On tax competition, public good provision and jurisdictions' size

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In this paper, we analyse competition among jurisdictions to attract foreign capital through low taxes and public inputs that enhance firms' productivity. The competing jurisdictions are different in size and mobility of capital is costly. We find that for moderate mobility costs, small economies can attract foreign capital by supplying higher levels of public goods than larger jurisdictions, without practising tax undercutting. The classical result that small jurisdictions are attractive because they engage in tax dumping is recovered only for high mobility costs of capital.

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1. Introduction

In this paper, we analyze competition among countries to attract entrepreneurs through low taxes on capital and/or high level of public goods, which enhance firm productivity. Our main interest is in investigating which types of countries (small or large) are attractive to foreign entrepreneurs and which instruments (taxes or public goods) are chosen by the successful jurisdiction.

The phenomenon of tax competition among countries to attract *mobile* capital, entrepreneurs or shoppers has generated a large body of literature. Two topics have attracted particular attention. One focus, the normative approach to tax competition, has considered the inefficiencies created by mobility (see for instance Zodrow and Mieszkowski, 1986, Wilson, 1995, Mintz and Tulkens, 1986, Wildasin, 1988ab, Bucovetsky, 1991, Bucovetsky and Wilson, 1991, Matsutmoto 1998, Bucovetsky, Marchand and Pestieau, 1998). A second topic of interest has been the study of the characteristics[2] that a country should possess to be a desirable destination for investors and foreign consumers (Wilson, 1991, Kanbur and Keen, 1993, Barros and Cabral, 2000, Bjorvatn and Eckel, 2005, Haufler and Wooton, 1999). In this paper, we adopt a similarly positive approach rather than a normative one by focusing on the role of countries' size asymmetries in attracting mobile investors.

A finding that generally appears in the tax competition literature is that small jurisdictions benefit from low taxes. The argument is that small countries face more elastic tax bases than larger countries if tax rates are uniform (Wilson, 1991, Kanbur and Keen, 1993, Hindriks and Myles, 2006). This feature may also arise from the homogeneity of the population in small countries. Wealthy individuals migrate to small jurisdictions in which they are able to democratically choose low taxes for themselves (Hansen and Kessler, 2001).

It is important to note that if small countries were always to offer lower capital tax rates than larger ones, then they would be importers of capital and exhibit a high capital-labor ratio. Marceau, Mongrain and Wilson (2010) use data from 1991 to 1999 to show that this is not the case, claiming that

> "the correlation between the size-population of a country and its tax rate is not clear. For example, some large countries like France and Germany have below average tax rates.

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[2]For example, the level of employment, population density, production technology, tariffs and subsidies.

> (...) [T]he predictions of the asymmetric tax competition literature do not appear to be realized in the real world equilibrium."

Furthermore, recent data (Devereux *et al*, 2008, Chen and Mintz, 2008) on effective corporate taxes show that some small countries, such as Belgium or the Netherlands, set very low tax rates, even lower than those of small countries such as Luxembourg. Some medium-sized countries such as Austria set rates that are as high as those in some large countries. Large countries are also divided in clusters on this basis: one requiring the payment of high taxes (Argentina, China, Russia, US, France) and another offering low taxes (Ukraine, Poland). Therefore, the evidence is that there is no monotonic increasing relationship between capital tax rates and the population size of jurisdictions.

The model developed in this paper allows for a non-monotonic pattern of capital tax rates based on the assumption that countries of unequal size compete for foreign entrepreneurs using taxes and public goods as incentives that improve firm productivity. The existing literature has already analyzed the role of public goods differentiation in relaxing fiscal competition (Zissimos and Wooders, 2008 and Hindriks *et al,* 2008). Accordingly, tax rate differentials between competing jurisdictions may persist in equilibrium. In the same vein, the stratification of countries in different tax classes can be explained by the quality differentiation of public goods (Justman, van Ypersele and Thisse, 2001). Bénassy-Quéré *et al,* 2007 also study joint competition through taxes and the provision of public goods that enhance consumers' utility and firms' productivity. They find in particular that both the amount of public R&D expenditures as a share of GDP and the road infrastructure had a positive impact on FDIs flowing from the United States to European countries in 1994-2003.

We consider two jurisdictions of uneven size, where size refers to the population in a given jurisdiction[3]. Public goods that cover a wide range of infrastructures, services and regulations, provided by the local and/or the central government, are attractive to firms if they enhance their productivity[4]. Consequently, entrepreneurs decide where to locate capital according to differences in the level of public goods offered and tax differentials, net of the mobility cost. Competition between jurisdictions follows a two-stage game. First, governments decide on the level of public goods to supply, and then they set tax rates to maximize their rents. This timing leads to a strategic effect of public good provision on tax competition intensity because jurisdictions can anticipate during the first stage how harsh tax competition will be in the second stage.

