

A discusión

FISCAL COMPETITION AND PUBLIC EDUCATION IN REGIONS*

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Abstract

We explore an economy with two regions and independent local administrations. Local governments collect taxes to finance public education, but once educated agents can choose to migrate to the other region. The Nash equilibrium of the long-run game between the two governments is compared to a golden rule-type social optimum. Preliminary results show that the Nash equilibrium will result in over- or under-investment depending on the extent to which public education is subject to congestion.

Keywords: Successive generations, Public education, Federal and local government, Fiscal games.

Classification Numbers: E13, O41, I29.

1 Introduction

European integration is rendering labor increasingly mobile within the Union. Simultaneously, the Bologna process aiming at fixing standards in European higher education is likely to increase competition among educational institutions. These are fundamental changes that raise important issues like: who has to finance higher education, how can national governments behavior affect convergence among member states, or whether coordination from the European Commission could play a role.

This paper is an attempt to build a framework in which local governments have large degrees of freedom fixing their fiscal policies and the levels of education, but cannot prevent agents from moving from one region to another. We wish to examine whether strategic behavior leads local administrations to over- or under-invest in education.

Two seminal papers by Buchanan and others originated a large literature on the decentralized provision of public goods. This is our departure point, adapted to the specific characteristics of public education. As put forward by Starrett (1980), the discussion is about a situation in which increasing taxes allows to increase expenditures on the public good, but attracts immigrants with the consequent congestion costs. From the individual point of view, the migration decision involves a comparison of alternative combinations of private and public good. Local governments are affected by the decisions of the other regions, and they behave strategically when choosing their tax schemes and the provision of the public good. This literature examines whether decentralized equilibria (usually the Nash equilibrium of the game between local governments) attains this optimum, and if not, whether there is a role for a federal government.

There are three reasons why that framework has to be adapted to address issues related to education. First, agents get formal education and pay taxes in different periods of their life and, eventually, in different regions. Second, the agent that pays the taxes is not the same agent that enjoys the expenditure of these public revenues. Third, once received, education is embodied in the individual and does not depend on the region of residence.

The first reason makes the problem faced by the local government essentially different from the case of the public good. In this paper we interpret education in a very broad sense, from primary school to professional or higher education. It is assumed that agents get educated in the region in which they are born, the region chosen by the parents. Migration decisions are taken when the agent is mature, when he is already

educated. Hence, the problem of a local government is not anymore one of choosing the right combination of a private good and a public good. Those who benefit from education are not making any decisions yet, and if they will migrate or not, it will depend on taxes in a future period. In our context, increasing taxes may improve public education but causes a loss of revenues because mature agents decide to emigrate to other regions. The key feature of education will then be the extent to which it is subject or not to congestion. If expenditures are shared by all students, emigration may have good effect in per capita terms if the loss of population cause a less than proportional loss of revenues. In that sense, our analysis parallels that of Boadway and Flatters (1982) in the context of public goods. Following these authors, in the model presented below, some congestion parameter will determine whether investment in education is something like a private good or rather some sort of public good.² We will see that this congestion parameter will largely determine whether local governments tend to under- or over-invest in education with respect to some reasonable social optimum. Incidentally, from the individual point of view, the migration decision is simpler in our case. There is no combination of private and public good to evaluate: when mature, agents just migrate to the lower tax region.

The second reason explains why in the case of education it is not that clear what is a social optimum. In the case of public goods, it is usually the case that only one Pareto-efficient allocation is compatible with a demographic equilibrium: when agents do not have an incentive to change residence. Hence, the discussion is often about what tax/service scheme makes of the social optimum a Nash equilibrium, or whether some (federal) coordination device is needed for the decentralized equilibrium to be optimal, at least in some constraint sense.³ In the case of education, there is no straightforward

²As a matter of fact, education is not a public good but an investment, but this is not what makes the case of education essentially different from the case of the public good. We shall emphasize again that the difference with the public good case is that education is received in a period of life different from that in which the agent makes migration and private consumption decisions.

