) - \eta\left(\widetilde{L}^{pri} - \widetilde{L}^{pub}\right)\right] e^{-\rho t} dt = 0, \tag{13}$$

where $\widetilde{L}^{pri}$ and $\widetilde{L}^{pub}$ denote the labour supply of the marginal individual in each regime of education, and symmetrically $\widetilde{C}_t^{pri}$ and $\widetilde{C}_t^{pub}$ denote her level of consumption. Equation (13) is derived from the utility function (4) applied to the cases of the marginal individual following private and public education. It shows the surplus utility from private over public education, and equates to zero for the marginal individual who has a level of motivation $\widetilde{\delta}$.[10] Had equation (13) been greater (resp. lower) than zero, the utility from private (resp. public) education would be greater. In other words, equation (13) defines the threshold status-seeking, or rivalry, level $\widetilde{\delta}$ of the agent who is exactly indifferent between the two regimes. Note that equation (13) captures the two effects of the long run: consumption considerations favour private education because the labour supply and human capital are higher in that regime; but leisure considerations in utility favour public education because under that regime the individual works less.

As shown in the appendix, the model-economy described in Section 2 admits the existence of a unique (saddle) steady-state in which individuals face a common rate of growth g and choose in an endogenous manner the kind of educational regime to attend. The choice of education regime depends on the individuals' level of motivation, δ_k, $k = 1, 2$, relative to the level of motivation $\widetilde{\delta}$. As our model-economy comprises two types of individuals, the following Proposition applies:

Proposition 1: On the individuals' choice of education regime:

There exists a unique level of ambition, $\widetilde{\delta}$, so that the individual with ambition $\widetilde{\delta}$ is exactly indifferent between public and private education. Thus, under the assumption $\delta_1 < \delta_2$, we have:

(a) If $\delta_1 < \delta_2 < \widetilde{\delta}$, every individual opts for the public education regime;

(b) If $\widetilde{\delta} < \delta_1 < \delta_2$, every individual opts for the private education regime;

(c) If $\delta_1 < \widetilde{\delta} < \delta_2$, individuals of group 1 opt for public education while individuals of group 2 opt for private education.

[10] The value of $\widetilde{\delta}$ verifying equation (13) is computed in the appendix.

Proof: *See Appendix.*

Proposition 1 establishes which type of individual chooses (in an endogenous manner) which type of education to attend. Note that cases (a) and (b) represent corner solutions whereby every individuals opt for the same educational regime. Intuitively, a high income tax rate reduces the available income of individuals so that none of them is willing (or is sufficiently motivated) to pay for the additional expenses required to attend the private education regime. If the tax rate is low, in contrast, every individual (including the less ambitious) opts for the private regime as the amount of resources allocated by the government to public education is too low. Thus, the structure of the model allows for an extensive analysis of growth and distribution under a variety of regimes: purely public (case a), purely private (case b), and mixed (case c). In this paper, we focus on the mixed regime of education (c) as it seems to have been overlooked in the main literature but also because this is the most interesting case. The results we obtain in a pure public regime (a) and in a pure private regime (b) as well as their comparison are relegated to the appendix.

3.4 Growth and distribution in the mixed regime of education

3.4.1 Steady-State

The aim of this sub-section is to establish the steady-state outcome of the model in a mixed regime of education. Let us assume that $\delta_1 < \widetilde{\delta} < \delta_2$. As shown in the appendix, we can manipulate equations (1), (2), (3), (5), (7), (9), (12) to obtain the results depicted in Proposition 2 where the symbol "$*$" is used to denote any steady-state value.

Proposition 2: On the steady-state in the mixed regime of education:

The mixed regime of education is characterized by constant amounts of labour allocated to output production:

$$L_1^* = \frac{1+\delta_1}{\eta}, \tag{14}$$

$$L_2^* = \frac{1+\delta_2}{\eta}\left[\frac{\rho+g^*}{\varphi g^*+\rho}\right]. \tag{15}$$

From (12) and (9), the expenditure ratio in private education is:

$$\varepsilon^* = \frac{(1-\tau)(1-\varphi)g^*}{g^*+\rho}. \tag{16}$$

The common rate of growth, g^*, is the solution of:

$$\frac{g^{1+\frac{(1-p)}{p}}\left(\varphi g+\rho\right)^{(1-p)\frac{p\varphi+1-\varphi}{p\varphi}}}{\left(\rho+g\right)^{(1-p)}} \tag{17}$$

$$= \phi^{1+\frac{(1-p)}{p\varphi}}\left(\frac{A}{\eta}\right)^{1+\frac{(1-p)(1-\varphi)}{p\varphi}}\left(1+\delta_1\right)^p\left(1+\delta_2\right)^{(1-p)\left(1+\frac{(1-\varphi)}{p\varphi}\right)}\tau\left[(1-\tau)(1-\varphi)\right]^{\frac{(1-p)(1-\varphi)}{p\varphi}}.$$

The relative amount of human capital, $\widehat{H}^* \equiv (H_{1t}/H_{2t})^*$, *and after-tax income (or consumption),* $\widehat{C}^* \equiv (C_{1t}/C_{2t})^*$, *are given by:*

$$\widehat{H}^* = \left[\frac{\phi A\left(1+\delta_1\right)^p\left(1+\delta_2\right)^{(1-p)}}{\eta}\right]^{\frac{1}{1-p}}\left(\frac{\tau}{g^*}\right)^{\frac{1}{1-p}}\frac{\rho+g^*}{\varphi g^*+\rho}<1, \tag{18}$$

$$\widehat{C}^* = \frac{1+\delta_1}{1+\delta_2}\widehat{H}^*<1, \tag{19}$$

Proof: *See Appendix.*

Direct inspection of Proposition 2 allows us to establish the main properties of the model in a mixed regime of education in respect to growth and distribution. We note from equations (14) and (15) that labour supply of individuals attending private education is higher than that of those attending public education for two reasons: not only, there is a kind of structural break due to the change in educational regime which leads individuals to allocate more resources to output production as mentioned above, but also those in private education are the more motivated: $\delta_2 > \delta_1$. Thereby, status-seeking is an adequate source of heterogeneity: even if the only source of heterogeneity is the idiosyncratic pursuit of status, this is enough to generate real heterogeneity among individuals, with different labour supplies, and different choices of education. This result is important as status-seeking and keeping up with the Joneses has often been employed in the literature under the assumption of symmetry. Thus, agents are assumed to wish to be in the lead, even though they know (or ought to know) that this cannot be possible; i.e., they have a kind of "status illusion". Here, the very status-seeking motive also generates the asymmetry that gives scope to status-seeking. Equations (18), (19) reveal indeed that individuals 1 who are less motivated end up with a lower level of human capital, $\widehat{H}^* < 1$ and after-tax income (or consumption), $\widehat{C}^* < 1$. For the latter, status-related motivation matters in a dual way, both because of the differences in work effort (the first ratio), but also because of differences in acquired human capital (second ratio).[11]

[11] In a pure private regime, the same kind of result would apply: $\widehat{H}^* < 1$, $\widehat{C}^* < 1$. In a pure public regime, however, we would obtain $\widehat{H}^* = 1$, but as before we would obtain $\widehat{C}^* < 1$ due to a lower labour supply in output production from individuals 1 (see, e.g., the appendix).