The main findings of the paper can be summarized as follows. A large jurisdiction can only be attractive to capital through the supply of higher levels of public goods than its smaller rival offers. Such a result emerges if the mobility cost of capital is very low. Importantly, a small jurisdiction does not need to lower taxes to be attractive to foreign investments. For a certain range of mobility costs, it attracts foreign capital by supplying a higher level of public goods than its larger rival does without levying lower taxes. We show that for this equilibrium to occur, the cost level of mobility has to be intermediate and small countries must demonstrate no other specific feature apart from their size. However, adopting a low

[3]Country size may be defined by its population, by its area, or by its national income (Streeten, 1993).We focus on the population aspect rather than on spatial size. We thus assume that spatial area does not present a physical limitation for newly established firms. We also focus on competition between jurisdictions that differ greatly in size. Accordingly, we assume that when the population size is very small, the investment in human capital and the number of entrepreneurs are most likely very limited.

[4]In this context, we may consider transportation infrastructures, universities and public R&D investment in addition to property rights enforcement, capital market regulations, labor and environmental regulations and the absence of red tape procedures. It follows that countries' ability to attract foreign investment may also be based on the quality of their institutions. In the Oxford Handbook of Entrepreneurship (2007), it is argued that the number of entrepreneurs in a country depends, among other factors, on the character of regulations, property rights, accounting standards and disclosure requirements. Furthermore, in recent years there has been a surge of country and cross-country studies relating economic development to institutions, especially those affecting capital market development and functionality (La Porta et al.,1997, among others).

tax regime is a winning strategy for a small country if the mobility cost of capital is high enough.

A new general conclusion can be drawn based on the this model: all other things being equal, a certain degree of size asymmetry between jurisdictions is sufficient to define the direction of capital movements.

Findings relevant to our paper can be found in Hindriks *et al* (2008) and Zissimoss and Wooders (2008). Zissimos and Wooders (2008) address the inefficiency issues that may arise when jurisdictions compete regarding both taxes and public investments. They show that competition in public goods makes competition in taxes less fierce but has negative consequences for efficiency. We show that this impact on the intensity of tax competition may not always exist because it depends on the size asymmetry of the competing jurisdictions and the mobility cost of capital. Hindriks *et al* (2008) also develop a model of tax and public goods competition with perfect capital mobility. Their aim is to investigate equalization schemes in federal states. They assume that jurisdictions differ in their attractiveness when one possesses a superior production technology. This asymmetry can be altered by public investments. The authors find that a region can be attractive to capital even if its capital taxes are higher than those of its rival if its level of equilibrium investment is not efficient, as in Zissimos and Wooders (2008). In both papers, inefficiency arises because jurisdictions make investment decisions at the first stage of the game and then compete in taxes. Hence, to make tax competition less fierce, jurisdictions invest inefficiently in public goods. Our approach shares with their paper the idea that fiscal choice is inefficient because of the strategic effect of public goods levels on tax competition intensity. However, the purpose of our paper is different.

Other contributions also deal with competition for capital between asymmetric jurisdictions. For example, Barros and Cabral (2000) consider a subsidy game between asymmetric countries to attract foreign direct investments to alleviate unemployment. In equilibrium, the winner is the country that gains the most in terms of employment for given transportation costs. Haufler and Wooton (1999) also consider competition for foreign investments by stressing the role of international trade costs and the "home market" effect. Because the authors consider asymmetrically sized home markets, the large country will have an advantage in attracting foreign capital. In both papers, a small economy can only be attractive to foreign investments if it underbids the larger one in terms of taxes or if it overbids it in terms of subsidies. In our paper, however, we show that the small country can win in interjurisdictional competition without being attractive in term of taxes.

The paper is organized as follows. The next section presents the model and defines the SPN equilibria of the two-stage game. Section 3 presents the properties of such equilibria when capital flows from the small to the large country. Section 4 analyzes the equilibrium where capital flows from the large country to the small one. Section 5 concludes.

2. The model

Consider two jurisdictions h and f of uneven size. The term jurisdiction refers equally to different regions of the same country or to different countries provided that these entities have the power to tax. Size refers to the magnitude of the population, which coincides with the number of capital-owners who are simultaneously entrepreneurs and workers. Entrepreneurs are endowed with one unit of a capital good (one individual—one unit of capital—one firm). They are heterogeneous according to their willingness to invest abroad. Thus, we assume that capital-owners are distributed over the interval $[0,1]$, with density s_h (resp. s_f in country f), $s_h + s_f = 1$, in an increasing order of their willingness to invest at home[5]. Assume without loss of generality that h is the small jurisdiction, i.e. $s_h < 1/2$.

The technology is defined as follows. Each entrepreneur is able to combine one unit of the capital good with her own labor to produce $q + a_i$, $(i = h, f)$ units of a final good, where q is the

[5] These exogenously given populations will not change because we consider entrepreneurs as commuters. What changes is where the capital is invested.

private component of (gross) productivity[6]. The fraction a_i $(i = h, f)$ of the produced good depends on a public input -public good- supplied by jurisdiction $i = h, f$[7]. One additional unit of public goods produces one additional unit of private good. It follows that a_i also represents the amount of public good supplied by jurisdiction $i = h, f$. Providing firms located at $i = h, f$ with this public good is costly. The corresponding cost function is given by $C(a_i) = a_i^2$ $i = h, f$.