³There is for example a discussion about the need for coordination when some instruments are available to the local governments. For instance, Myers (1990) and Mansoorian and Myers (1993) have put in question the need for any federal coordination if regions can make transfers to “purchase” the right size of their population. However, this remains an open debate, as some authors, like Hercowitz and Pines (1992) question these results.

concept of social optimum because the agent that pays taxes is different from that receiving revenues through public education. Below we construct a model of successive generations in which virtually any fiscal policy induces a Pareto efficient allocation provided that revenues are fully invested in education and not wasted.

There is a third characteristic of public education that makes it essentially different from the public good case: human capital is embodied in the individual. Migration involves a redistribution of human capital among regions. Observe that this implies that agents will be in general heterogeneous within regions, even at a demographic equilibrium, because their stock of human capital may differ depending on the region of origin. This is an additional difficulty to set a concept of social optimum.⁴

In this paper we wish to set up a model economy that accounts for these three basic characteristics of public education. In its present state, we introduce an economy of overlapping generations with two regions. When mature, each generation pays taxes to finance public education for the young generation. Once educated, agents decide at the beginning of their mature age whether or not to migrate. If net labor earnings of the other region exceed net labor earnings at home, the agent will decide to move to the other region. A key feature of the model is that migration changes both population and the stock of human capital as migrants carry with themselves their individual skills. If each region sets the fiscal policy independently, increasing taxes has two effects:

- Increase revenues from each resident to fund public education.
- Expel agents who decide to migrate to avoid higher taxes, reducing the tax base and therefore reducing aggregate revenues.

If the government cares for future generations, the first effect is positive and the second is negative. Whether a government will tend to increase taxes or not will depend on the extent to which education is subject to congestion. Below we will assume that an individual stock of human capital h is attained by investing in education an amount $E = N^\theta h$ of the consumption good. When $\theta = 1$, education behaves like a private good. Losing residents implies reducing the tax base but also to number of pupils to share the budget because $h = E/N$. Hence, the government may have the incentive to

⁴At this stage, however, we concentrate on long run strategic interaction, and in steady states there will be no migration by definition. The problem will arise some time when we consider truly dynamic games.

increase taxes to increase per capital expenditures in education in the loss of residents is compensated by a more than proportional increase in education expenditures per pupil. When $\theta = 0$, education is more like a public good $h = E$. Reducing the tax base is not compensated by a reduction in the number of pupils.

In the sections below we will consider the long run game between the two governments. We will compare the Nash equilibrium with some golden rule tax rate. We will see that at the Nash equilibrium governments will tend to under-invest in education (too low taxes) when education is more like a public good. Conversely, the non-cooperative equilibrium will tend to over-invest in education (too high taxes) when education is more like a private good.

2 A world with two regions

In this section we describe a successive generations' economy composed of two regions with independent governments. Individuals are productive to the extent to which the government invests in their education. There is no human capital spillovers and therefore there is no growth: individual human capital will be a stationary variable in the long run.

2.1 Population and human capital dynamics

When describing the local region, it will be understood that each variable has its counterpart for the foreign region. A tilde will denote that any particular variable refers to the foreign region.

World population is constant and normalized to $W > 0$. At the beginning of period t the local region has population N_{t-1} . A fraction ρ_t of the local population remains in their region of origin and a fraction $1 - \rho_t$ migrates. Hence, population in period t is given by

$$N_t = \rho_t N_{t-1} + (1 - \tilde{\rho}_t) \tilde{N}_{t-1} \quad (1)$$

where $\rho_t N_{t-1}$ is the number of agents who did not leave the region and $(1 - \tilde{\rho}_t) \tilde{N}_{t-1}$ is the number of newcomers. Each individual born in period $t - 1$ in the local region has received education e_{t-1} from the government bears a stock of human capital $h_t = e_{t-1}$. This very simple linear technology simplifies the analysis with no loss of generality. The

production function of the physical good described below will be strictly concave. If the production function of human capital would be concave, it would just add some extra degree of concavity to the production possibilities frontier of the region.

Aggregate stock of human capital after migration has taken place is

$$H_t = \rho_t N_{t-1} h_t + (1 - \tilde{\rho}_t) \tilde{N}_{t-1} \tilde{h}_t. \quad (2)$$

Individuals are assumed to organize spontaneously to engage in productive activities. We abstract from distribution issues and assume that in this implicit arrangement each agent owns an equal share of the property of the firm. Available technology is represented by an aggregate production $Y_t = H_t^\alpha$ for some $\alpha \in (0, 1)$. Decreasing returns to scale can be interpreted as an abstraction of technological progress. It is an appealing assumption because it makes the wage endogenous: increasing the labor force because of migrations will bid down wages.

