On tax competition, public good differentiation and jurisdictions' size[*]

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Abstract

In this paper, we focus on competition among countries to attract firms through tax and public goods. We assume that the competing jurisdictions are different in size and that the mobility of capital is costly. The source for attractiveness can be public goods (services) that improve productivity and/or low taxes on capital. Firms face mobility costs that indicate international integration. The main findings of the paper are: *(i)* for moderate mobility cost levels, small jurisdictions, can win the competition for firms, if they supply a higher level of public goods than the big one, even though they are tax hells; *(ii)* big jurisdictions can be the favorite location of firms only when mobility is very high and only because of public goods advantage in the big country. And finally *(iii)* there exists levels of mobility costs, for which tax competition is not relaxed because of the differentiation in public goods levels.

Keywords: Jurisdiction's size; Tax competition; Public goods competition; Foreign direct investment; Regional location

JEL Classification: H25; H73; F13; F15; F22

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1 Introduction

In this paper, we focus on competition among countries to attract firms through tax and public goods. In that context, we assume that the competing jurisdictions are different in size and that the mobility of capital is costly.

Our main interest is to investigate which country (small or large) will be attractive to foreign investments and which instrument (tax or public goods) the successful jurisdiction will choose.

The study of tax competition among countries to attract entrepreneurs or mobile shoppers has generated a large body of literature. Two topics have attracted particular attention: (i) the inefficiencies originated by capital mobility (see for instance Zodrow and Mieszkowski (1986), Wilson (1986, 1991, 1995, 1999), Mintz and Tulkens (1986), Wildasin (1988a, 1988b), Bucovetsky (1991), Bucovetsky and Wilson (1991), DePater and Myers (1994), Matsutmoto (1998), Bucovetsky, Marchand and Pestieau (1998), Bruecker (2000) or Wilson and Wildasin (2005) for a survey on tax competition effects); (ii) the characteristics[1] that a country should possess to be the destination of investors and foreign consumers (Wilson, 1991, Kanbur and Keen (1993), Barros and Cabral (2000)), (Bjorvatn and Eckel (2005), Haufler and Wooten (1999)). This paper is related to the second issue by focusing on the size asymmetry between countries.

One result which appears in the tax competition literature, as far as size asymmetry is concerned, is that small countries tend to select low tax rates and thus are able to attract foreign tax bases (Wilson (1991), Kanbur and Keen (1993)). The reason is that small countries face more elastic tax bases than larger countries do if tax rates were uniform. Another argument that supports this small country feature is provided in Hansen and Kessler (2001). In this paper, wealthy individuals migrate to small jurisdictions where they are able to democratically choose low taxes for themselves.According to Marceau, Mongrain and Wilson (2007), if small countries would offer low capital tax rates they should be importers of capital and exhibit a high capital-labor ratio. Using some data from 1991 to 1999, they show that this is not the case. They claim that

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

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[1]For example, the level of employment, population density (Trandel, 1994), production technology, tarifs and subsidies.

France and Germany have below average tax rates. .... the predictions of the asymmetric tax competition literature do not appear to be realized in the real world equilibrium."(Marceau, Mongrain and Wilson, 2007, pages 4-5).

Recent data (OECD, 2007) of taxes on capital show that some small countries set high tax rates (Ireland, Iceland, Luxembourg and San Marino) and that medium sized countries like Netherlands, Denmark and Austria set high tax rates as large countries. So the evidence is that there is no monotonic increasing relationship between the capital tax rates set by jurisdictions and their population size.

The model we develop in this paper allows for a non-monotonic pattern of tax rates by assuming that countries of unequal size compete for capital with taxes and public goods which improve firms' productivity.

The existing literature has already analysed the role of public goods differentiation in relaxing tax competition (Zissimos and Wooders, 2008). Accordingly, tax rate differentials between competing jurisdictions may persist at equilibrium. In the same vein, the stratification of countries in different tax classes can be explained by the the quality differentiation of public goods (van Ypersele and Thisse, 2001).

In our model, we consider two jurisdictions of uneven size. Size refers to the amount of productive resources available in a given jurisdiction. There is a one to one relationship between a firm, an entrepreneur/worker and a unit of capital (productive resource) and entrepreneurs are heterogeneous according to their willingness to move to a foreign country. Public goods are attractive since they are assumed to enhance the productivity of firms. Accordingly, entrepreneurs decide where to locate their firm according to differentials in offered public good levels and tax differentials. Competition between jurisdictions follows a two-stage game. First, governments decide about the level of public goods to supply, and then they set the tax rates[2] .

The main findings are summerized as follows.