Although some may argue that the main reason for educational inequality is that poorer people are credit constrained, and thus cannot afford to invest in education (see, e.g., Chen, 2005), our results parallel those of Cameron and Heckman (2001). While we highlight the role of motivation captured by the idiosyncratic parameter measuring the taste of individuals for social status (δ_k, $k = 1, 2$), Cameron and Heckman (2001) suggest that individuals' ability seems to play a crucial role in this respect. The reason is that individuals' ability has a direct positive effect on educational attainment. Thereby, it can explain why lump-sum transfers to poor families do not always lead to a reduction in inequalities.

3.4.2 The growth-inequality relationship

In this sub-section, we spell out the implications of the model for growth and discuss the relationship between growth and distribution. It is interesting to mention that in an "AK" model of growth, where productive public services complement private capital in production, Barro (1990) highlighted the fundamental tension between the productive role of government services that is beneficial for growth and the distortionary role of the resulting taxation that is detrimental to growth.[12] In our framework, this tension is reinforced because the government sector supports public education, which contributes to growth because of educational spillovers, but also provides a drag to growth as it takes resources away from individuals who will not use public education. To see this, from equation (17), we can compute:

$$\frac{dg^*}{d\tau} = \left[\frac{1}{\tau} - \frac{(1-p)(1-\varphi)}{p\varphi(1-\tau)}\right] \left\{ \left[\frac{1}{(1-p)} + \frac{1}{p}\right] \frac{(\rho+g)}{g} + \frac{(p\varphi + 1 - \varphi)(\rho+g)}{p(\varphi g + \rho)} \right\}^{-1}. \quad (20)$$

The first term in brackets on the right hand side of (20), $1/\tau$, represents the positive effect of public education, which contributes to growth via the spillover effect; the second term in brackets on the right hand side, $(1-p)(1-\varphi)/[p\varphi(1-\tau)]$, is the resource-withdrawal effect that the tax exerts on private education, which is detrimental for growth. As in Barro (1990), at a low enough tax rate, a marginal increase in that rate (and in the size of government) increases the growth rate because of the strong effect this exerts on a resource-starved public education system. Because of diminishing marginal returns, this effect dominates the detrimental resource-withdrawal effect. At high tax rates, however, the balance of effects is reversed. Hence, there is an inverted U-shaped relationship between growth and the size of the public educational sector. Formally, maximum growth is attained

[12] See Futagami, Morita and Shibata, (1993), Ghosh and Mourmouras (2004), Tsoukis and Miller (2003) for further references on this issue; see also Blankenau and Simpson (2004) who use a model with human capital accumulation as mentioned in the introduction.

if:

$$\tau^{\max} = \frac{p\varphi}{(1-p)(1-\varphi) + p\varphi}. \tag{21}$$

Thus, we can state:

Proposition 3: On the relationship between the size of the public education sector and growth in a mixed regime of education:

If $\tau < \tau^{\max}$, a larger public education sector increases growth, whereas if $\tau > \tau^{\max}$, it decreases growth.

The growth-maximising tax rate reflects two factors. On the one hand, it reflects the contribution of public services to the production of private education through the spillover effect, φ. As a result, the tax-maximising growth rate is increasing with φ ($d\tau^{\max}/d\varphi > 0$): larger spillovers from public education are indeed synonymous with a greater contribution of public education to the determination of the long-run level of growth. Moreover, it reflects the relative size of its sector, so that the "technical spillover" is also weighted by the size of the group in public education, p. Ceteris paribus, the greater is the number of people attending public education the higher the growth-maximising tax rate should be: $d\tau^{\max}/dp > 0$. Thus, our analysis adds to the analysis of growth-maximising flat income-tax rate, that has focused so far on the technical contribution of public services, the size of the sector that utilises such services.

Our analysis also highlights the tension between the direct beneficiaries and non-beneficiaries from such services, absent in an explicit way from the original AK framework of Barro (1990) and that of Blankenau and Simpson (2004). This raises political economy issues, absent in earlier analyses, which are analysed in the next Section. Before turning to this issue, it is interesting to analyse the effects of a change in the tax rate on inequality. From equations (18) and (19), noting that $1-(\tau/g^*)dg^*/d\tau > 0$ (see (20)) and given that $0 < 1 - g^*(1-p)(1-\varphi)\rho/\{(\rho+g^*)(\varphi g^* + \rho)\} < 1$ is always satisfied, we obtain

$$\frac{d\widehat{H}^*}{d\tau} = \frac{\widehat{H}^*}{(1-p)\,\tau}\left\{1 - \frac{\tau}{g}\frac{dg^*}{d\tau}\left[1 - \frac{g^*(1-p)(1-\varphi)\,\rho}{(\rho+g^*)(\varphi g^* + \rho)}\right]\right\} > 0, \tag{22}$$

$$\frac{d\widehat{C}^*}{d\tau} = \left(\frac{1+\delta_1}{1+\delta_2}\right)\frac{d\widehat{H}^*}{d\tau} > 0. \tag{23}$$

Equations (22) and (23) reveal that, in a mixed regime of education, inequalities in the level of education and consumption decrease as the size of the public education sector increases if it is sufficiently small ($\tau < \tau^{\max}$).[13] Thus, we can state:

[13] From a general perspective, one should mention that at the empirical level, the issue of whether inequality and growth are positively or negatively correlated remains open. Persson and Tabellini (1994)

Proposition 4: On the relationship between the size of the public education system, growth and inequality in the mixed regime:

Since a larger public education regime always reduces inequalities, higher growth and more equity are compatible as long as $\tau < \tau^{\max}$.