Agents perceive labor earnings after taxes $(1 - \tau_t)w_t h_t$ where $w_t = \alpha H_t^{\alpha-1}$ but profits are assumed to be fully taxed. The full tax on profits can be seen as a way of abstracting from property issues and will simplify the no-mobility condition below. We do not think, however, that is an essential assumption, and no intuition in the sections to come seem to rely on this assumption. Further, when we think of actual migrations, it is very likely that the decisions are taken on the basis of labor income comparisons, and profits (like dividends to shares or returns to bank deposits) do not seem to play any role.

2.2 Public education

We abstract from private education because most European education, including higher education, is either public, as in France and Spain, or strongly subsidized, as in Belgium. Each agent in the economy, regardless of his origin, gives birth to a single new agent. An agent born in period t in the local region receives public education h_{t+1} from the government. The government's budget constraint is

$$N_t^\theta h_{t+1} = (1 - \alpha)H_t^\alpha + \tau_t w_t H_t$$

where the first term are profits and the second the government's share of labor earnings.

Public education is assumed to have some degree of congestion controlled by parameter θ . When $\theta = 1$ education is something like a private good while $\theta = 0$ renders

education some sort of public good. As discussed in the introduction, we will prove that the extent to which education is subject or not to congestion costs will determine the behavior of local governments if these care about per capita variables.

2.3 No-mobility conditions

Free mobility is the only reasonable assumption if we are to consider migrations within federal states or with member states of the European Union. Since profits are fully taxed, agents will migrate until net labor earnings are equalized across regions.

For any given stock of capital h_t , an agent will consume $c_t = (1 - \tau_t)w_t h_t$ at home and $d_t = (1 - \tilde{\tau}_t)\tilde{w}_t h_t$ if he decides to migrate. Hence, an agent from the local region will stay at home if $(1 - \tau_t)w_t \geq (1 - \tilde{\tau}_t)\tilde{w}_t$ and will migrate otherwise. Since this is true for the foreign region too, at a demographic equilibrium

$$(1 - \tau_t)w_t = (1 - \tilde{\tau}_t)\tilde{w}_t.$$

It should be clear by now that benefits are fully taxed to simplify the no-mobility conditions: in this economy there cannot be migration in both senses. In other words, $\rho_t < 1$ implies $\tilde{\rho}_t = 0$ and viceversa.

Observe too that agents have no cost associated to migration. The decision is taken solely on the basis of net labor earnings comparisons. We will argue later in this paper that this is a better representation of actual migration flows. A period in this model economy is intended to represent approximately forty years in real life. Even if it is costly to move in the short run, this cost is “diluted” in forty years of a better life because of higher income. In any case, the introduction of mobility costs is very likely to give local governments some room to set different tax rates but very unlikely to constitute any fundamental characteristic of this economy.

2.4 Equilibrium for exogenous taxes

To examine the behavior of this economy let us assume for the moment that taxes are given. Both governments have fixed a stream of taxes τ_t and $\tilde{\tau}_t$ for $t \geq 0$.

At the beginning of period t variables given are N_{t-1} and h_t . From equations (1) and (2) it is immediate to derive the aggregate resources constraints for population and

human capital

$$\begin{aligned} N_t + \tilde{N}_t &= W \\ H_t + \tilde{H}_t &= N_{t-1}h_t + \tilde{N}_{t-1}\tilde{h}_t. \end{aligned} \quad (3)$$

The no-mobility condition can be written in terms of aggregate human capital as

$$(1 - \tau_t)H_t^{\alpha-1} = (1 - \tilde{\tau}_t)\tilde{H}_t^{\alpha-1}. \quad (4)$$

Using $w_t = \alpha H_t^{\alpha-1}$, the government's budget constraint is

$$N_t^\theta h_{t+1} = (1 - \alpha(1 - \tau_t))H_t^\alpha.$$

From this equation it is clear that the only constraint faced by governments is that $\tau_t \leq 1$ and $1 - \alpha(1 - \tau_t) \geq 0$. This implies that feasible choices of τ_t have to verify

$$\frac{\alpha - 1}{\alpha} \leq \tau_t \leq 1. \quad (5)$$

Indeed, since benefits are fully taxed, it remains open the possibility that the labor tax is in fact a subsidy $\tau_t < 0$.