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[2]Public goods in this context, cover a wide range of infrastructure, services or regulations supplied in a jurisdiction, by the local and/or central government. It is usually made a simplification thinking that a higher level of public goods is the "instrumental" variable for a better entrepreneurial environment. Indeed, there is a wide agreement among economists that institutions (See Bowles (2003) for a definition) and the entrepreneurship environment created by public goods play a crucial role on entrepreneurship. Indeed, the Oxford Handbook of Entrepreneurship (2007) argues that the abundance of entrepreneurs in a country depends, among other factors, from the rules, regulations, government

If capital mobility is high, small jurisdictions are not able to be attractive to foreign investments even if they opt for tax attractiveness unless they enjoy specific comparative advantages. If the level of capital mobility is intermediate, small countries win the competition for capital by supplying much higher public goods than larger jurisdictions and though they set high taxes. It follows that small jurisdictions can at the same time be tax hells and the destination for foreign capital. However, when mobility costs are high, we find that a small jurisdiction is induced to set lower taxes than larger countries in order to attract foreign investments. In this case we recover the classical result that small countries win the competition for capital because of low taxes.

Two conclusions can be drawn. The level of taxation on capital is not a sufficient measure for attractiveness and high taxes may persist because of the high level of public goods supplied to attract capital.

Related literature to our paper is given by Zissimoss and Wooders (2008) and Hindriks, Peralta and Weber (2008). Zissimos and Wooders (2008) address the inefficiency issues that may arise when jurisdictions compete both on 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 be true, since it depends on the size asymmetry of the competing jurisdictions and on the mobility cost of capital. Hindriks, Peralta and Weber (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 are different in attractiveness because one possesses a superior production technology. This asymmetry can be changed by public investments. The authors find that a region can be attractive for capital even if its capital taxes are higher than its rival but the 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,

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quality, property rights, accounting standards, disclosure requirements, etc. Furthermore, recent years have produced 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, 1998), Beck and Levine (2005), or Pieretti et al (2007) for the role of financial institutions on the competitive advantage of Luxembourg financial market.

to make tax competition less fierce, jurisdictions invest inefficiently in public goods. We do find the same inefficiency problem but the aim of our paper is different. We rather study how size asymmetry of countries and mobility cost can influence the equilibrium of the game.

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 in order to alleviate unemployment. At equilibrium the winner is the country which gains most in terms of employment for given transportation costs. Haufler and Wooten (1999) also consider competition for foreign investments by stressing the role of international trade costs and the "home market" effect. Since the authors consider an asymmetry between the size of home markets, the large country will have an advantage in attracting foreign capital. In both papers, a small economy can only be attractive for foreign investments if it underbids the larger one in terms of taxes or if it overbids it in terms of subsidies. In our paper, we however show that the small country can win the competition without being tax attractive.

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. Section 4 deals with attractiveness, while section 5 presents some efficiency issues. Section 6 concludes.

2   The model

Consider two jurisdictions ($i = h, f$) of uneven size. The term jurisdiction refers indistinguishably to different regions of the same country or to different countries provided that these entities have the power to tax. Size refers to the amount of productive resources available in a given jurisdiction. In this paper, available productive resources are defined as the number of capital-owners who are at the same time entrepreneurs and workers (one individual per firm). The capital-owner types in h (resp. f) are represented by the $[0, 1]$-interval with density s_h (resp. s_f in country f), $s_h + s_f = 1$. Entrepreneurs are heterogeneous to the extent of their willingness to live in a foreign country. They are ranked in their home country h in an increasing order of willingness to stay at home rather than moving to the foreign country.

Each entrepreneur is endowed with one unit of a capital good that combined with her own labor produces $q + a_i$, ($i = h, f$) units of a final good,

where q is the private component of (gross) productivity. This output good is sold on a competitive (world) market at a given price normalized to one. Assuming that both countries have equally access to a common market implies that the smallest jurisdiction does not suffer from a reduced home market. We further suppose that the unit production cost is constant. So we set it equal to zéro without loss of generality.

The fraction a_i, $(i = h, f)$ of the produced good depends on a public input supplied by jurisdiction $i = h, f$. This input may represent public infrastructures or regulations. We further assume that one additional unit of the public service produces one additional unit of the private good. It follows that a_i also represents the amount of public input supplied by jurisdiction $i = h, f$. Providing firms localized at $i = h, f$ with this public input is costly. The corresponding cost function is given by $C(a_i) = a_i^2$ $(i = h, f)$.

An entrepreneur of type $x_i, x_i \in [0, 1]$, either invests one unit of physical capital in his own country i, or she invests in the foreign jurisdiction $j \neq i, (j, i = h, f)$. Its profit is given by $\pi_i = q + a_i - t_i$, where t_i denotes the tax in country i levied per unit invested (private) capital[3]. The disutility of investing abroad for an entrepreneur of type x equals $k \cdot x$.

The cost k represents a unit cost of moving capital abroad. The parameter, k can 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 by being more tax and/or public-service attractive.

Type x_i located in one country, say in i, is indifferent between investing abroad, in country j, and staying at home when

$$q + a_i - t_i = q + a_j - t_j - kx_i,$$

which yields,

$$x_i(a_i, a_j, t_i, t_j) = \frac{1}{k} \left[(a_j - a_i) + (t_i - t_j) \right]^4. \tag{1}$$

If x_i is positive, jurisdiction j is the host jurisdiction for a set of entrepreneurs of jurisdiction i who have a disutility to move inferior to x_i.