It is interesting to relate this result to actual data. First of all, we can refer to the concluding remarks of Saint-Paul and Verdier (1993) who note that western countries have enjoyed sustained growth associated with an evening of inequalities in the last two centuries. Taking France as an example, they explain that the promotion of public education contributed to such a trend. In the same vain, the World Bank (1993) and Vandycke (2001) report more recent evidence from Asian countries[14] in which government played an active role in the process of human capital accumulation. They argue that in promoting public education and in guaranteeing public education for all, the governments of these countries contributed to the rise in skills of their populations, leading in turn to the high levels of growth observed during the period 1965-1990 and a reduction in inequalities. More recently, Blankenau et al. (2007) validated this outcome using panel data from 23 developed countries over the period 1960-2000.[15]

The fact remains however that we can observe large disparities across countries in respect to the amount of resources spent in education. From the data of OECD (2008), we can obtain Table 1 which shows the relative proportions of public and private expenditure on education in some OECD countries, as well as the total expenditure on education as a percentage of GDP.

Table 1 Here

From Table 1, OECD countries spend in average 5.8 percent of their GDP in education, with 84.7 percent coming from public sources and the remaining share coming from private sources. Some countries have public education shares well above ninety percent, sometimes very close to hundred percent such as Norway, Finland, Italy, France. In contrast, a number of countries put a larger responsibility on the private education system like in Japan, South

present cross-country evidence of a negative effect of inequality on growth. In contrast, using a panel of U.S. states, Partridge (1997) concludes that greater inequality is associated with greater growth. Other studies, finally, conclude that changes in income and changes in inequality are unrelated (Deninger and Squire, 1996; Chen and Ravallion, 1997). At a theoretical level, we can refer to Aghion, Caroli and Garcia Penalosa (1999) who present a review of a variety of theoretical arguments on this issue.

[14] Japan, Hong Kong, Korea, Singapore, Taiwan, China, Indonesia, Malaysia, Thailand.

[15] Argentina, Australia, Austria, Belgium, Canada, Denmark, Finland, France, Greece, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, United Kingdom and United States.

Korea, United-Kingdom, United-states and Canada among others. These large differences raise implicitly the issue concerning the choice of the government size, i.e. the actual choice of the tax rate, τ. This task is carried out next.

3.4.3 Equilibrium in a majority voting system: choice of public education size

In this sub-section, we seek to determine the choice of tax rate by the median voter, that is the amount of resources to be devoted to public education in a democratic system. In line with Alesina and Rodrik (1994), such analysis will allow us to highlight the conflict between those in public education who are likely to wish to have a higher tax rate to support it, and those in private education, who are likely to prefer less rather than more tax.

To tackle this issue, we assume the existence of a majority voting system which allows the government to determine the level of the income tax-rate, τ. To conduct the analysis, we assume that the economy has reached the steady-state. In this case, we compute the long-run level of utility of individuals, i.e. when the labour supply of individuals 2 is constant and the growth rate of consumption equals the growth rate of human capital and the economy-wide growth rate, g^*. From (4) we obtain:

$$U_{k0} = -\delta_k \log\left(\overline{C_0}\right)/\rho + (1+\delta_k)\log\left(C_{k0}\right)/\rho + \eta\left(T - L_k^*\right)/\rho + g^*/\rho^2, \tag{24}$$

where we recall that $\overline{C_0} = (C_{10})^p\,(C_{20})^{1-p}$, $C_{10} = (1-\tau)AL_1^*H_{10}$, $C_{20} = (1-\varepsilon^*-\tau)AL_2^*H_{20}$ and the labour supplies are given by equations (14) and (15). Note that the first, second and third term on the right hand side of (24) represent the instantaneous or short-run welfare of an individual (i.e. at $t = 0$) while the last term g^*/ρ^2 represents her long-term welfare, as captured by the growth rate deflated by the squared discount rate, g^*/ρ^2.

Let us denote by τ_k, $k = 1, 2$, the level of the income tax rate chosen by a median voter belonging to group k. Under the assumption that the parameters of the model verify $\rho^2(1+\delta_2)(1-\varphi)/(\varphi g^* + \rho)^2 < 1$, (which is verified if δ_2 is small enough), the following applies:

Proposition 5: On the level of the tax rate in different policy regimes:

The median voter, and the democratic system in general, set a tax rate which is less than the growth-maximising one, $\tau^{\max}$. Formally, let τ_k be the tax rate preferred by the median voter if that voter belonged to group k; then, we have:

$$\tau_2 < \tau_1 < \tau^{\max}, \tag{25}$$

where

$$\tau_1 = \frac{\tau^{\max}}{\frac{\rho(1+\delta_1)(1-p)}{p\varphi+(1-p)(1-\varphi)}\left\{\left[1+\frac{\varphi p}{(1-p)}\right]\frac{1}{g^*}+\frac{(1-\varphi)\varphi}{(\varphi g^*+\rho)}\right\}+1},$$

$$\tau_2 = \frac{\tau^{\max}}{\frac{\rho(1+\delta_2)(1-p)\left\{\left[1+\frac{\varphi p}{(1-p)}\right]\frac{1}{g^*}+\frac{(1-\varphi)\varphi}{(\varphi g^*+\rho)}\right\}}{\left\{\left[1-\frac{(1+\delta_2)(1-\varphi)\rho^2}{(\varphi g^*+\rho)^2}\right][p\varphi+(1-\varphi)(1-p)]\right\}}+1}.$$

Proof: *Simple algebra applied to equation (24) in which we set* $k = 1$ *and* $k = 2$*, allows us to obtain* τ_1 *and* τ_2*, respectively. Simple comparisons of the level of the different tax rate allows us to show that* $\tau_2 < \tau_1 < \tau^{\max}$*. It should be mentioned that in the derivation of the level of the tax rates, we assume that the average level of consumption,* $\overline{C_0}$*, is taken as given.*

Proposition 5 has several implications. Interestingly, it states that individuals prefer a lower level of growth and a less equal society than those which are potentially possible to achieve (under $\tau = \tau^{\max}$). This result contrasts with the one obtained by Alesina and Rodrik (1994). They find that in general the median voter chooses a tax rate which is higher than the growth maximizing tax rate.

In fact there is one similarity and one difference between our result and that of Alesina and Rodrik (1994). The similarity is that in both frameworks, in choosing the tax rate level (τ_k, $k = 1, 2$), individuals balance the short run welfare losses (or gains) in current consumption from a larger public sector and the long-run gains (losses) resulting from a higher (lower) level of growth. By construction, the growth maximising tax rate accounts only for the long-run welfare effects of a larger public sector. In the framework of Alesina and Rodrik (1994), the marginal benefit of a greater amount of public good (i.e. a greater tax rate) increases as the median voter becomes poorer, inducing individuals to choose a lower growth and a more equal society. In our model, in contrast, the mechanism which is working is different. A greater size of the government is synonymous of a short run welfare loss in that individuals must sacrifice current consumption to fund the public education sector. This means that individuals still prefer a lower level of growth, but now they also implicitly prefer and choose more inequality.

