

# Tax Competition with Heterogeneous Capital Mobility\*

Steeve Mongrain  
Simon Fraser University

John D. Wilson  
Michigan State University

February 19, 2014

---

\*We are grateful to IEB for its financial support. We would like to thank May Elsayyad, Jonathan Hamilton, Leonzio Rizzo, and Tanguy van Ypersele, as well as participants to the 2011 Journée Louis André Gérard Varet, the IEB IV Workshop on Fiscal Federalism, and the GREQAM seminar, for useful comments on earlier versions of this paper. The usual disclaimer applies.

# 1 Introduction

A controversial issue in the study of tax competition is whether it is desirable for countries or regions to agree not to provide preferential treatment to different forms of capital. The common view is that without such restrictions, countries will aggressively compete for capital that is relatively mobile across different locations, resulting in taxes that are far below their efficient level. By eliminating such preferential treatment, no capital will be taxed at very low rates, because doing so would sacrifice too much tax revenue from the relatively immobile capital. But this solution is not without cost: in an attempt to attract mobile capital, governments can be expected to reduce the common tax rate below the tax at which relatively immobile capital would be taxed in the preferential case. In an important paper, Keen (2001) analyzes this tradeoff using a model in which two identical regions compete over two tax bases that exhibit different degrees of mobility. He finds that governments raise more revenue when the more mobile tax base gets preferential treatment. On the other hand, Haupt and Peters (2005) introduce a preference for investing in the home country, referred to as "home bias," and show that non-preferential regimes lead to higher tax revenue. It is surprising that this seemingly minor assumption changes completely the desirability of one regime versus the other.

Attacking the issue from a different angle, Janeba and Peters (1999) show that the elimination of preferential treatment leads to higher total tax revenues in a context where one of the tax bases is infinitely elastic with respect to cross-country differences in tax rates, in contrast to the finite elasticity assumptions employed by Keen (2001) and Haupt and Peters (2005). The importance of this tax-base elasticity is also apparent in the subsequent papers that have generalized and extended the comparison between preferential and non-preferential regimes, including Wilson (2005), Konrad (2007), and Marceau, Mongrain and Wilson (2010).

Keen (2001) and Haupt and Peters (2005) cannot analyze the case where one of the tax base elasticities approaches infinity, because pure-strategy equilibria do not exist under their assumption of identical regions. In contrast, Wilson (2005) and Marceau, Mongrain and Wilson (2010) address the existence problem by considering mixed-strategy equilibria, and obtain results supporting Janeba and Peters (1999). In particular, the non-preferential regime raises more revenue than the preferential regime. This result further demonstrates the importance of tax base elasticities, because both of these

papers share the assumption that the mobile tax base is infinitely elastic, in contrast to Keen (2001). Janeba and Smart (2003) investigate a more general model than is typically found in the literature on tax-base discrimination, allowing them relate the comparison of the two regimes not only to how the tax bases respond to differences in tax rates across regions, but also how these tax bases respond to a uniform increase in both regions' tax rates.

In the current paper, we further investigate the conditions under which limiting preferential treatment of particular tax bases is desirable. But we depart from much of the literature in two important ways, and we obtain new results that differ significantly from those in the literature. First, we replace the assumption that regions seek to maximize tax revenue, which is assumed in all of the papers reviewed above, with the more balanced view that regions also care about the "surplus" obtained in the private sector. Our second departure from the usual framework is shared by the Haupt-Peters paper: firms are distinguished by their region of origin, producing a "home bias effect." But we fill in the microfoundations for this home bias effect by assuming that firms differ in their cost of relocating from one region to another. In doing so, we are able to demonstrate how the ranking of the two regimes depends critically on the distribution of moving costs.

We consider a two-region world in which each region initially possesses a stock of "domestic firms," which must incur a cost to relocate to the other region. The "foreign firms" that the region seeks to attract are the other region's domestic firms. In the special case of uniform moving costs, we not only find that the non-preferential regime is preferred, but we are also able to quantify how much more tax revenue it raises. If we further specialize the model by assuming revenue-maximizing regions, this difference in revenues becomes very large. But it declines when private surplus receives significant weight in the regional objective function.