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[3] For sake of simplicity, we shall assume that q is such that the profit of each firm is positive for any admissible level of public goods and taxes.

[4] Obviously, if j is the home country, then x_j obtains as follows
$x_j(a_i, a_j, t_i, t_j) = \frac{1}{k} \left[(a_i - a_j) + (t_j - t_i) \right].$

In this context, country j attracts entrepreneurs from jurisdiction i if the net gain of moving to j, i.e. $a_j - t_j$, is higher than the net gain obtained by staying in jurisdiction i, $a_i - t_i$, after taking into account the mobility cost. It follows also that attractiveness of jurisdiction j can be decomposed in two dimensions: tax attractiveness $\Delta_t = t_i - t_j$ and public good attractiveness, $\Delta_a = a_j - a_i$.

Definition 1 *A jurisdiction is tax attractive if it levies the lowest level of taxes on capital compared to other jurisdictions.*

Definition 2 *A jurisdiction is public good attractive if it supplies the highest level of public good services compared to other jurisdictions.*

The jurisdictions are assumed to maximize their tax revenue net of public investment cost. The payoff functions are given by

$$B_i(a_i, a_j, t_i, t_j) = s_i(1 - x_i)t_i - a_i^2, \qquad (2)$$
$$B_j(a_i, a_j, t_i, t_j) = ((1 - s_i) + s x_i) t_j - a_j^2. \qquad (3)$$

After substituting (1) in (2) and (3) we obtain

$$B_i(a_i, a_j, t_i, t_j) = -\frac{1}{k} s_i t_i^2 + \left[\frac{1}{k} s_i (a_i - a_j + t_j) + s\right] t_i - a_i^2, \qquad (4\text{a})$$

$$B_j(a_i, a_j, t_i, t_j) = -\frac{1}{k} s_i t_j^2 + \left[\frac{1}{k} s_i (a_j - a_i + t_i) + 1 - s_i\right] t_j - a_j^2. \qquad (4\text{b})$$

The two jurisdictions play a two stage game. First, they decide about the quantity of public goods to provide. Then, they select the level of taxes. The choice of sequentiality follows from the rule that the most irreversible decision has to be taken first. The game is solved through backward induction. Given, the couple (k, s_i), the SPNE of the game is defined as $(a_i(k, s_i), a_j(k, s_i), t_i(k, s_i), t_j(k, s_i))$.

2.1   The tax game

Each jurisdiction maximizes its budget with respect to its own tax rate, assuming that its rival's tax is given and the level of public services is fixed

in the first stage

$$\underset{t_i}{Max}B_i(t_i, t_j)$$
$$\underset{t_j}{Max}B_j(t_i, t_j)$$

The first order conditions yield the following the best reply functions

$$
\begin{aligned}
t_i(t_j) &= \frac{t_j}{2} + \frac{(a_i - a_j)}{2} + \frac{k}{2}, \\
t_j(t_i) &= \frac{t_i}{2} + \frac{(a_j - a_i)}{2} + \frac{1 - s_i}{s_i}\frac{k}{2}.
\end{aligned}
$$

The objective functions are strictly concave in t_i and t_j ($\frac{\partial^2 B_{i(j)}}{\partial t^2_{i(j)}} = -\frac{2s_{i(j)}}{k} < 0$).
The best reply functions are increasing and have slopes smaller than one.
Accordingly, there exists a unique equilibrium in tax rates. So, we get

$$\widetilde{t}_i(a_i, a_j) = \frac{(a_i - a_j)}{3} + \frac{1}{3}\frac{1 + s_i}{s_i}k, \tag{5a}$$

$$\widetilde{t}_j(a_i, a_j) = \frac{(a_j - a_i)}{3} + \frac{1}{3}\frac{2 - s_i}{s_i}k \tag{5b}$$

Substituting these values in (4a) and (4b), we finally have

$$
\begin{aligned}
B_i(a_i, a_j) &= -\frac{9k - s_i}{9k}a_i^2 + \frac{2}{9k}\left[k(1 + s_i) - s_i a_j\right]a_i + \frac{1}{9ks}\left[k(1 + s_i) - s_i a_j\right]^2, \\
B_j(a_i, a_j) &= -\frac{9k - s_i}{9k}a_j^2 + \frac{2}{9k}\left[k(2 - s_i) - s_i a_i\right]a_j + \frac{1}{9ks_i}\left[k(2 + s_i) - s_i a_i\right]^2.
\end{aligned}
$$