As τ_1 is chosen by those who use the public education system and τ_2 is chosen by those who attend the private education system, it results that $\tau_2 < \tau_1 < \tau^{\max}$. The important feature is that, as we are likely to observe $\tau < \tau^{\max}$ in a democratic system, we have a possible explanation to the empirical fact discussed above whereby there seems to be a positive relationship between government expenditure in education and the level of economic growth. We thus can state:

Corollary: *In democracies, we are likely to observe positively-correlated growth and equality rates.*

Another noteworthy somewhat interesting feature about our results is that individuals who attend the private education system are willing to allocate part of their income to educate the less motivated: we have $\tau_2 > 0$. This result is not the outcome of an altruistic behaviour. This is due to the fact that the more motivated benefit indirectly from the public education system through the spillover effect, φ. In other words, the external effect is partly internalised by the more motivated individuals as they realise the positive effect on long-term growth of funding public education for the less ambitious (productive) ones.

Before concluding, we can briefly infer the effects of a change in the tax rate on aggregate welfare and on the welfare of each type of individual. If $\tau < \tau_2$ ($\tau_1 < \tau < \tau^{\max}$), more public education increases growth, reduces inequalities and increases (decreases) the welfare of all individuals. If, $\tau_2 < \tau < \tau_1$, only the less motivated see their welfare to increase. The effect on aggregate welfare depends on how one weights the contribution of the less motivated relative to the more motivated in the social welfare function.

4 Conclusion

We have analysed a simple model of human capital accumulation in which a publicly funded education system coexists with a privately funded one. We introduced heterogeneity across individuals via an idiosyncratic parameter measuring their status-motivation. While the effects of social status has a number of precedents in the literature, their investigations have often been hampered by the usual device of symmetric equilibrium that has been imposed in models of this kind for tractability. Instead, this paper has gone down the bolder route of allowing heterogeneity among individuals, as a way of investigating the growth-distribution nexus jointly. More precisely, we have analysed a model in which the status-seeking motive is itself a source of heterogeneity by letting the relevant parameter in the utility function be agent-specific. We showed that the more motivated individuals choose to attend the private education system. It requires more working efforts, but allows them to obtain a higher level of education than in the public education regime, and in turn to forge ahead. The less motivated ones, on the other hand, opt for the public education regime and benefit from a greater amount of leisure and a lower status.

We obtained that the size of the public education sector and the long-run level of growth describe an inverted-U shaped relationship reminiscent of Barro (1990). Ceteris paribus, in contrast with the existing literature, our framework shows that a larger public education sector is compatible with both a reduction of inequalities and an increase of the long-term economic growth rate. Although, one concludes that there is no clear-cut relationship between growth and inequality driven by the tax rate, our analysis also highlights the tension between the direct beneficiaries and non-beneficiaries from such public service. We showed that in a majority voting system every individuals agree on a size of the public education sector which is lower than that which maximises growth. The reason is that a larger public education sector induces short-run welfare losses to individuals as it takes resources away which could alternatively be consumed. Thus, this result suggests that the growth-inequality relationship, is more likely to be negative.

Let us conclude by the scope that this analysis gives. The choice between public and private education analysed here may be thought of as a parable for the provision of public goods in general, so that the results derived here may have a broader appeal. In particular, we may think of the public provision of health as another possible channel for the government to improve equity and boost growth. Health represents indeed an important component of human capital: a feature firstly recognised by Grossman (1972) in his seminal paper on demand for health and introduced in an endogenous growth model by van Zon and Muysken (2001). On the empirical side, authors such as Weil (2005) have provided evidence supporting the idea that health affects productivity both directly (healthier individuals make better workers) and indirectly (healthier individuals acquire more skills). Thus, this is a relevant issue. The framework developed here is suitable for studying this question which is on the agenda for future work.

5 Appendix

5.1 Choice of education of individuals: proof of Proposition 1

In what follows, we characterise the choice of individuals regarding the education regime. Let us first demonstrate the existence and uniqueness of the level of ambition $\widetilde{\delta}$ making an individual indifferent between the two regimes of education. Then, comparing the level of ambition of any individual to this critical level, we determine her choice of education. To get there, let us assume that individuals of group 1 choose public education (i.e., we are disregarding case (b) of Proposition 1) and let us determine the critical level of ambition of individuals of group 2 that make them indifferent between private and public education.

Using (1), (5) and (12), with $\varepsilon^* = 0$ when individuals are in public education and $\varepsilon^* = (1-\tau)G/(1+G) > 0$ when they are in private education, we can simplify the critical condition (13) to obtain:

$$\widetilde{h}_t^{pri} - h_t^{pub} = \frac{(1-\varphi)g}{\varphi g + \rho}, \tag{26}$$

where $\widetilde{h}_t^{pri} \equiv \log \widetilde{H}_t^{pri}$ is the log-level of private education obtained by the individual with motivation $\widetilde{\delta}$, and $h_t^{pub} \equiv \log H_t^{pub}$ is the log-level of public education.

Recalling that $\overline{H_t} = (H_{1t})^p(\widetilde{H_t}^{pri})^{1-p}$ where $H_{1t} = H_t^{pub}$, from equations (3) and (6), we have $g = \phi A\tau[(1+\delta_1)/\eta]^p(\widetilde{L}^{pri})^{(1-p)}(\widetilde{H_t}^{pri}/H_{1t})^{1-p}$ and $g = \phi(\varepsilon^* A\widetilde{L}^{pri})^{1-\varphi}(\widetilde{H_t}^{pri}/H_{1t})^{-p\varphi}$, respectively. Using (9), we can simplify the latter expression to obtain: $g^{\varphi}(\varphi g+\rho)^{(1-\varphi)} = \phi[A(1+\widetilde{\delta})(1-\tau)(1-\varphi)/\eta]^{(1-\varphi)}(\widetilde{H_t}^{pri}/H_{1t})^{-p\varphi}$.