An entrepreneur of type $x, x \in [0, 1]$, either invests one unit of capital in her country i, or invests in the foreign jurisdiction j. If she invests in her home country, her profit is given by $\pi_i = q + a_i - t_i$, where t_i denotes the tax in country i levied on one unit of capital[8]. If she invests abroad (country j), her profit becomes $q + a_j - t_j$ net of kx, which is the disutility of investing abroad given her type x. The coefficient k represents a unit cost of moving capital abroad. When $k \to +\infty$, capital is immobile, and when $k \to 0$, capital is perfectly mobile. This parameter can also be interpreted as a measure of the degree of international integration. We will see that the value of k is critical in explaining how each country adjusts its attractiveness based on tax- and/or public-service-related considerations.

From now on we assume, without loss of generality, that investments flow from jurisdiction i, $i = h, f$ to $j = h, f$. The capital-owner of type x_i is indifferent between investing abroad and staying at home if

$$q + a_i - t_i = q + a_j - t_j - kx_i, \tag{1}$$

which yields

$$x_i(a_i, a_j, t_i, t_j) = \frac{(a_j - a_i) + (t_i - t_j)}{k}. \tag{2}$$

In other words, country j attracts capital from jurisdiction i if the net gain of investing in j i.e. $a_j - t_j$, is higher than the net gain obtained by staying in jurisdiction i, $a_i - t_i$, net of the mobility cost.

Jurisdictions are assumed to maximize their tax revenue net of public investment cost. The payoff function of the capital exporting jurisdiction $i, i = h, f$ is

$$B_i(a_i, a_j, t_i, t_j) = s_i(1 - x_i)t_i - a_i^2. \tag{3}$$

For the capital importing jurisdiction j, $j = h, f$

$$B_j(a_i, a_j, t_i, t_j) = [(1 - s_i) + s_i x_i]\, t_j - a_j^2 \tag{4}$$

Governments play a two-stage game. First, they decide on the quantity of public goods to provide. Then, they select the level of tax rates. The choice of sequentiality follows from the rule that the most irreversible decision must be made first. The game is solved through backward induction.

Definition *Given the fundamentals of the model* $(k, s_i), i = h, f$ *, the SPNE of the game is defined as* $(a_i^*(k, s_i), a_j^*(k, s_i), t_i^*(k, s_i), t_j^*(k, s_i); x_i^*(k, s_i))$ *for* $i, j = h, f, i \neq j$.

3. Capital flows from h to f

Consider the case in which capital flows from the small country h to the large one f. Hence, the small country is in this section the capital exporter, $s_i = s_h$.

3.1. The tax game

Each jurisdiction maximizes its budget with respect to its own tax rate, assuming that its rival's

[6] This output good is sold in a competitive (world) market at a given price normalized to one. Assuming that both countries have equal access to a common market implies that the smaller jurisdiction does not suffer from a reduced home market. We further suppose that the unit production cost is constant and equal to zero without loss of generality.

[7] This public input may represent material and immaterial public infrastructures. a_i satisfies the requirements necessary for it to be called a local public good, which means that it is jointly used without rivalry by firms located in the same jurisdiction. It follows that the benefits and costs of these goods only accrue at the jurisdictional level. As in Zissimoss and Wooders (2008), we do not consider congestion costs. Taking into account congestion would complicate our framework without improving the qualitative character of the results. Moreover, if a_i represents immaterial public goods such as law and regulations (protecting intellectual property, specifying accurate dispute resolution rules, etc), the absence of congestion is easily justified by the particular nature of these goods.

[8] For the sake of simplicity, we assume that q is such that the profit of each firm is positive for all equilibrium levels of public goods and taxes.

tax is given and the level of public services is fixed in the first stage

$$\underset{t_h}{Max} B_h(t_h, t_h) \tag{5}$$

$$\underset{t_f}{Max} B_f(t_h, t_f) \tag{6}$$

The objective functions are strictly concave in t_i and t_j ($\partial^2 B_{i(j)}/\partial t_{i(j)}^2 = -2s_{i(j)}/k < 0$) and the first order conditions yield the following best reply functions

$$t_h(t_f) = \frac{t_f}{2} + \frac{(a_h - a_f)}{2} + \frac{k}{2}, \tag{7}$$

$$t_f(t_h) = \frac{t_f}{2} + \frac{(a_f - a_h)}{2} + \frac{1 - s_h}{s_h}\frac{k}{2}. \tag{8}$$

Clearly, taxes are strategic complements, and best reply functions have slopes smaller than one. Accordingly, there exists a unique equilibrium in tax rates given by

$$\widetilde{t}_h(a_h, a_f) = \frac{(a_h - a_f)}{3} + \frac{1}{3}\frac{1 + s_h}{s_h}k, \tag{9a}$$

$$\widetilde{t}_f(a_h, a_f) = \frac{(a_f - a_h)}{3} + \frac{1}{3}\frac{2 - s_h}{s_h}k \tag{9b}$$

Note the negative strategic effect of public good provision by country f on the tax rate of country h, and vice versa. Each jurisdiction has an incentive to dampen its own investment in public goods to lower the incentive of the rival jurisdiction to engage in tax-cutting behavior. This is similar to what we see in Hindriks *et al* (2008) and Zissimos and Wooders (2008), who show that at equilibrium, public goods will be supplied inefficiently. Substituting tax values (9a) and (9b) in (3) and (4) we obtain the payoff functions $B_h(a_h, a_f)$ and $B_f(a_h, a_f)$.