2.2   Competition on public goods

At the first stage, each jurisdiction maximizes its budget with respect to its
own public input service by assuming that its rival's public supply is given

$$\underset{a_i}{Max}B_i(a_i, a_j)$$
$$\underset{a_j}{Max}B_i(a_i, a_j)$$

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From the first order conditions, the resulting best replies write as

$$a_i(a_j) = -\frac{s_i}{9k-s}a_j + \frac{k(1+s_i)}{9k-s_i}, \tag{6}$$

$$a_i(a_j) = -\frac{s_i}{9k-s_i}a_i + \frac{k(2-s_i)}{9k-s_i}. \tag{7}$$

In the following, we assume that $9k - s_i > 0$ ($k > \frac{s_i}{9}$). Accordingly, the objective functions are strictly concave in t_h and t_f ($\frac{\partial^2 B_{i(j)}}{\partial a_{i(j)}^2} = -\frac{9k-s_i}{9k} < 0$) and public goods are strategically substitutes. The equilibrium in public services obtains as

$$a_i^*(s_i, k) = \frac{1}{3}\frac{3k(1+s_i) - s_i}{9k - 2s_i} \tag{8}$$

$$a_j^*(s_i, k) = \frac{1}{3}\frac{3k(2-s_i) - s_i}{9k - 2s_i} \tag{9}$$

Introducing equilibrium public services into equations (5a) and (5b) yields equilibrium tax rates

$$t_i^*(s_i, k) = k\frac{3k(1+s_i) - s_i}{s_i(9k - 2s_i)}, \tag{10}$$

$$t_j^*(s_i, k) = k\frac{3k(2-s_i) - s_i}{s_i(9k - 2s_i)}. \tag{11}$$

In appendix 1, we derive the conditions for which both taxes and public goods are positive. Substituting the difference in tax rates and institutions and infrastructure quality in (1) we obtain that the flow of entrepreneurs quitting i and moving to j, writes as

$$x_i^*(s, k) = \frac{(1 - 2s_i)(s_i - 3k)}{s_i(9k - 2s_i)}$$

It follows that when $s_i \in (0, \frac{1}{2}[$, we have $x_i^* > 0$, if $\frac{2s_i}{9} < k < \frac{s_i}{3}$; while when $s_i \in [\frac{1}{2}, \infty)$, $x^* > 0$ if $k > \frac{s_i}{3}$ and $k < \frac{2s_i}{9}$. We now introduce size asymmetry between the two jurisdictions. Thus, we assume, without loss of generality, that h is the smallest country ($0 \leq s_h < \frac{1}{2}$). From now on we assume for simplicity that $s_h = s$ and $s_f = 1 - s$. The following lemma may be deduced.

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Lemma 3 *When $s_i = s$ and $s_j = 1 - s$, there is an inflow of entrepreneurs into the large jurisdiction (f) if*

$$k \in \left[\frac{s}{3(1+s)}, \frac{s}{3} \right).$$

When $s_i = 1 - s$ and $s_j = s$, there is an inflow of entrepreneurs into the small jurisdiction (h) if

$$k \in \left\{ \left(\frac{1-s}{9}, \frac{1-s}{3(2-s)} \right] \cap \left[\frac{1-s}{3}, \infty \right) \right\}.$$

Notice that at this stage the nature of attractiveness is not precised. This issue will be addressed in section (3).

In this paper, the types of entrepreneurs in one jurisdiction differ for 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 entrepreneurs decide to leave i, it is not possible, that for the same parameters (s, k), there are entrepreneurs quitting j.Therefore, if the sets defined in lemma 3 intersect, there may be multiple equilibria[5]. This does however not occur if jurisdictions differ sufficiently in size. Indeed it is easy to check that a sufficient condition is that $0 \leq s < \frac{1}{4}$. In other words, if jurisdictions sufficiently differ in size, the SPE is unique. That is the assumption we will make from now on because we are particularly interested in very small jurisdictions. Accordingly, the intervals given in Lemma 3 are ordered in the following way. In the interval $\left[\frac{s}{3(1+s)}, \frac{s}{3} \right)$, mobility costs will be said *low, moderate* in the interval $\left(\frac{1-s}{9}, \frac{1-s}{3(2-s)} \right]$ and *high* in $\left[\frac{1-s}{3}, \infty \right)$. It thus follows from the above lemma that very small jurisdictions cannot be attractive to foreign investments if capital mobility is high enough unless these jurisdictions enjoy a specific comparative advantage [6]. It is straightforward to calculate and show that public rents for each jurisdiction are positive, under the assumption we have made that $k > \frac{s_i}{9}$.

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[5] If the constellation of parameters is such that multiple equilibria occur, other conditions (not taken into account in our model) like expectations of entrepreneurs, governement credibility, political stability may reduce this indeterminancy.