The two expressions for the growth rate and equation (26) make up a 3×3 system in relative human capital between the two sectors of education, $\widetilde{h}_t^{pri} - h_{1t}$, growth rate, g, and the level of motivation, $\widetilde{\delta}$. As equation (26) implies that $(\widetilde{H_t}^{pri}/H_{1t}) = \exp[(1-\varphi)g/(\varphi g + \rho)]$, simple manipulations of these expressions yield:

$$(g)^{\varphi}(\varphi g+\rho)^{1-\varphi}\exp\left[p\varphi\frac{(1-\varphi)g}{\varphi g+\rho}\right] = \phi\left[\frac{A(1-\tau)(1-\varphi)\left(1+\widetilde{\delta}\right)}{\eta}\right]^{1-\varphi}, \tag{27}$$

and

$$\frac{g\,(\varphi g+\rho)^{1-p}}{(\rho+g)^{1-p}}\exp\left[-\frac{(1-p)\,(1-\varphi)g}{\varphi g+\rho}\right] = \frac{\phi A\tau}{\eta}\,(1+\delta_1)^p\left(1+\widetilde{\delta}\right)^{1-p}. \tag{28}$$

Eliminating the term $(1+\widetilde{\delta})$ between equations (27) and (28), we obtain:

$$\frac{(g)^{1+\frac{1}{1-p}}}{(\rho+g)} = \left(\frac{\phi A\tau}{\eta}\right)^{\frac{1}{1-p}}(1+\delta_1)^{\frac{p}{1-p}}\,(g)^{\frac{1}{1-\varphi}}\exp\left[g\frac{(1-\varphi)+p\varphi}{\varphi g+\rho}\right]\phi^{\frac{-1}{1-\varphi}}\left[\frac{A(1-\tau)(1-\varphi)}{\eta}\right]^{-1}.$$

This condition shows that a solution for $g > 0$ (and thus for $\widetilde{\delta} > 0$) exists and is unique. That is, if $\delta_2 = \widetilde{\delta}$, individuals of group 2 are indifferent between private and public education. As individuals of group 1 have a level of ambition such that $\delta_1 < \widetilde{\delta}$, they never choose to attend the private regime. Hence, if $\delta_2 > \widetilde{\delta}$, (26) holds with a strict inequality. Individuals of group 2 always opt for the private regime. The growth rate, g, and the relative amount of human capital, $\widehat{H}$, are determined by solving a system of two equations in the growth rate and relative human capital as shown below. The case (c) of Proposition 1 applies. If $\delta_2 < \widetilde{\delta}$, however, individuals of group 2 never choose the private regime of education. The case (a) of Proposition 1 applies. Following the same kind of reasoning, (i.e. by characterising the critical level of ambition of individuals 1 that make them indifferent between private and public education), we could characterise the case (b) of Proposition 1.

5.2 Steady-state in the mixed regime of education

In the mixed regime of education, the less motivated opt for the public regime, while the more motivated opt for the private regime. We thus have: $\overline{H_t} = (H_{1t})^p(H_{2t})^{1-p}$. Using this information, equations (2) and (3) imply:

$$g^{pub} = \phi A\tau \left(\frac{1+\delta_1}{\eta}\right)^p \left(\frac{1+\delta_2}{\eta}\right)^{(1-p)} \left[\frac{\rho+g}{\varphi g+\rho}\right]^{(1-p)} \left(\widehat{H}\right)^{-(1-p)},$$

and

$$g^{pri} = \phi \left[\frac{A(1+\delta_2)(1-\tau)\varepsilon}{(1-\tau-\varepsilon^*)\eta}\right]^{1-\varphi} (\widehat{H})^{p\varphi}.$$

From (9) and (12) we have $G = (1-\varphi)g/(\varphi g+\rho)$ and $\varepsilon = (1-\tau)G/(1+G)$. Gathering the results depicted above allows us to determine the implicit value of the growth rate, g^*. We obtain

$$\begin{aligned} &\frac{g^{1+\frac{(1-p)}{p}} (\varphi g+\rho)^{(1-p)\frac{p\varphi+1-\varphi}{p\varphi}}}{(\rho+g)^{(1-p)}} \\ = \;& \phi^{1+\frac{(1-p)}{p\varphi}} \left(\frac{A}{\eta}\right)^{1+\frac{(1-p)(1-\varphi)}{p\varphi}} (1+\delta_1)^p (1+\delta_2)^{(1-p)\left(1+\frac{(1-\varphi)}{p\varphi}\right)} \tau \left[(1-\tau)(1-\varphi)\right]^{\frac{(1-p)(1-\varphi)}{p\varphi}}. \end{aligned}$$

which is the solution given in equation (17) or

$$\begin{aligned} &\frac{g^{\varphi+\frac{p\varphi}{1-p}} (\varphi g+\rho)^{1-\varphi+p\varphi}}{(\rho+g)^{p\varphi}} \\ = \;& \phi^{1+\frac{p\varphi}{1-p}} \left(\frac{A}{\eta}\right)^{1-\varphi+\frac{p\varphi}{1-p}} (1-\varphi)^{1-\varphi} (1+\delta_1)^{p\frac{p\varphi}{1-p}} (1+\delta_2)^{1-\varphi+p\varphi}(1-\tau)^{1-\varphi} (\tau)^{\frac{p\varphi}{1-p}}, \end{aligned}$$

depending on how we eliminate $\widehat{H}$. It can easily checked that the two expressions are exactly the same. The second one is simply the first one to the power $p\varphi/(1-p)$. Simple algebra shows that a solution for $g^* = g^{pub} = g^{pri}$, with $g^* > 0$, exists and is unique. The human capital ratio, the consumption ratio, and the quantities of labour follow directly from (1), (2), (5), (7).

5.3 Outcome in a pure public and pure private regime

In this appendix, we depict the outcome of the model in a pure public education regime and in a pure private regime of education, respectively. In the case of a pure public regime (case (a) in proposition 1), all individuals get the same level of human capital: $\widehat{H}^* = 1$. The level of growth follows from (6) and is thus given by:

$$g^{pub} = \frac{\phi\tau}{\eta}(1+\delta_1)^p (1+\delta_2)^{(1-p)}. \tag{29}$$

Moreover, from (1) where $\varepsilon = 0$, the consumption ratio, $\widehat{C}^*$, is given by:

$$\widehat{C}^* = \frac{C_{1t}}{C_{2t}} = \frac{L_1}{L_2} = \frac{1+\delta_1}{1+\delta_2}. \tag{30}$$

Similarly, the growth rate in a pure private regime (part (b) of Proposition 1) is given by: $g^{pri} = \phi(\varepsilon^* A L_k)^{1-\varphi}(\overline{H_t}/H_{kt})^{\varphi}$ for all k, where we recall that $\varepsilon^* = \varepsilon_1^* = \varepsilon_2^*$ (see (12)). Taking the ratio of this equation for a typical individual 1 and a typical individual 2, respectively, we obtain:

$$\widehat{H}^* = \frac{H_{1t}}{H_{2t}} = \left(\frac{L_1}{L_2}\right)^{(1-\varphi)/\varphi} = \left(\frac{1+\delta_1}{1+\delta_2}\right)^{(1-\varphi)/\varphi}. \tag{31}$$