We have five equations (add the foreign government budget constraint) and six unknowns: for the two regions, population N_t , human capital H_t , and education h_{t+1} .

The last equation determines the sense of migration. Given any initial condition, from equations (4) and (3) we can determine aggregate stocks H_t and \tilde{H}_t . Then check whether people should be migrating from the foreign region $H_t > N_{t-1}h_t$ or the reverse. The last equation is

$$\begin{cases} H_t - N_{t-1}h_t = (\tilde{N}_{t-1} - \tilde{N}_t)\tilde{h}_t & \text{if } H_t \geq N_{t-1}h_t \\ \tilde{H}_t - \tilde{N}_{t-1}\tilde{h}_t = (N_{t-1} - N_t)h_t & \text{otherwise} \end{cases}.$$

Observe that since agents in different regions can bear different levels of education, changing taxes changes all variables in a continuous fashion except population: changes will not be differentiable at the point where the sense of migration is reversed.

3 Long run optimal fiscal policies

In this context there is no natural social welfare criterium. For the sake of comparisons, we resort to a long run optimality criterion that is familiar to growth theorists: the

golden rule. Observe that education in this context is the only form of savings, and education is in turn determined by the tax rate. Hence, the tax rate here plays the same role as the savings rate in the Solow model, and a reasonable reference point will be the tax rate that maximizes per capita consumption in the long run.

3.1 The golden rule in the closed economy

Unless one finds interesting to examine erratic or cyclic fiscal policies, it is reasonable to think that a fiscal policy in a closed economy consists of a sequence of tax rates $\tau_t, \tau_{t+1}, \dots$ that become constant at least from some give period on $\tau_t = \tau$.

In order to examine the long run equilibrium of the economy we shall simply assume that a fiscal policy is a given fixed tax rate τ verifying the constraint (5) above. If there is no migration, the equilibrium dynamics are described by the equations

$$\begin{aligned} c_t &= (1 - \tau_t)\alpha H_t^{\alpha-1} h_t \\ N_t^\theta h_{t+1} &= (1 - \alpha(1 - \tau_t))H_t^\alpha. \end{aligned}$$

Normalize population to one and in the long run

$$\begin{aligned} c &= (1 - \tau)\alpha h^\alpha \\ h^{1-\alpha} &= 1 - \alpha(1 - \tau). \end{aligned}$$

The golden rule tax rate maximizes per capita consumption in the long run. The second equation can be used to obtain an expression for $dh/d\tau$. Differentiating the first equation and equalizing to zero yields the golden rule tax rate $\tau^* = 2 - 1/\alpha$.

The modified golden rule stems from the maximization of a discounted sum of utilities. If we assume an additively separable social welfare function the government solves

$$\max \sum_{t=0}^{\infty} \beta^t U(\alpha h_t^\alpha (1 - \tau_t)) \quad \text{s.t.} \quad h_{t+1} = (1 - \alpha(1 - \tau_t))h_t^\alpha.$$

where U is any differentiable one-period utility function with $U' > 0$ and $U'' < 0$. Note that consumption can be expressed in terms of education as $h_t^\alpha - h_{t+1}$ so that we have to solve

$$\max \sum_{t=0}^{\infty} \beta^t U(h_t^\alpha - h_{t+1}).$$

The first order condition in the steady state is $-1 + \beta\alpha h^{\alpha-1} = 0$ so that $h^{1-\alpha} = \beta\alpha$. Since in any case $h^{1-\alpha} = 1 - \alpha(1 - \tau)$ we can just solve $\beta\alpha = 1 - \alpha(1 - \tau)$ for the tax rate to obtain $\tau^{**} = 1 + \beta - 1/\alpha$. Of course, $\tau^{**} = \tau^*$ when $\beta = 1$, and $\tau^{**} < \tau^*$ whenever $\beta < 1$. If the government cares relatively more for the first generations, its optimal fiscal policy will tend to invest less in education.