[6]It is not meaningless to notice that smallness may be a source of comparative advantage. Small economies are likely to have greater cohesion and thus social flexibility and openness to change (Kuznets, 1960). These attributes create conditions of political and social stability and absence of bureaucratic red tape what may give very small economies

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3   Properties of the equilibrium: tax h(e)avens and tax hells[7]

Size difference between jurisdictions induces asymmetric equilibrium taxes and public inputs. Indeed, using equations (8), (9), (10) and (11), we get

$$\Delta_a^* = a_i^*(s_i, k) - a_j^*(s_i, k) = k\frac{2s_i - 1}{9k - 2s_i}, \qquad (12)$$

$$\Delta_t^* = t_i^*(s_i, k) - t_j^*(s_i, k) = \frac{3k^2(2s_i - 1)}{s_i(9k - 2s_i)}. \qquad (13)$$

Kanbur and Keen (1993) show that a small jurisdiction does always fix lower taxes than a larger one when there is competition in commodity taxes. The reason is that the small jurisdiction faces a greater potential of cross border shoppers and is thus confronted with a more (tax) elastic demand (if tax rates were identical).

In our model, firms face the following capital supplies :

$$S_i(t_j/t_i, a_i, a_j) = s_i - x_i(t_j/t_i, a_i, a_j) = s_i - \frac{1}{k}\left[(a_i - a_j) + (t_j - t_i)\right], \quad (14)$$

$$S_j(t_j/t_i, a_i, a_j) = 1 - s_i + x_i(t_j/t_i, a_i, a_j) = 1 - s_i + \frac{1}{k}\left[(a_j - a_i) + (t_i - t_j)\right] \quad (15)$$

Accordingly we get the following tax elasticities:

$$\epsilon_j = \frac{\partial S_j}{\partial t_j}\frac{t_j}{S_j} = -\frac{1}{k}\frac{t_j}{1 - s_i + \frac{1}{k}\left[(a_j - a_i) + (t_i - t_j)\right]} \qquad (16)$$

$$\epsilon_i = \frac{\partial S_i}{\partial t_i}\frac{t_i}{S_i} = -\frac{1}{k}\frac{t_i}{s_i + \frac{1}{k}\left[(a_i - a_j) + (t_j - t_i)\right]} \qquad (17)$$

If taxes are equalized and public goods are not differentiated ($t_i = t_j = t$; $a_j = a_i$) , the smallest jurisdiction, say $s_i = s_h$, will face the most elastic capital supply since, $|\epsilon_f| = \frac{1}{k}\frac{t}{1 - s_h} < |\epsilon_h| = \frac{1}{k}\frac{t}{s_h}$ when $0 \leq s_h < \frac{1}{2}$. We thus recover the case of Kanbur and Keen (1993). If we now assume that jurisdictions offer different public good levels ($a_j \neq a_i$) it is no more true

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a comparative advantage in attracting foreign firms (Kuznets, 1960; Streeten, 1993).

[7]We borrow this termonology from Hansen and Kessler (2001).

that the smallest country will always fix the lowest tax rate. Assume that the small jurisdiction has a competitive advantage in terms of public inputs ($a_h - a_f > 0$). If this advantage is sufficiently high ($a_h - a_f > \tilde{\Delta}_a = \frac{k}{2}(1 - 2s_h)$), we get $|\epsilon_f| = \frac{1}{k}\frac{t}{1-s+\frac{1}{k}(a_f-a_h)} > |\epsilon_h| = \frac{1}{k}\frac{t}{s+\frac{1}{k}(a_h-a_f)}$ for $t_h = t_f = t$. This creates an incentive for the big jurisdiction to cut its taxes. So we may observe that *small jurisdictions can be tax hells, or big jurisdictions can be tax h(e)avens.* Note that the threshold ($\tilde{\Delta}_a = \frac{k}{2}(1 - 2s_h)$) above which the small jurisdiction has to differentiate decreases with increasing international integration (a lower k).

4   Size and attractiveness

In this section, we show that there exists equilibria where small and/or big jurisdictions may be attractive for foreign capital but not necessarily due to tax motives. For that reason, let us start by analysing the relationship between the size jurisdictions and their capacity to attract foreign entrepreneurs.

Proposition 4 *If a big jurisdiction attracts foreign capital it may only be attractive in terms of public-goods.*

Proof.   Consider the first part of the lemma (3). Since foreign investment

stems from the small jurisdiction say h, $s_i = s_h = s$, it is required that $k \in \left[\frac{s}{3(1+s)}, \frac{s}{3}\right)$. Since $k > \frac{s}{3(1+s)} > \frac{2s}{9}$, it follows from equations (8), (9), (10) and (11)that $t_h^* < t_f^*$ and $a_f^* > a_h^*$.   ■

We thus see that for the range of parameter values given by $k \in \left[\frac{s}{3(1+s)}, \frac{s}{3}\right)$ the small country's best tax strategy is to undercut the big country at equilibrium. This result is reminiscent of Keen and Kanbur (1993), but with the proviso, that the small country is not successful in attracting foreign investments even if it engages in tax haven behaviour. Indeed, we see that the big country's relative attractiveness in terms of public inputs outweighs the small country's tax attractiveness. The intuition behind that aggressive behavior of the big country could be explained as follows. At equilibrium, the jurisdiction f considers that the capital mobility is high enough to pose a threat for potential tax base losses. Consequently, it has an incentive to

react strongly by supplying a much higher level of public goods than its rival. In other words, if the big country wants to maximize its rent it cannot counteract the small country by trying to undercut its taxes.