Using this information with equations (9), (11), (12) and $\overline{H_t} = (H_{1t})^p (H_{2t})^{1-p}$, we obtain:

$$\left(g^{pri}\right)^{\varphi}\left(\varphi g^{pri} + \rho\right)^{1-\varphi} = \phi\left[\frac{(1-\tau)(1-\varphi)A}{\eta}\right]^{1-\varphi}(1+\delta_1)^{p(1-\varphi)}(1+\delta_2)^{(1-p)(1-\varphi)}, \tag{32}$$

and

$$\widehat{C}^* = \frac{C_{1t}}{C_{2t}} = \frac{H_{1t}}{H_{2t}}\frac{L_1}{L_2} = \left(\frac{1+\delta_1}{1+\delta_2}\right)^{1/\varphi}. \tag{33}$$

From the above results, we note that the pure public educational regime produces more growth than the pure private one at least if $(g^{pub} =)\phi\tau(1+\delta_1)^p(1+\delta_2)^{(1-p)}/\eta > \phi[A(1+\delta_1)^p(1+\delta_2)^{(1-p)}(1-\tau)(1-\varphi)/\eta]^{1-\varphi}(> g^{pri})$ (see (29) and (32)), given that $\varphi g^{pri} + \rho$

is likely to be lower than one. The following increases the probability of the public regime growth rate being higher than the private regime rate: A higher tax rate, higher disutility of labour relative to the productivity parameter in output sector, η/A, and a lower average level of status motivation and ambition. Moreover, the private-education regime produces always more income inequality than the public regime. Inequality becomes larger if the spillover effect in education (captured by φ) is low (see equations (30), (33)).

5.4 Transitional dynamics in the mixed regime of education

We characterise the transitional dynamics of the model in a mixed regime of education. As mentioned, we assume that the choice of education regime is made once and for all at the beginning of the planning horizon ($t = 0$) for all individuals. We note that the growth rate of those in public education is given by: $g_t^{pub} = \phi A\tau(L_{1t})^p(L_{2t})^{(1-p)}(\widehat{H}_t)^{p-1}$, where we have denoted $\widehat{H}_t \equiv H_{1t}/H_{2t}$ that is a constant variable in steady-state and used $\overline{H_t} = (H_{1t})^p (H_{2t})^{1-p}$. Similarly, the growth rate in private education is given by: $g_t^{pri} = \phi(\varepsilon_{2t}AL_{2t})^{1-\varphi}(\widehat{H}_t)^{p\varphi}$. The first order conditions for individuals 2, who opt for the private regime of education, are repeated below for convenience:

$$\frac{1+\delta_2}{L_{2t}}\frac{1-\tau}{1-\tau-\varepsilon_{2t}} = \eta,$$

$$\frac{(1+\delta_2)}{1-\tau-\varepsilon_{2t}} = \mu_{2t}(1-\varphi)\frac{\overset{\bullet}{H}_{2t}}{\varepsilon_{2t}},$$

$$\frac{(1+\delta_2)}{\mu_{2t}H_{2t}} + (1-\varphi)g_t^{pri} = -\frac{\overset{\bullet}{\mu}_{2t}}{\mu_{2t}} + \rho.$$

Let us denote by $\omega_t \equiv \varepsilon_{2t}/(1-\tau-\varepsilon_{2t})$ the relative amount of resources allocated to education and consumption (which is constant in steady-state). We can manipulate the first order conditions with the law of motion of human capital in the private sector (3) to obtain:

$$\frac{(1+\delta_2)(1-\tau)\omega_t}{\eta} = \varepsilon_{2t}L_{2t},$$

$$L_{2t} = \frac{1+\delta_2}{\eta}(1+\omega_t),$$

$$(1+\delta_2)(\omega_t)^{\varphi} = \mu_{2t}(1-\varphi)\phi\left(A\frac{(1+\delta_2)(1-\tau)}{\eta}\right)^{1-\varphi}(H_{1t})^{p\varphi}(H_{2t})^{1-p\varphi},$$

$$(1-\varphi)g_t^{pri}\left(\frac{1}{\omega_t}+1\right) = -\frac{\overset{\bullet}{\mu}_{2t}}{\mu_{2t}} + \rho.$$

Simple manipulation of the three equations above allows us to obtain the following 2×2 system in relative human capital and relative amount of resources allocated to education and consumption $(\widehat{H}_t, \omega_t)$:

$$\overset{\bullet}{\omega}_t = \omega_t \left\{ \begin{array}{c} \frac{\rho}{\varphi} + \frac{p\phi A\tau}{\eta} (1+\delta_1)^p (1+\delta_2)^{1-p} (1+\omega_t)^{(1-p)} (\widehat{H}_t)^{p-1} \\ +\phi \left[(1-p) - \frac{(1-\varphi)}{\varphi\omega_t}\right] \left[\frac{A(1+\delta_2)(1-\tau)\omega_t}{\eta}\right]^{1-\varphi} (\widehat{H}_t)^{p\varphi} \end{array} \right\},$$

$$\overset{\bullet}{\widehat{H}}_t = \widehat{H}_t \left\{ \begin{array}{c} \frac{\phi A\tau}{\eta} (1+\delta_1)^p (1+\delta_2)^{1-p} (1+\omega_t)^{(1-p)} (\widehat{H}_t)^{p-1} \\ -\phi \left[\frac{A(1+\delta_2)(1-\tau)\omega_t}{\eta}\right]^{1-\varphi} (\widehat{H}_t)^{p\varphi} \end{array} \right\}.$$

Taking a first order Taylor approximation of the above system around the steady state, we obtain:

$$\begin{pmatrix} \overset{\bullet}{\omega}_t/\omega_t \\ \overset{\bullet}{\widehat{H}}_t/\widehat{H}_t \end{pmatrix} = M \begin{pmatrix} \omega_t - \omega^* \\ \widehat{H}_t - \widehat{H}^* \end{pmatrix}, \tag{34}$$

where "$*$" indicates the steady-state value of any variable and we have used the steady-state property $g^{pub} = g^* = \phi A\tau(1+\delta_1)^p(1+\delta_2)^{1-p}(1+\omega^*)^{(1-p)}(\widehat{H}^*)^{p-1}/\eta$, $g^{pri} = g^* = \phi[A(1+\delta_2)(1-\tau)\omega^*/\eta]^{1-\varphi}(\widehat{H}^*)^{p\varphi}$, $\omega^* \equiv G^* = (1-\varphi)g^*/(\varphi g^* + \rho)$ (see equations (9) and (12)). Lastly, the matrix M is given by:

$$M = \begin{pmatrix} \frac{p(1-p)g^*}{1+\omega^*} + \left(1-p+\frac{1}{\omega^*}\right)\frac{(1-\varphi)g}{\omega^*} & -\frac{p(1-\varphi)g^*}{\widehat{H}^*}\left(1-p+\frac{1}{\omega^*}\right) \\ \left[(1-p)\omega^* - (1-\varphi)(1+\omega^*)\right]\frac{g^*}{\omega^*(1+\omega^*)} & -g^*(1-p+p\varphi) \end{pmatrix}.$$

Using $\omega^* = (1-\varphi)g^*/(\varphi g^* + \rho)$, we notice that $(1-p)\omega^* - (1-\varphi)(1+\omega^*) = (1-\varphi)[(1-p)g^* - (\varphi g^* + \rho) - (1-\varphi)g^*]/(\varphi g^* + \rho) = -(1-\varphi)(pg^* + \rho)/(\varphi g^* + \rho) < 0$. Using this information, direct inspection of the M matrix reveals that its determinant is strictly negative meaning that its eighenvalues are real and have opposite signs. Hence, the unique steady state equilibrium is a saddle point and the stable arm is a line going through the steady-state.