3.2 The behavior of the open economy in the long run

Consider now the open economy. Before we go on to consider any strategic behavior, let us examine the reaction of the economy to changes in the local tax rate when the foreign region maintains constant the fiscal policy.

The main difference with respect to the closed economy is that population is now endogenous: changes in the local tax rate, given the foreign tax rate, will eventually cause migrations and therefore a redistribution of population between the two regions. The impact on education, and therefore on consumption, will depend to a large extent on the relationship between the labor share of income α and the degree of congestion in the education sector θ .

Figure 1 displays the typical reaction of all variables in the long run to changes in the local fiscal policy τ when the foreign $\tilde{\tau}$ remains fixed. Parameters are fixed as $\alpha = 0.50$ and $\theta = 0.20$ so that education is more like a public good. The foreign tax rate is fixed to $\tilde{\tau} = 0.20$. Local variables are represented by solid lines and foreign variables by dashed lines. World population is normalized to $N_t + \tilde{N}_t = 20$.

Population in the local region N_t decreases until $\tau_t = 1$ in which case all agents in the local region just migrate to the foreign region for obvious reasons: net income in the local region is zero. What is interesting is what happens to human capital. The initial increase in τ makes revenues per head increase faster than population decreases, and hence the initial increase in human capital stock. Of course, to the extent that individual consumption is a function the individual stock of human capital, a similar story applies to the reaction of consumption to changes in τ .

When education is more like a private good, the government may want to increase taxes with no bound. In that case the problem of choosing some τ to maximize per capita consumption may not be well defined.

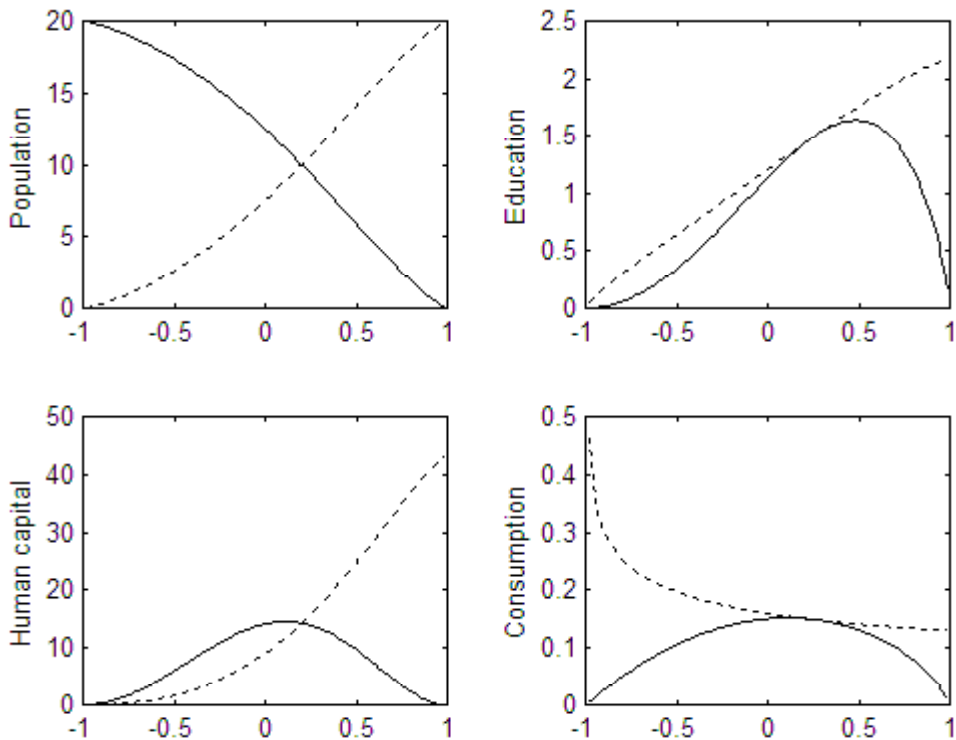


Figure 1: Reaction of the steady state to changes in the local tax

4 The long run Nash equilibrium

In the previous section we saw that for θ low enough the golden rule objective function is well defined. In terms of strategic behavior, this means that the reaction function is well defined. In this section we show that if c is a concave function of τ , the reaction function is well defined and a Nash equilibrium exists.