This behaviour can explain the persistence of high taxes in big jurisdictions. Indeed, high level of taxation may be essential for these countries to be able to supply high level of public services to attract foreign capital. This result is the same as in Zissimos and Wooders (2008) but the mechanism is different.

As far as small jurisdictions are concerned, we may state the following results

Proposition 5 *A small jurisdiction is attractive to foreign investors:*

(i) in terms of public goods, notwithstanding its high taxes if the level of mobility cost is intermediate.

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

Proof. Consider the second point of Lemma (3). Since foreign investment

stems from the big jurisdiction say f, $s_j = s_f = 1 - s$,

(i) for intermediate k, we get $t_h^* > t_f^*$ and $a_h^* > a_f^*$ since $k \leq \frac{1-s}{3(2-s)} < \frac{2s}{9}$

(ii) for high k, we get $t_h^* < t_f^*$ and $a_h^* < a_f^*$ since $k \geq \frac{1-s}{3(2-s)} > \frac{2s}{9}$. ∎

When the mobility cost is intermediate, namely $k \in \left[\frac{s}{3(1+s)}, \frac{s}{3} \right)$, the big jurisdiction undercuts in taxes its small rival but it is not successful in attracting foreign capital. The reason is that the small jurisdiction counteracts by supplying a much higher level of public goods. For that intermediate constellation of mobility costs, we obtain the opposite result to Proposition 4 where it was the big country which was attractive in termes of public goods.

The small jurisdiction which does not undercut in taxes builts its attractiveness on the public-good advantage because the incentive of cross-bordering is not high enough.

When mobility cost is high ($k \in \left[\frac{s}{3}, \infty \right)$), the tax base is captive. This leads the big jurisdiction to select high taxes, inducing the small one to be a tax h(e)aven.

To summarize our results, *(i)* a tax hell can be attractive for firms and *(ii)* small jurisdictions can be tax hells as well as tax h(e)avens. Therefore, small countries may be attractive to entrepreneurs as tax h(e)avens or tax

hells, according to the degree of international integration. Accordingly, small jurisdictions select either taxes or public goods as instrument for international attractiveness.

Finally we address the question if more provision of public goods induce more capital taxation. Deriving Δ_a^* and Δ_t^* with respect to k, we find no monotonic relationship[8]. When $k \in \left[\frac{1-s_h}{3}, \infty\right)$ we obtain $\frac{\partial \Delta_a^*}{\partial k} < 0$, but $\frac{\partial \Delta_t^*}{\partial k}$ can be positive or negative. Therefore, in this interval of parameters (s, k) a higher mobility leads jurisdictions to differentiate in public goods, but taxes may not follow the same path since a higher k, can cause a reduction of Δ_t^*. Indeed when $k \in \left[\frac{1-s_h}{3}, \infty\right)$, as mobility cost falls, the big jurisdiction may need to increase its level of public goods and decrease its taxes to contain the outflow of entrepreneurs. This strategic move leads to a higher gap Δ_a^* and a smaller Δ_t^*. In all the other admissible sets of k, jurisdictions continue to increase their differentiation increasing the gap Δ_a^*, as k decreases, relaxing tax competition.

To conclude, there is an interval of parameter values of k such that an increase in capital mobility increases tax competition even if jurisdictions differentiate in public goods.

4.1 Is competition for capital efficient ?

In this section we focus on efficiency. Assume that there exists a central planner that wants to set the optimal level of taxes and public goods for both jurisdictions, as if it was a federal governement. The planner maximizes the total surplus Θ, namely the jurisdictions' rents [9] and the firms's profits net of mobility costs

$$
\begin{aligned}
\underset{a_i, a_j}{Max} \Theta(a_i, a_j) \quad = \quad & s_i(1 - x_i)(1 + a_i) + [1 - s_i(1 - x_i)]\,)\,(1 + a_j) - a_i^2 - a_j^2 \\
& - s_i \int_{x_i}^{s_i} kydy
\end{aligned}
$$

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[8]See Appendix 2 for the derivatives.

[9]Notice that differently from Zissimos and Wooders (2008), we assume that the benevolent planner can maximise total welfare by deciding on the provision of public goods in each jurisdiction, but she does not decide on the level of foreign direct investment. This level is chosen by the entrepreneurs, given the level of efficient public goods.