3.2. Competition in public goods

At the first stage, each jurisdiction maximizes its budget with respect to its own public good provision

$$\underset{a_h}{Max} B_h(a_h, a_f) \tag{10}$$

$$\underset{a_f}{Max} B_f(a_h, a_f) \tag{11}$$

From the first order conditions, the resulting best replies are

$$a_h(a_f) = -\frac{s_h}{9k - s_h}a_f + \frac{k\,(1 + s_h)}{9k - s_h}, \tag{12}$$

$$a_f(a_h) = -\frac{s_h}{9k - s_h}a_h + \frac{k(2 - s_h)}{9k - s_h}. \tag{13}$$

In the following, we assume that $k > s_h/9$ to guaranty the concavity of the objective functions in a_h and a_f. The equilibrium for public services is then

$$a_h^* = \frac{3k(1 + s_h) - s_h}{3\,(9k - 2s_h)} \tag{14}$$

$$a_f^* = \frac{3k(2 - s_h) - s_h}{3\,(9k - 2s_h)} \tag{15}$$

Introducing the equilibrium public services into equations (9a) and (9b) yields equilibrium tax rates

$$t_h^* = \frac{3k}{s_h}a_h^*, \tag{16}$$

$$t_f^* = \frac{3k}{s_h}a_f^*. \tag{17}$$

Given the concavity condition $k > s_h/9$, the above equilibrium values are positive if $s_h/9 < k < s_h/3(2 - s_h)$ or $k > s_h/3(1 + s_h)$. For these parameter values, the equilibrium of the game is unique because the best replies, in each stage of the game, satisfy the uniqueness conditions[9]. If $s_h/3(2 - s_h) < k < s_h/3(1 + s_h)$, the small country neither supplies any public good nor taxes its residents, i.e. $a_h^* = 0$ and $t_h^* = 0$. In this set, the best reply of the large country becomes $a_f^* = k(2 - s_h)/\,(9k - s_h)$ and $t_f^* = 3ka_f^*/s_h$.

We substitute the equilibrium values of tax rates and public goods in (2) to obtain the flow of capital moving from h to f

$$x_h^* = \frac{(1 - 2s_h)\,(s_h - 3k)}{s_h\,(9k - 2s_h)}, \tag{18}$$

where $0 < x_h^* < 1$ if $s_h/3(1 + s_h) < k < s_h/3$.

[9] Notice that perfect mobility $k = 0$ does not meet the concavity conditions related to the choice of public goods provision. If capital is immobile, $k \to +\infty$, equation (2) is not defined. These boundary cases therefore need special treatment as presented in Appendix A.

The equilibrium public budget B_h^* and B_f^* obtain as

$$B_h^* = \frac{(9k - s_h)(3k - s_h + 3ks_h)^2}{9s_h(2s_h - 9k)^2} \quad (19)$$

$$B_f^* = \frac{(9k - s_h)(s_h - 6k + 3ks_h)^2}{9s_h(2s_h - 9k)^2} \quad (20)$$

These levels are positive due to the concavity of the objective functions. It follows that equilibrium taxes generate sufficient revenues to fund the equilibrium public goods.

Given the equilibrium of the game $(a_h^*(k,s_h), a_f^*(k,s_h), t_h^*(k,s_h), t_f^*(k,s_h); x_h^*(k,s_h))$, we can then state the following lemma

Lemma 1 The capital exporter is the small country h, $x_h^* > 0$, if [10] $k \in \left(\frac{s_h}{3(2-s_h)}, \frac{s_h}{3}\right)$.

Using Lemma (1), we can now identify the instrument used by the large country to attract capital:

Proposition 1 *If a large jurisdiction imports foreign capital, $x_h^* > 0$, it is only because it is attractive in terms of public goods.*

Proof. Due to Lemma 1, capital flows from h to f if $k \in \left(\frac{s_h}{3(2-s_h)}, \frac{s_h}{3}\right)$. This interval is equal to $\left(\frac{s_h}{3(2-s_h)}, \frac{s_h}{3(1+s_h)}\right) \cup \left(\frac{s_h}{3(1+s_h)}, \frac{s_h}{3}\right)$. If $k \in \left(\frac{s_h}{3(1+s_h)}, \frac{s_h}{3}\right)$, we have $k > \frac{s_h}{3(1+s_h)} > \frac{2s_h}{9}$ and it follows from equations (14), (15), (16) and (17) that $t_h^* < t_f^*$ and $a_f^* > a_h^*$. Moreover, for $k \in \left(\frac{s_h}{3(2-s_h)}, \frac{s_h}{3(1+s_h)}\right)$, $a_h^* = 0$ and $t_h^* = 0$ and the best replies $a_f^* = \frac{k(2-s_h)}{9k-s_h}$ and $t_f^* = \frac{3k}{s_h}a_f^*$ of the large country carry a positive sign. It follows that $a_f^* > a_h^*$ and $t_h^* < t_f^*$. ∎

[10] For completeness, notice that for $k \in (\frac{s_h}{3}, \frac{1}{3})$ and $k \in (\frac{s_h}{9}, \frac{s_h}{3(2-s_h)})$, the equilibrium values are such that $a_h^* - t_h^* > a_f^* - t_f^*$. Thus, given the advantage presented by the small country $a_h^* - t_h^*$, there exists no type of investors that would be willing to move from country h to country f. In this area, the equilibrium of the game is given by the interior equilibrium with $x_h^* = 0$ (see the left-hand side of Figure 1).