4.1 The reaction function

We assume that the government cares of per capita consumption of the local residents. In the short run it may be possible that we have agents of different origin and therefore different levels of consumption. In the long run, however, a demographic steady state will require no migration and there will be just one type of agent in the region. From section 2 we know that each agent consumes $c = (1 - \tau)wh$ which can be written as $c = (1 - \tau)\alpha H^{\alpha-1}h$. Since there is no migration in the steady state, we have $H = Nh$

so that

$$c = (1 - \tau)\alpha \frac{H^\alpha}{N}.$$

Fix the fiscal policy of the other region $(\alpha - 1)/\alpha \leq \tilde{\tau} \leq 1$ and the non cooperative objective of the government is to maximize c with respect to τ . Using again $H = Nh$, the government budget constrain relates H and N so that

$$c = (1 - \tau)\alpha \tilde{N}^{\frac{(1-\theta)\alpha}{1-\alpha}-1} (1 - \alpha(1 - \tau))^{\frac{\alpha}{1-\alpha}}.$$

To obtain an expression for $dc/d\tau$ we need to know the reaction of N to changes in τ . Observe that the no-mobility condition relates the ratio of aggregate stocks of human capital to the fiscal policies. From (4) we obtain

$$\frac{H}{\tilde{H}} = \left(\frac{1 - \tau}{1 - \tilde{\tau}} \right)^{\frac{1}{1-\alpha}}.$$

Using the government budget constraint and this ratio, and after some cumbersome calculations, we may write

$$\frac{N}{W - N} = \left[\frac{1 - \alpha(1 - \tilde{\tau})}{1 - \alpha(1 - \tau)} \left(\frac{1 - \tau}{1 - \tilde{\tau}} \right) \right]^{\frac{1}{1-\theta}}.$$

From this expression, and again after some tedious calculations, we can obtain an expression for $dN/d\tau$. From the expression for consumption above we can obtain $dc/d\tau$ as a function of $dN/d\tau$. In a symmetric Nash equilibrium $\tau = \tilde{\tau}$ and all these expressions simplify considerably to arrive to

$$\tau^N = 2 - \frac{1}{\alpha} - \frac{1}{2} + \frac{1 - \alpha}{2\alpha(1 - \theta)}.$$

Observe that the golden rule tax rate is $2 - 1/\alpha$. The two last terms can be seen as the contribution of strategic behavior to the fiscal policy.

4.2 Interpretation

Increasing θ increases the contribution of strategic behavior to the equilibrium tax rate. The more education is like a private good, the more the government may have the incentive to act in an elitist way: increasing taxes may reduce the tax base but increase the per capital expenditures in education. It can be proven that if α and θ

are such that the strategic component of τ^N is positive, then $dc/dN < 0$, that is, the government has an incentive to reduce population by increasing taxes.

As we suspected in the previous section, the Nash equilibrium may not be well defined. As θ approaches to one, the last term of τ^N diverges violating the feasibility condition that $\tau < 1$.

5 Concluding remarks

The original motivation of this paper was to examine endogenous growth issues in a world with human capital accumulation and strategic behavior of local governments. This paper can be seen as a preliminary exploration of a framework suitable to be adapted to examine issues related to growth in regions. Further research would extend the analysis to growing regions in order to analyze, for instance, whether and how regions may or may not converge due to the strategic behavior of governments.

The first extension we wish to consider is the introduction of transfer schemes in order to implement the social optimum, in the case above, the golden rule. Once the long run game is fully understood, we wish to examine the dynamic game between the two governments. We aim to analyze the impact of period-by-period competition and whether subgame perfect equilibria can help us better understanding this type of economies. Of course, there is a number of qualifications to be made to this type of analysis. For instance, one may wonder if there are such benevolent governments that care of residents consumption. One plausible objective is the size of the administration. From a political economics point of view, politicians may be more interested in the size of the budget $N_t^\theta h_{t+1}$ than in the effective production of human capital h_{t+1} . This paper is a first step towards constructing a framework to address all these questions.

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