Perhaps our most surprising finding involves the conditions under which the preferential regime is preferred, as in Keen (2001) but in contrast to Haupt-Peters (2005). The main surprise is that these conditions are not that tax bases are sufficiently inelastic with respect to interregional differences in tax rates – recall the message from the previous literature that the desirability of the preferential regime depended strongly on tax bases not being highly elastic – but that the tax bases are sufficiently *elastic*. This result is proved for the case of two identical regions. In this case, the preferential regime turns out to be preferable when there are a large number of firms with low moving costs, implying that these firms are highly responsive

to small differences in tax rates between regions. In the non-preferential case, both regions set the same tax rates in the Nash equilibrium, so no firms move in equilibrium. However, each region has a large incentive to reduce its tax rate by a small amount, since it can then obtain the large number of firms with low moving costs; that is, the tax-base elasticity is high. This undercutting drives down the common equilibrium tax rate. In contrast, a significant number of firms move between regions in the equilibrium for preferential case, because each region has an incentive to set its rate on foreign firms discretely below the tax rate on its domestic firms, in an effort to induce some foreign firms to operate within its borders. Thus, the marginal firm is no longer a firm with small moving costs. Without a relatively large number of firms at the margin, there is less downward pressure on tax rates in the preferential case.

A crucial insight here is that the relevant responsiveness of firms to small changes in tax rates from their equilibrium levels can differ significantly between the two tax regimes. If there are relatively many firms with low moving costs, then firm location is very sensitive to small tax changes around the symmetric equilibrium for the non-preferential regime. But this responsiveness is then relatively low at the margin in the preferential case, where each region sets different tax rates on domestic and foreign tax firms, implying that the marginal firm does not have a low moving cost.

From a policy perspective, these results call into question the view that preferential tax treatment of particular types of firms or capital should be limited as a result of the increasing integration of the world economy, given that this integration includes lots of firms with low moving costs.

We also investigate the effects of asymmetries in the sizes of regions, measured by their relative numbers of domestic firms, along with how the results depend on the relative weights given to tax revenue and private surplus in the welfare function. An important insight here is that the difference in equilibrium welfare levels for the two regimes disappears as one region becomes infinitesimally small relative to the other. This result suggests that the problems created by the existence of tiny tax havens cannot be solved by requiring the non-preferential treatment of different tax bases.

The plan of this paper is as follows. First, we describe the basic features of the model. We then analyze the properties of a non-preferential regime, followed by the properties of a preferential regime. Finally, we compare the two systems. A final section provides concluding remarks.

## 2 The Model

The economy contains two regions, indexed by  $i \in \{1, 2\}$ , and a mass of firms of size  $2N$ . In each region, there are  $N_i$  domestic firms. Each firm in region  $i$  generates  $\gamma \geq 1$  of before-tax profits for its owners. Profits are taxed where they are earned. All firms have the possibility of moving, but face different moving costs  $c$ . Moving costs are distributed between zero and one according to a cumulative distribution function,  $F(c)$ , and the corresponding density distribution function,  $f(c)$ . Thus, any movement of firms from one region to another is based on tax considerations, and will therefore result in the expenditure of socially wasteful moving costs. One could also interpret those moving costs as location-specific productivity. A firm with a zero moving cost would be equally productive in both regions, while a firm in region  $i$  with high moving cost would correspond to a firm with a high suitability toward region  $i$ .

Regions care about both public funds generated by tax revenue and private surplus. Define  $W^i(R^i, \Pi^i)$  as the region  $i$  objective function, where  $R^i$  is total tax revenue and  $\Pi^i$  is total private surplus generated by firms located in region  $i$ , given the tax policy. We assume that this objective function is the same across regions and displays constant marginal benefits in both arguments. Consequently, we can define  $W(R^i, \Pi^i) = \omega R^i + \Pi^i$ , where  $\omega$  is the marginal benefit of tax revenue, and the marginal benefit of the private surplus is normalized to equal one. Under the government's optimal tax policy,  $\omega$  will equal the marginal cost of government revenue, in units of numeraire private surplus. Using common terminology,  $\omega$  then equals the marginal cost of public funds, and the excess of  $\omega$  over one is the excess burden associated with raising revenue. Tax revenue maximization is a special case where  $\omega$  goes to infinity, in which case private sector income receives no weight in the government's objective function.

We will also consider regional size differences. Region 1 is initially endowed with at least as many firms as region 2, so  $N_1 \geq N_2$ . We define  $n \in [1/2, 1]$  as an index of size heterogeneity between the two regions, where  $N_1 = n2N$ , and  $N_2 = (1 - n)2N$ . If both regions have the same size, then  $n = 1/2$ ; heterogeneity grows as  $n$  increases.