We conclude that for $k \in (s_h/3(2-s_h), s_h/3)$, the small country adopts a low tax regime at equilibrium. This result is reminiscent of that of Keen and Kanbur (1993), but with the proviso that *the small country is not successful in attracting foreign capital even if it engages in tax undercutting.* This tax behavior of the small country is due to the elasticity rule explained in Kanbur and Keen (1993). But the reason why the small country does not succeed in attracting foreign capital is that the large country's relative attractiveness in terms of public goods outweighs its small rival's tax attractiveness. The mechanism underlying Proposition 1 is that capital mobility is high enough to compel the small country to undercut its tax rate to such an extent that it can only afford a low level of public spending compared to that of its rival.

This behavior can explain why large countries persist in setting high tax rates that may be essential to supply high levels of public goods to attract foreign capital.

4. Capital flows from f to h

We now turn our attention to the case wherein the exporting country is the big country $s_i = s_f$, thus the small is attractive to capital. We solve the same game as above, and the equilibrium emerges as

$$a_f^* = \frac{3k(2-s_h) - (1-s_h)}{3(9k - 2(1-s_h))} \quad (21)$$

$$a_h^* = \frac{3k(1+s_h) - (1-s_h)}{3(9k - 2(1-s_h))} \quad (22)$$

Using the equilibrium public services, equilibrium tax rates are established as

$$t_f^* = \frac{3k}{1-s_h}a_f^*, \quad (23)$$

$$t_h^* = \frac{3k}{1-s_h}a_h^*. \quad (24)$$

The above equilibrium values are positive if $(1-s_h)/9 < k < (1-s_h)/3(2-s_h)$ or $k > (1-s_h)/3(1+s_h)$. The large country neither supplies a public good nor levies taxes if $(1-s_h)/3(1+s_h) > k > (1-s_h)/3(2-s_h)$. The best replies of the small country become $a_h^* = k(1+s_h)/(9k-2(1-s_h))$ and $t_h^* = k(9ks_h - s_h + 1)/2(1-s_h)(9k+s_h-1)$, which both carry a positive sign given the conditions on the values of k. Also note that, as in the previous section, we can show that the public budgets are positively signed at equilibrium. In equilibrium, we obtain $a_f^* - a_h^* = (1-2s_h)k/(2s_h+9k-2)$. Then, it can easily be verified that $a_f^* - a_h^* > 0$ and $t_f^* - t_h^* > 0$ if $k > 2(1-s_h)/9$. Let us set $\overline{k} = 2(1-s_h)/9$.

Proposition 2 *The smaller jurisdiction adopts a low tax regime if the cost of capital mobility exceeds the trigger value $\overline{k}$. However, if capital mobility is high enough, $k < \overline{k}$, the smaller jurisdiction offers more public goods than its rival and taxes more.*

It follows that the classical result according to which small countries always undercut taxes hinges on the condition that capital mobility cost has to exceed a trigger value $\overline{k}$, which decreases with the degree of size asymmetry between the competing jurisdictions. Given this result, we now investigate whether the small country can attract foreign entrepreneurs without tax undercutting. To put it differently, can we have $x_f^* > 0$ if $k < \overline{k}$?

Substituting the equilibrium tax rates and public goods levels in (2), the capital flow x_f^* from f to h, is

$$x_f^* = \frac{(1-2s_h)(3k+s_h-1)}{(1-s_h)(9k+2s_h-2)}, \tag{25}$$

where $0 < x_f^* < 1$ if $k > (1-s_h)/3$ or $k < (1-s_h)/3(2-s_h)$. We can then state the following lemma

Lemma 2 *The capital exporter is a large country, i.e. $x_f^* > 0$, if*[11]

$$k \in \left\{ \left(\frac{1-s_h}{9}, \frac{1-s_h}{3(1+s_h)} \right) \cup \left(\frac{1-s_h}{3}, \frac{1}{3} \right) \right\}$$

[11] As in footnote (9), notice that for $k \in (\frac{1-s_h}{3(1+s_h)}, \frac{1-s_h}{3})$, the equilibrium values are such that $a_f^* - t_f^* > a_h^* - t_h^*$. Thus, $x_f^* = 0$.

Note that the sets of admissible k defined in Lemma 1 and Lemma 2 may overlap. If their intersection is not empty, we cannot univocally determine which country, the large or the small one, is the destination for capital flows[12]. The source of this indeterminacy resides in the size asymmetry of the competing jurisdictions. Indeed, it is easy to verify that this intersection is empty if $0 \leq s_h < 1/4$. *It follows that, all other things being equal, the size difference between jurisdictions defines the direction of capital flows.* From now on, we assume that s_h will be small enough to eliminate this indeterminacy. Accordingly, the intervals given in Lemma 1 and in Lemma 2 are ordered in the following way: in the interval $(s_h/3(2-s_h), s_h/3)$, mobility costs will be said to be *low*. In the interval $((1-s_h)/9, (1-s_h)/3(1+s_h))$, mobility costs will be considered *moderate* and *high* in $((1-s_h)/3, 1/3)$.