5.5 A more general technology in public education

In this appendix, we modify slightly the model in specifying a more general technology of education in the public sector, such as: $\overset{\bullet}{H}{}_t^{pub} = \phi\left(\tau\overline{Y_t}\right)^{1-\varphi}\left(\overline{H_t}\right)^{\varphi}$, where $Y_t = (Y_{1t})^p (Y_{2t})^{1-p}$. We will show that we would obtain the same results as in the simplified model used in the main text. For simplicity, let us focus on the mixed regime of education in steady-state. An important feature is that the behaviour of individuals described in the main text remain unchanged. The only difference is that in steady-state the level of growth in public education (6) is now replaced by

$$g = \phi\,(A)^{1-\varphi}\,(\tau)^{1-\varphi}\left(\frac{1+\delta_1}{\eta}\right)^{p(1-\varphi)}\left(\frac{1+\delta_2}{\eta}\right)^{(1-p)(1-\varphi)}\left[\frac{\rho+g}{\varphi g+\rho}\right]^{(1-p)(1-\varphi)}\left(\widehat{H}\right)^{-(1-p)},$$

where we have used $Y_{kt} = AL_{kt}H_{kt}$, $k = 1, 2$, with L_{kt} given by (5) and (11) for individuals 1 and 2, respectively. Recalling that the level of growth in private education is given by $g = \phi\{A(1+\delta_2)(1-\tau)\varepsilon/[(1-\tau-\varepsilon)\eta]\}^{1-\varphi}(\widehat{H})^{p\varphi}$, we follow the same line of reasoning as before. Using $G = (1-\varphi)g/(\varphi g^* + \rho)$ and $\varepsilon^* = (1-\tau)G/(1+G)$ (see (9) and (12)), the growth rate in private education is given by:

$$g = \phi\left[\frac{A(1+\delta_2)(1-\tau)(1-\varphi)g}{\eta\,(\varphi g+\rho)}\right]^{1-\varphi}(\widehat{H})^{p\varphi}.$$

Eliminating $\widehat{H}$, we obtain:

$$\begin{aligned}\frac{(g)^{\varphi\left(1+\frac{p}{1-\varphi}\right)}(\varphi g+\rho)^{(1-\varphi)(1+p\varphi)}}{(\rho+g)^{(1-\varphi)p\varphi}} \quad = \quad & A^{(1-\varphi)\left(1+\frac{p\varphi}{1-p}\right)}(\phi)^{1+\frac{(1-\varphi)p\varphi}{1-p}}(1-\varphi)^{1-\varphi}\eta^{-(1-\varphi)\left(1+p\varphi+\frac{p^2\varphi}{1-p}\right)} \\ & \times(1+\delta_2)^{(1-\varphi)(1+p\varphi)}(1+\delta_1)^{\frac{p^2\varphi(1-\varphi)}{1-p}}(1-\tau)^{1-\varphi}(\tau)^{\frac{(1-\varphi)p\varphi}{1-p}}.\end{aligned}$$

Simple algebra allows us to show that the growth rate which is solution of this equation has the same properties as those described in the main text for the simpler model. In particular, we note that we have an inverted U-shaped relation between growth, g, and the tax rate, τ.

6 References

Abel, A.B. (1990) Asset Pricing under Habit Formation and Catching up with the Joneses, American Economic Review, 80, pp. 38-42.

Abel, A.B. (2005) Optimal Taxation when Consumers Have Endogenous Benchmark Levels of Consumption, Review of Economic Studies, 72, pp. 21–42.

Aghion, P., Caroli, E. , Garcia-Penalosa, C. (1999) Inequality and Economic Growth: The Perspective of the New Growth Theories, Journal of Economic Literature, 37, pp. 1615-1660.

Alesina, A., Tabellini , G. (1990) Voting on the Budget Deficit, American Economic Review 80, pp. 37-49

Alesina, A., Rodrik D. (1994) Distributive politics and economic growth. Quarterly Journal of Economics 109, pp. 465–490.

Alonso-Carrera, J. (2001) More on the Dynamics in The Endogenous Growth Model with Human Capital, Investigaciones Economicas, 25, pp. 561-583.

Barro, R.J (1990) Government Spending in a Simple Model of Endogenous Growth, Journal of Political Economy, 98, pp. S103-S125.

Barro, R.J. (1991) Economic growth in a cross section of countries, Quarterly Journal of Economics 106, pp. 407-443.

Blankenau, W.F., Simpson, N.B. (2004) Public Education Expenditures and Growth, Journal of Development Economics, 73, pp. 583– 605.

Blankenau, W.F., Simpson, N.B., Tomljanovich, M. (2007) Public Education Expenditures, Taxation, and Growth: Linking Data to Theory, American Economic Review 97, pp. 393-397

Cameron, S., Heckman, J. (2001) The dynamics of educational attainment for black, hispanic, and white males. Journal of Political Economy, 109, pp. 455–499.

Chen, H.J. (2005) Educational systems, growth and income distribution: a quantitative study, Journal of Development Economics, 76, pp. 325– 353

Chen S., Ravallion M. (1997) What Can New Survey Data Tell Us about Recent Changes in Distribution and Poverty?, *The World Bank Economic Review*, 11, pp. 357-382.

Choudhary, A., Levine, P., McAdam, P., Welz, P. (2007). Relative Preferences, Happiness and 'Corrective' Taxation, University of Surrey, mimeo.

Clark, A.E., Oswald, A.J., (1996) Satisfaction and comparison income, Journal of Public Economics, 61, pp. 359-381.

Corneo, G., Jeanne, O. (1997) On relative wealth effects and the optimality of growth, Economics letters, 54, pp. 87-92.