Maximizing with respect to the level of public goods that each country should provide, we obtain the following efficient amounts :

$$a_i^e = \frac{1}{2}s_i - \frac{1}{2}s_i x_i,$$

$$a_j^e = \frac{1}{2}s_i x_i - \frac{1}{2}s_i + \frac{1}{2}$$

These values induce a flow of entrepreneurs moving from country i to country j equal to:

$$x_i^* = \frac{1}{s_i}\left(s_i - \frac{1}{2}\right).$$

which is nonnegative only if $s_i \geq \frac{1}{2}$. This condition implies that the efficient migration of capital takes place from the large country to the small one. Given x_i^*, the efficient provision of public goods equals $\frac{1}{4}$ for each country. It follows that jurisdictional competition for capital does not lead to an efficient equilibrium. Indeed, using equations (8) and (9), we show in the appendix 3 that $a_i^* < \frac{1}{4}$ and $a_j^* < \frac{1}{4}$. The intuition is to be found in the sequentiality of the game. When jurisdictions compete to attract capital, they compete on public goods as well as on taxes. They end up supplying an inefficient quantity of public goods because they anticipate in the first stage of the game that they will compete in taxes in the second stage (see Zissimos and Wooders, 2008 and Hindriks, Peralta and Weber, 2008, for a similar result). Nonetheless, the level of taxes is higher than the one resulting if jurisdictions had to compete only on taxes[10].

5   Conclusions

This paper investigates the relationship between country size and attractiveness to international capital. Attractiveness is built through public goods or services that improve firms' productivity and low taxes on capital. Entrepreneurs face different costs of mobility according to their willingness to locate their capital in a foreign country. We show that when mobility cost is low and intermediate, a jurisdiction can only be attractive through the supply of

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[10]A game of only one stage where jurisdiction compete on taxes, yields $\hat{t_j} = \frac{1}{3s_i}(2k - ks_i)$ and $\hat{t_i} = \frac{1}{3s_i}(k + ks_i)$. It is easy than to see that $\hat{t_i} - \hat{t_j} < t_i^* - t_j^*$.

higher levels of public goods and not through lower taxes. However, adopting a tax haven behaviour may only be a winning strategy if mobility cost is high enough. Another important conclusion is that small jurisdictions may attract international capital by supplying a high level of public goods and without being tax havens. For this equilibrium to occur we show that the cost level of mobility has to be intermediate and that no comparative advantage specific to small country size is necessary.

The 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, in order to check the effects of preferential taxation, namely, the switch of the burden of taxes on less mobile factors.

6 Appendix

Appendix 1

In this appendix we derive the conditions where taxes and public goods are nonnegative. Given $s \in (0,1)$ and the condition $k > \frac{s}{9}$, the feasibility set of the parameter k is defined by the conditions of nonnegativity of (a_i^*, t_i) and $(a_j^*, t_j^*)^{11}$. The variables chosen by country i are nonnegative if

$$\left\{ \left(k > \frac{s}{3(1+s)} \right) \cap \left(k > \frac{2s}{9} \right) \right\} \cup \left\{ \left(k < \frac{s}{3(1+s)} \right) \cap \left(k < \frac{2}{9}s \right) \right\}.$$

While the variables chosen by country j are nonnegative if

$$\left\{ \left(k > \frac{s}{3(2-s)} \right) \cap \left(k > \frac{2s}{9} \right) \right\} \cup \left\{ \left(k < \frac{s}{3(2-s)} \right) \cap \left(k < \frac{2}{9}s \right) \right\}.$$

Hence, (a_h^*, t_h^*) and (a_f^*, t_f^*) are both acceptable if:

$$\left(k > \frac{s}{3(1+s)} \right) \cup \left(k < \frac{s}{3(2-s)} \right) \quad \text{when } s \ \in \ (0, \frac{1}{2}],$$

$$\left(k > \frac{s}{3(2-s)} \right) \cup \left(k < \frac{s}{3(1+s)} \right) \quad \text{when } s \ \in \ (\frac{1}{2}, 1[.$$

Appendix 2

In this section of the appendix we analyze the derivative of public-goods difference, Δ_a^* and tax difference, Δ_t^*. Lemma 3 says: When $s_i = s_h$ and $s_j = s_f$, the big jurisdiction f is the destination of entrepreneurs if

$$k \in \left[\frac{s_h}{3(1+s_h)}, \frac{s_h}{3} \right).$$

When $s_i = s_f$ and $s_j = s_h$, the small jurisdiction h is the destination if

$$k \in \left\{ \left(\frac{1-s_h}{9}, \frac{1-s_h}{3(2-s_h)} \right] \cap \left[\frac{1-s_h}{3}, \infty \right) \right\}.$$

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[11]Note that we are addressing attractiveness when countries do not subsidy entrepreneurs. In fact, we are requiring jurisdictions to be attractive when they tax capital. Consequently, the set of parameters for which we define for attractiviness of the small country can be even higher if this country could subsidy.