Some restrictions on the distribution of moving costs are desirable. More specifically,  $f'(c)/f(c) \in [-1/\gamma, 1/\gamma]$  guarantees the existence and the unique-

ness of an equilibrium.<sup>1</sup> This condition is sufficient, but not necessary, and simply excludes distribution functions with large peaks and valleys. As a source of examples, we will use the density function,  $f(c) = (1 - \beta) + 2\beta c$ , where  $\beta \in [-1, 1]$ . Note that  $f'(c) = 2\beta$ , so  $\beta > 0$  represents an increasing density function, while  $\beta < 0$  represents a decreasing density function. The uniform distribution function is represented by  $\beta = 0$ . The cumulative distribution function,  $F(c) = (1 - \beta)c + \beta c^2$ , is quadratic, with  $F(0) = 0$  and  $F(1) = 1$ . Finally, existence and uniqueness of a pure strategy equilibrium is guaranteed if  $\beta$  rests between plus and minus  $\frac{1}{1+2\gamma}$ .

The timing is as follows. First, regions choose their tax rates and all firms draw a moving cost. Then firms chose whether to move or remain in their initial location. Finally, production occurs and taxes are collected.

### 3 Non-Preferential Regime

Under a non-preferential regime, each region  $i \in \{1, 2\}$  sets a unique tax rate  $t_i$  for all firms, regardless of whether a firm is already in the region (domestic firms) or just moved to the region (foreign firms). For any given  $t_i \geq t_j$ , a firm in region  $i$  stays in region  $i$  as long as  $[1 - t_i]\gamma \geq [1 - t_j]\gamma - c$ . Thus, only firms with  $c \geq (t_i - t_j)\gamma$  stay in region  $i$ . If  $t_i < t_j$ , firms in region  $j$  move to region  $i$  whenever  $c < (t_i - t_j)\gamma$ . Total tax revenue in region  $i$  is denoted by  $R^i(t_i, t_j)$ , and is given by

$$\begin{aligned} R^i(t_i, t_j) &= \gamma t_i N_i \left[ 1 - F((t_i - t_j)\gamma) \right] \text{ if } t_i \geq t_j; \\ &= \gamma t_i N_i + \gamma t_i N_j F((t_j - t_i)\gamma) \text{ if } t_i < t_j. \end{aligned} \quad (1)$$

Total surplus  $\Pi^i(t_i, t_j)$  from domestic and foreign firms located in region  $i$  is given by

$$\begin{aligned} \Pi^i(t_i, t_j) &= \gamma_i (1 - t_i) N_i \left[ 1 - F((t_i - t_j)\gamma) \right] \text{ if } t_i \geq t_j; \\ &= \gamma_i (1 - t_i) \left[ N_i + N_j F((t_j - t_i)\gamma) \right] \\ &\quad - N_j \int_0^{(t_j - t_i)\gamma} c f(c) dc \quad \text{ if } t_i < t_j. \end{aligned} \quad (2)$$

---

<sup>1</sup>See Lemma 1 and 2 for formal proofs

As stated before, we assume that governments care about private surplus generated by firms (domestic or foreign) who are in or just moved to the region for a given set of policies. This implies that the set of firms generating private surplus is taken as given by each government. This assumption is well motivated in Gordon and Cullen (2012).

If the government in region  $i$  maximizes  $W(R^i, \Pi^i) = \omega R^i + \Pi^i$  by choosing  $t_i$  for a given  $t_j$ , the best-response function,  $t_i(t_j)$ , is given by:

$$\begin{aligned} [\omega - 1] \left[ 1 - F((t_i - t_j)\gamma) \right] &= \omega \gamma t_i f((t_i - t_j)\gamma) \text{ if } t_i \geq t_j; \\ [\omega - 1] \left[ 1 + \frac{N_j}{N_i} F((t_j - t_i)\gamma) \right] &= \omega \frac{N_j}{N_i} \gamma t_i f((t_j - t_i)\gamma) \text{ if } t_i < t_j. \end{aligned} \quad (3)$$

The left-hand side of each equation represents the net marginal benefit (public minus private) associated with an increase in the tax rate for a given allocation of firms, while the right-hand side represents the marginal cost of losing firms as a result of the same increase in tax rate.

It is helpful to interpret a government's tax-setting rule in terms of the elasticity of its tax base,  $B_i$ , with respect to tax  $t_i$ :  $\epsilon_i = -\frac{t_i}{B_i} \frac{\partial B_i}{\partial t_i}$ , which is given by:

$$\begin{aligned} \epsilon_i &= \gamma t_i \frac{f((t_i - t_j)\gamma)}{1 - F((t_i - t_j)\gamma)} \text{ if } t_i \geq t_j; \\ &= \gamma t_i \frac{(N_j/N_i) f((t_j - t_i)\gamma)}{1 + (N_j/N_i) F((t_j - t_i)\gamma)} \text{ if } t_i < t_j. \end{aligned} \quad (4)$$

At the optimum,  $\epsilon_i = \frac{\omega - 1}{\omega}$ . This elasticity would equal one if the objective function gave positive weight only to tax revenue, implying that governments pursue a revenue-maximizing tax policy. With some weight placed on private surplus, however, a region's optimal tax rate is kept below this revenue-maximizing rate.