Corneo G., Jeanne O. (1999) Pecuniary emulation, inequality and growth, European Economic review, 43, pp. 1665-1678.

de la Croix, D., Doepke, M. (2004) Public versus private education when differential fertility matters, Journal of Development Economics, 73, pp. 607–629.

Deninger, K., Squire, L. (1996) A New Data Set Measuring Income Inequality, *The World Bank Economic Review*, 10, pp. 565-591.

Fershtman, C., Murphy, K.M., Weiss, Y. (1996) Social Status, Education and Growth, Journal of Political Economy, 104, pp. 108-132.

Futagami, K., Morita, Y., Shibata, A., (1993) Dynamic Analysis of an Endogenous Growth Model with Public Capital, Scandinavian Journal of Economics, 95, pp. 607-625.

Futagami K., Shibata A. (1998) Keeping one step ahead of the Joneses: Status, the distribution of wealth, and long run growth, Journal of Economic Behavior & Organization, 36, pp. 109-126.

Garcia-Penalosa, C., Turnovsky, S.J. (2006) Growth and Income Inequality: A Canonical Model, Economic Theory, 28, pp. 25-49.

Glomm, G., Ravikumar, B. (1992) Public versus Private Investment in Human Capital: Endogenous Growth and Income Inequality, Journal of Political Economy, 4, pp. 818–834.

Ghosh, S., Mourmouras, I.A. (2004) Debt, Growth and Budgetary Regimes, Bulletin of Economic Research, 56, pp. 241-250.

Grossman, M., (1972) On the Concept of Health Capital and Demand for Health, Journal of Political Economy 80, 223-255.

Kempf, H., Rossignol, S. (2005) Growth, inequality and integration: a political economy analysis. Journal of Public Economic Theory 7, pp. 709–739.

Kempf, H., Rossignol, S. (2005) Is Inequality Harmful for the Environment in a Growing Economy?, Economics & Politics 19, pp. 53-71.

Ljungqvist, L., Uhlig, H. (2000) Tax Policy and Aggregate Demand Management Under Catching Up with the Joneses, American Economic Review, 90, pp. 356-366.

Lucas, R.E. (1988) On the Mechanics of Economic Development, Journal of Monetary Economics, 22, pp. 3-42.

Mankiw, N.G., Romer, D., Weil, D.N. (1992) A contribution to the empirics of economic growth, Quarterly Journal of Economics 107, pp. 407–437.

Maurer, J., Meier, A. (2008) Smooth it Like the Joneses? Estimating Peer-Group Effects in Intertemporal Consumption Choice, The Economic Journal, 118, pp. 454-476.

McBride, M. (2001) Relative income effects on subjective well-being in the cross-section, Journal of Economic Behavior & Organization, 45, pp. 251-278.

OECD (2008) Education at a Glance, OECD indicators.

Partridge, M. (1997) Is Inequality Harmful For Growth? Comment, American Economic Review, 87, pp. 1019-1032.

Persson, T., Tabellini, G. (1994) Is inequality harmful for growth? American Economic Review, 84, pp. 600-621.

Pham, T.K.C. (2005) Economic growth and Status-seeking through personal Wealth, European Journal of Political Economy, 21, pp. 404-427.

Pollak, R.A. (1976) Interdependent Preferences, American Economic Review, 66, pp. 309-320.

Saint-Paul, G., Verdier, T. (1993) Education, Democracy and Growth, Journal of Development Economics 42, pp. 399-407.

Schultz, T.W. (1961). Investment in Human Capital, American Economic Reviewa, 51, pp. 1-17.

Schultz, T.W. (1963) The economic value of education. New York: Columbia University Press.

Schultz, T.W. (1964) Transforming Traditional Agriculture, New Haven, Yale University Press.

Sylwester, K. (2002) Can education expenditures reduce income inequality? Economic Education Review, 21, 43–52.

Tamura, R. (1991) Income convergence in an Endogenous Growth Model, Journal of Political Economy, 99, pp. 522-540.

Tournemaine, F. (2008) Social aspirations and choice of fertility: why can status motive reduce per-capita growth? Journal of Population Economics, 21, 49-66.

Tournemaine, F., Tsoukis, C. (2008) Relative Consumption, Relative Wealth and Growth, Economics Letters, 100, pp. 314-316.

Tournemaine, F., Tsoukis, C. (2009) Status Jobs, Human Capital and Growth: the effects of heterogeneity. Oxford Economic Papers 61, 467–493.

Tournemaine, F., Tsoukis, C. (2010) Gain versus pain from status and ambition: Effects on growth and inequality. Journal of Socio-Economics, 39 pp. 286-294.

Tsoukis, C (2007) Keeping up with the Joneses, Growth, and Distribution, Scottish Journal of Political Economy, 54, pp. 575-600.

Tsoukis, C. Miller, N.J. (2003) Public services and endogenous growth, Journal of Policy Modeling, 25, pp. 297-307.

Turnovsky, S.J. (1996) Methods of Macroeconomic Dynamics, Boston, MA: MIT Press.

Vandycke, N. (2001) Access to Education for the Poor in Europe and Central Asia, World Bank Technical paper No 511, IBRD, Washington DC.

van Zon, A., Muysken, J. (2001) Health and endogenous growth, Journal of Health Economics 20, 169–185.

Weil, D. (2005) Accounting for the effect of health on economic growth, NBER wp.

11455.

World Bank (1993) The East Asian Miracle. Economic Growth and Public Policy. World Bank. Policy Research Department Washington, D.C.

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

Country	Share of public expenditures	Share of private expenditures	Total expenditures as a percentage of GDP	
Australia	72.4	27.6	5.8	
Austria	89.2	10.8	5.5	
Belgium	94.4	5.6	6	
Canada	73.8	26.2	6.2	
Czech Republic	88.4	11.6	4.6	
Denmark	91.9	8.1	7.4	
Finland	97.5	2.5	6	
France	90.9	9.1	6	
Germany	85.2	4.8	5.1	
Hungary	90.5	9.5	5.6	
Iceland	89.8	10.2	8	
Italy	92.3	7.7	4.7	
Japan	66.7	33.3	4.9	
South Korea	58.8	41.2	7.2	
Mexico	80.2	9.8	6.5	
Netherlands	84.3	5.7	6.7	
New Zealand	79.9	20.1	5.7	
Poland	90.5	9.5	5.9	
Portugal	92	8	5.7	
Slovak Republic	85.2	4.8	4.4	
Spain	88.9	11.1	4.6	
Sweden	97.3	2.7	6.4	
United Kingdom	75.3	24.7	6.2	
United States	68	32	7.1	
OECD average	**84.7**	**15.3**	**5.8**	

Table 1: Relative proportions of public and private expenditure on education in some OECD countries (source: OECD, 2008)