We found that tax and public attractiveness write as

$$\Delta_a^* = a_i^*(s,k) - a_j^*(s,k) = k\frac{2s_i - 1}{9k - 2s_i},$$

$$\Delta_t^* = t_i^*(s,k) - t_j^*(s,k) = \frac{3k\,(2s_i - 1)}{s_i\,(9k - 2s_i)}k$$

We know study the sign of the derivative wrt to k of the above variables, in each of the intervals of k where an equilibrium is defined

1. When $s_i = s_h$ and $s_j = s_f$; $\Delta_a^* = a_h - a_f < 0$; and $\Delta_t^* = t_h^*(s,k) -$

$t_f^*(s,k) < 0$ therefore, s_f (BIG) is attractive for entrepreneurs because of its high public goods, and the equilibrium is defined in $k \in \left[\frac{s_h}{3(1+s_h)}, \frac{s_h}{3}\right)$.

$\frac{\partial \Delta_a^*}{\partial k}\left(-k\frac{2s_h - 1}{9k - 2s}\right) = 2\,(9k - 2s)^{-2}\,(2s_h - 1)\,s < 0$

$\frac{\partial \Delta_t^*}{\partial k}\left(-\frac{3k(2s - 1)}{s(9k - 2s)}k\right) = (3)\,(2s_h - 9k)^{-2}\,(9k - 4s_h)\,(1 - 2s_h)\,\frac{k}{s_h} < 0$

When $(9k - 4s_h) > 0 \Rightarrow \frac{\partial \Delta_t^*}{\partial k} > 0 \Rightarrow \frac{4}{9}s_h < k$. But $k > \frac{4}{9}s_h$ is never the case in $\left[\frac{s_h}{3(1+s_h)}, \frac{s_h}{3}\right)$. So $\frac{\partial \Delta_t^*}{\partial k} < 0$. Hence, when the big jurisdiction is attractive for its high level of public goods there is *comovement* of tax and public attractiveness.

2. $\Delta_a^* = a_f - a_h > 0$; and $\Delta_t^* = t_f^*(s,k) - t_h^*(s,k) > 0$ the big s_f looses because of its taxes: the equilibrium is in $\left[\frac{1-s_h}{3}, \infty\right)$.

$\frac{\partial}{\partial k}\left(k\frac{2s_f - 1}{9k - 2s_f}\right) = -2s_f\frac{2s_f - 1}{\left(9k - 2s_f\right)^2} < 0$

$\frac{\partial}{\partial k}\left(\frac{3k(2s_f - 1)}{s(9k - 2s_f)}k\right) = 3\frac{k}{s_f}\frac{2s_f - 1}{\left(9k - 2s_f\right)^2}(9k - 4s_f)$

As far as it concerns taxes, in this case, $k \in \left(\frac{4}{9}s_f, \infty\right)$ or $\left(\frac{4}{9}(1 - s_h); \infty\right)$, $\Rightarrow \frac{\partial \Delta_t^*}{\partial k} > 0$ is *not always true* in $\left[\frac{1-s_h}{3}, \infty\right)$, because $\frac{4}{9}(1 - s_h) > \frac{1-s_h}{3}$. Hence, for $k \in \left(\frac{1-s_h}{3}; \frac{4}{9}(1 - s_h),\right)$ there is comovement in the same direction. But for $k \in \left(\frac{4}{9}s_f, \infty\right)$, we have $\frac{\partial \Delta_a^*}{\partial k} < 0$ and $\frac{\partial \Delta_t^*}{\partial k} > 0$.

3. $\Delta_a^* = a_f - a_h > 0$; and $\Delta_t^* = t_f^*(s,k) - t_h^*(s,k) > 0$, the big s_f looses for its low public goods level and the equilibrium is defined in $\left(\frac{1-s_h}{9}, \frac{1-s_h}{3(2-s_h)}\right)$

.

In the set $\left(\frac{1-s_h}{9}, \frac{1-s_h}{3(2-s_h)}\right)$ it is never the case that $k \in \left(\frac{4}{9}(1-s_h), \infty\right)$, so it always the case that $\frac{\partial \Delta t}{\partial k} < 0$.

Appendix 3.

We want to proove that $a_i(k, s_i) = \frac{1}{3} \frac{3k(1+s_i)-s_i}{9k-2s_i} < \frac{1}{4}$ for all $k \in [0, +\infty)$ and $s_i \in [0, 1]$. For that purpose, let us derivate $a_i(k, s_i)^{12}$ wrt to k. It follows that $\frac{\partial a_i}{\partial k} = (9k - 2s_i)^{-2} (1 - 2s_i) s_i$.

A) $s_i > \frac{1}{2}$. Accordingly $\frac{\partial a_i}{\partial k}$ is negatively signed and a_i is a monotone decreasing function of k. Since we have $a_i(k, s_i) < \frac{1}{4}$ is verified for $k = 0$ (since $a_i(0, s_i) = \frac{1}{2}$) it is verified for all $k \in [0, +\infty)$.

B) $s_i < \frac{1}{2}$. Accordingly $\frac{\partial a_i}{\partial k}$ is positively signed and a_i is a monotone increasing function of k. Since we have $a_i(k, s_i) < \frac{1}{4}$ for $k \to +\infty$, the inequality holds for all $k \in [0, +\infty)$.

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