Given the equilibrium of the game, we can then state the following (see the right-hand side of Figure 1) proposition

Proposition 3 *A small jurisdiction is attractive to foreign capital*

(i) in terms of public goods notwithstanding its high taxes if the level of mobility cost is moderate; and

(ii) in terms of taxes, notwithstanding its low supply of public goods, if the level of mobility cost is high.

Proof. Consider the sets in Lemma 2. *(i)* When $k \in \left(\frac{1-s_h}{9}, \frac{1-s_h}{3(2-s_h)} \right) \cup$

[12] The overlapping of sets does not lead to two-way flows. In fact, the types of entrepreneurs in one jurisdiction differ based on their willingness to move abroad, but the set of types is the same across jurisdictions. Therefore, given the equilibrium quantities of public goods and taxes for each jurisdiction, there is only a one-way migration flow. In other words, if $x_i s_i$ entrepreneurs decide to invest in j, it is not possible, that for the same parameters (s_i, k), there are entrepreneurs quitting j. Indeed for each value k belonging to this intersection, we obtain two competing equilibria. One for (s_h, k) and one for $(1-s_h, k)$. More exactly, we have a *unique* equilibrium for (s_h, k) and another *unique* equilibrium corresponding to $(1-s_h, k)$.In the first case, the big country is the destination for capital, while in the second case capital flows to the small country.

$\left(\frac{1-s_h}{3(2-s_h)}, \frac{1-s_h}{3(1+s_h)}\right)$, we get $t_h^* > t_f^*$ and $a_h^* > a_f^*$. In particular, for $k \in \left(\frac{1-s_h}{9}, \frac{1-s_h}{3(2-s_h)}\right)$, $t_h^* > t_f^*$ and $a_h^* > a_f^*$ because $k < \frac{s_h}{3(1+s_h)} < \frac{2s_h}{9}$. For $k \in \left(\frac{1-s_h}{3(2-s_h)}, \frac{1-s_h}{3(1+s_h)}\right)$, we obtain $a_f^* = 0$ and $t_f^* = 0$ and the best replies of the large country are $a_h^* > 0$ and $t_h^* > 0$, as we showed above. It follows that $a_h^* > a_f^*$ and $t_h^* > t_f^*$. *(ii)* When $k \in \left(\frac{1-s_h}{3}, \frac{1}{3}\right)$, $t_h^* < t_f^*$ and $a_h^* < a_f^*$ because $k > \frac{s_h}{3(1+s_h)} > \frac{2s_h}{9}$. ■

Proposition 3*(i)* newly indicates that small jurisdictions can be attractive to foreign capital without adopting low-tax regimes. To explore the reason for this result, we begin to show the mechanism at work when capital mobility is first high and then low. Then we argue that the case highlighted in Proposition 3*(i)* appears to be an *intermediate case.*

Recall that when capital is highly mobile, tax competition is tough and the small country undercuts the large country's tax rate to such an extent that it can only afford a low amount of public goods. As a result, the large country's relative attractiveness in terms of public goods outweighs its small rival's tax attractiveness.

When capital mobility is low, tax competition is relaxed and tax rates increase because capital becomes more captive. This tax increase will however be more important in the large country where the tax base is the largest. Capital will partially flow to the small jurisdiction but this loss will be overcompensated for a tax increase levied on the capital owners who do not leave. As a result, the small country becomes tax attractive and has no incentive to supply a higher level of public goods.

When the mobility cost is moderate, capital mobility is not high enough to induce fierce tax competition as explained above and not low enough to induce the large country to increase tax rates as in the scenario of low capital mobility. This range of mobility costs may therefore entice the small country to make itself attractive in terms of public goods, which are made affordable when it taxes capital returns at a higher rate than the big country.

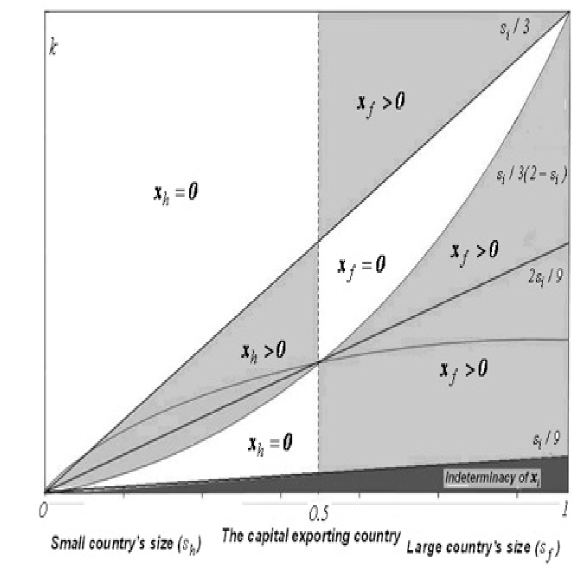
This intermediate case can be reproduced using the rule of capital supply elasticity with respect to tax rates. Consistently to this rule, the small jurisdiction supplies the highest level of public goods ($a_h - a_f > 0$) and that large country f sets the highest tax rate ($t_h - t_f > 0$) if the mobility cost k is not too high, $k < \widetilde{k}$. We proceed as in Kanbur and Keen (1993) when two public "instruments" are used. It follows that $a_h - a_f > (1-2s_h)/2(1-s_h)k$ and equal tax rates $t_h = t_f = t$ lead to a higher tax elasticity for the capital supply faced by the large country ($|\epsilon_f| > |\epsilon_h|$)[13]. In other words, if the differential in public goods supplied by jurisdiction h is high enough, the small country is able to alter the capital elasticity it faces to such an extent that it does not need to adopt a low tax regime. The large jurisdiction will undercut its small rival's tax rate ($t_h - t_f > 0$).

In summary, *(i) a jurisdiction that sets a higher tax rate than its rival can be attractive to foreign firms, and (ii) small jurisdictions can be high- or low-tax regimes according to the degree of international integration.*

For the sake of clarity, we present in Figure 1 the sets of parameters (k, s_i) that generate different patterns of capital movements.

The left-hand side shows the parameter constellations (k, s_h) for which capital flows out of the small country h, $x_h > 0$, or does not flow out, $x_h = 0$. The right-hand side of Figure 1 shows the parameter values (k, s_f) for which capital flows out of the large country f, $x_f > 0$, or does not flow out, $x_f = 0$. The white areas represent the set of parameters for which there is no capital outflow $x_i = 0$. The light-grey shaded areas represent the sets in Lemmas (1) and (2). The dark-grey-shaded area corresponds to the parameter values that do not verify the concavity conditions. Corner solutions are then possible, but the model is not able to univocally predict the sign of x_i.

[13]The tax bases of the large and the small countries are respectively defined by $S_f = s_f(1-x_f)$ and $S_h = (1-s_h)(1+x_f)$. If tax rates are equal across jurisdictions ($t_h = t_f = t$), we can easily obtain capital supply elasticities.



4.1. Public goods and tax competition

Finally, we ask if greater international differentiation in public goods will reduce the intensity in (capital) tax competition. Derivating the differentials $\Delta_a^* = a_i^* - a_j^*$ and $\Delta_t^* = t_i^* - t_j^*$ with respect to k shows that there is no monotonic relationship[14] between Δ_a^* and Δ_t^*. When $k \in ((1 - s_h)/3, 1/3)$, we obtain $\partial \Delta_a^* / \partial k < 0$, while $\partial \Delta_t^* / \partial k$ can be positive or negative. Thus, in the considered interval for k, greater mobility leads jurisdictions to differ in terms of public goods, but tax differentials may not move in the same direction because a higher k can cause a reduction in Δ_t^*. Indeed, when the mobility cost falls within the range $((1 - s_h)/3, 1/3)$, the large jurisdiction may need to increase its level of public goods and decrease its taxes relative to those of its smaller rival to contain the outflow of entrepreneurs. This strategic move leads to a higher Δ_a^* and a smaller Δ_t^*. For all other admissible sets of k, higher capital mobility (lower k) entices jurisdictions to differentiate (higher Δ_a^*) and tax competition is less intense (higher Δ_t^*).

Proposition 4 *There exists a range of k values such that an increase in capital mobility increases tax competition even if jurisdictions differentiate in public goods.*

[14] The derivates are given in Appendix B.

5. Conclusions

This paper investigates the relationship between country size (population) and attractiveness to international capital. Attractiveness is built through low taxes on capital or public goods or services that improve firm productivity. Entrepreneurs face different costs of mobility according to their willingness to locate their capital in a foreign country. We show that when the mobility cost is low or moderate, a jurisdiction can only be attractive through the supply of higher levels of public goods and not through lower taxes. However, adopting a low tax regime may only be a winning strategy if the mobility cost is high enough. Another important conclusion is that small jurisdictions may attract international capital by supplying a high level of public goods without being tax havens. We demonstrate that, for this equilibrium to occur, the cost level of mobility must be intermediate and no other specific feature is necessary for the small country apart from its size.

This paper can be extended along different lines. One extension would be to develop a dynamic model of repeated games to capture a possible learning effect of governments concerning the self-selection of entrepreneurs. It would also be interesting to introduce labor or different types of capital to control for different degrees of mobility to ascertain the effects of preferential taxation: namely, to switch the burden of taxes to less mobile factors.

Appendices

Appendix A

To study the extreme cases of capital mobility (no capital mobility and perfect mobility) specific treatments are necessary. More precisely, if $k < s_i/9$, the concavity condition is not fulfilled, and if $k > 1/3$, we obtain $x_i > 1$, which is not allowed ($0 \leq x_i \leq 1$).

No Capital immobility: $k \to +\infty$

Capital is not able to move and we have $x_i = 0$. There is thus no interjurisdictional competition to attract capital and equilibrium taxes and public goods can be deduced as follows. Because (domestic) capital supply is inelastic, tax maximizing governments will extract the maximum rent from the domestic firms $t_i^* = t_f^* = q$. Because the production of public goods is unnecessary (for attracting foreign capital) and costly, governments decide to set $a_i^* = a_j^* = 0$.

Perfect capital mobility: $k = 0$

Although this case has evident theoretical relevance, it does not include an important ingredient of our model, which is the heterogeneity of investors. With perfect mobility, we have two homogeneous groups of investors who are only different in terms of their initial locations.

With perfect capital mobility, countries set the value of public goods offered in the first stage and then enter a tax game *à la* Bertrand. We solve the model via backward induction. Countries h and f maximize $S_h t_h$ and $S_f t_f$ respectively, where S_h and S_f are the capital supply functions for the respective countries. Because we are in a Bertrand tax game, the capital supply functions are written as follows

$$S_h = \begin{cases} s_h + s_f = 1 & if \quad a_h - t_h > a_f - t_f \\ s_h & if \quad a_h - t_h = a_f - t_f \\ 0 & if \quad a_h - t_h < a_f - t_f \end{cases}$$

$$S_f = \begin{cases} s_h + s_f = 1 & if \quad a_f - t_f > a_h - t_h \\ s_f & if \quad a_f - t_f = a_h - t_h \\ 0 & if \quad a_f - t_f < a_h - t_h \end{cases}$$

This game leads to tax undercutting down to the level where $a_h - t_h = a_f - t_f$,which leads to the absence of capital movement ($x_i^* = 0$ for $i, i = h, f$). Now, we turn to the public goods game and consider the above condition of no movement. We therefore maximize $B_h(a_h) = s_h(a_h - a_f + t_f) - a_h^2$ with respect to a_h and $B_f(a_f) = (1-s_h)(a_f - a_h + t_h) - a_f^2$ with respect to a_f. Solving the FOCs leads to the equilibrium values $a_h^* = s_h/2$ and $a_f^* = s_f/2$. It follows that $t_f - t_h = a_f - a_h = (1-2s_h)/2 > 0$. In other words, the small country undercuts in taxes, $t_f^* > t_h^*$, and the large country counteracts in offering an excess level of public goods, $a_f^* > a_h^*$. It results paradoxically that capital does not move in the equilibrium even though there is perfect capital movement because the small country's tax attractiveness and the large country's public goods attractiveness neutralize each other.

Appendix B

Here we study the sign of the derivatives of $\Delta_a^* = a_i^* - a_j^* = k\frac{2s_i-1}{9k-2s_i}$ and $\Delta_t^* = t_i^* - t_j^* = k\frac{3k(2s_i-1)}{s_i(9k-2s_i)}$ with respect to k.

1. In the intervals $k \in \left(\frac{s_i}{3(2-s_i)}, \frac{s_i}{3}\right)$ and $k \in \left(\frac{s_i}{9}, \frac{s_i}{3(1+s_i)}\right)$, derivating wrt to k gives $\frac{\partial \Delta_a^*}{\partial k} = 2\frac{(2s_i-1)s_i}{(9k-2s_i)^2} < 0$ and $\frac{\partial \Delta_t^*}{\partial k} = \frac{3(9k-4s_i)(1-2s_i)k}{(2s_i-9k)^2 s_h}$. The sign of the last derivative depends on the sign of $9k - 4s_i$. When $9k - 4s_i > 0$, we get $\frac{\partial \Delta_t^*}{\partial k} > 0$. This implies $k > \frac{4}{9}s_i$, which is inconsistent with $k \in \left(\frac{s_i}{3(2-s_i)}, \frac{s_i}{3}\right)$ and $k \in \left(\frac{s_i}{9}, \frac{s_i}{3(1+s_i)}\right)$. So, $\frac{\partial \Delta_t^*}{\partial k} < 0$. Hence, when the big or the small jurisdiction is attractive because of the high level of public goods they provide, there is comovement in tax and public goods attractiveness when capital mobility increases.

2. Consider now $k \in \left(\frac{s_i}{3}, \infty\right)$. If $\Delta_a^* > 0$ and $\Delta_t^* > 0$, remember that entrepreneurs emigrate from jurisdiction f to avoid high taxes. Derivating the tax and public goods differentials gives $\frac{\partial \Delta_a^*}{\partial k} = \frac{2s_f(1-2s_f)}{(9k-2s_f)^2} < 0$ and $\frac{\partial \Delta_t^*}{\partial k} =$

$3\frac{k}{s_f}\frac{2s_f-1}{(9k-2s_f)^2}(9k-4s_f)$. It may be shown that for $k \in \left(\frac{1-s_h}{3};\frac{4(1-s_h)}{9}\right)$, $\frac{\partial\Delta_a^*}{\partial k}$ and $\frac{\partial\Delta_t^*}{\partial k}$ are identically signed. However, for $k \in \left(\frac{4}{9}(1-s_h),\infty\right)$, we have $\frac{\partial\Delta_a^*}{\partial k}<0$ and $\frac{\partial\Delta_t^*}{\partial k}>0$. In this case, there is no more comovement in tax and public goods attractiveness when capital mobility increases.

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