The following lemma provides a condition under which an equilibrium exists.

**Lemma 1:** *Whenever  $f'(c)/f(c) \in [-1/\gamma, 1/\gamma]$  for both  $i$ , the best-response functions are monotonically upward sloping, with a slope less than one. Then an equilibrium exists and is unique.*

**Proof of Lemma 1:** By differentiating the first-order condition, we obtain the slope of the best-response function:

$$\begin{aligned} \frac{\partial t_i(t_j)}{\partial t_j} &= \frac{(\omega - 1)f((t_i - t_j)\gamma) + \omega\gamma t_i f'((t_i - t_j)\gamma)}{(2\omega - 1)f((t_i - t_j)\gamma) + \omega\gamma t_i f'((t_i - t_j)\gamma)} \text{ if } t_i \geq t_j; \\ &= \frac{(\omega - 1)f((t_j - t_i)\gamma) - \omega\gamma t_i f'((t_j - t_i)\gamma)}{(2\omega - 1)f((t_j - t_i)\gamma) - \omega\gamma t_i f'((t_j - t_i)\gamma)} \text{ if } t_i < t_j. \end{aligned} \quad (5)$$

The second-order conditions are both satisfied if and only if the denominators are positive, or equivalently, iif:

$$t_i \frac{f'(c)}{f(c)} \in \left[ -\frac{\omega}{2\omega - 1} \frac{1}{\gamma}, \frac{\omega}{2\omega - 1} \frac{1}{\gamma} \right]. \quad (6)$$

If this condition is satisfied at  $t_i = 1$  and  $\omega = \infty$ , then it is always satisfied. We can then conclude that if the sufficient condition,  $f'(c)/f(c) \in [-1/2\gamma, 1/2\gamma]$ , is satisfied, the second-order conditions are also satisfied. Existence of an equilibrium is guaranteed when the second-order conditions are satisfied. For any value of  $t_i \geq t_j$ , region i's best-response function is then positively sloped, only if the numerator is also positive. This conditions holds if  $f'(c)/f(c) > -1/\gamma$ , and the reverse condition applies when  $t_i < t_j$ . Consequently, a sufficient condition for the best-response functions to be positively sloped is,  $f'(c)/f(c) \in [-1/\gamma, 1/\gamma]$ . Moreover, it is easy to see that if the best-response functions are upward sloping, then their slopes are less than one. This guarantees a unique solution. **QED**

Note that the conditions in Lemma 1 are sufficient, but not necessary. They ensure existence for all possible tax rates up to 100%, and for all positive values of the exogenous welfare weight,  $\omega$ .

We next examine the equilibrium tax rates when when the regions have the same size. Omitting region subscripts from common parameters, we have–

**Proposition 1:** *Under a non-preferential regime, if the regions are identical, there exists a unique Nash equilibrium where  $t_1 = t_2 = t^{np} = \frac{\omega - 1}{\omega} \frac{1}{\gamma f(0)}$ .*

**Proof of Proposition 1:** Given Lemma, 1 both reaction functions must cross only once. Solving equation (3) reveals that  $t_1 = t_2 = \frac{\omega - 1}{\omega} \frac{1}{\gamma f(0)}$ . **QED**

**Corollary to Proposition 1:** *Under a non-preferential regime, if the regions are identical and  $f(c) = (1 - \beta) + 2\beta c$ , there exists a unique Nash equilibrium, where  $t^{np} = \frac{\omega - 1}{\omega} \frac{1}{\gamma(1 - \beta)}$ .*

It follows that an increase in either  $\gamma$  or  $f(0)$  leads to a reduction in tax rates. Starting from  $t_1 = t_2$ , it is easy to see that the tax base elasticities are increasing in both  $\gamma$  and  $f(0)$ . As  $\gamma$  increases, firms become more mobile, since the average moving cost becomes small relative to the fiscal benefit of moving. Similarly, if  $f(0)$  is large, many firms are ready to move at no cost. Note also that the elasticity of the tax base with respect to the tax rate is the same, regardless of whether it is created by attracting more new firms or retaining more existing firms. As anticipated, taxes are high when the net marginal benefit of public spending,  $\omega - 1$ , is high. In this case, a high tax-base elasticity will be required to satisfy the optimality condition,  $\epsilon_1 = \epsilon_2 = \frac{\omega-1}{\omega}$ . Figure 1 illustrates the case where  $F(c)$  is a uniform distribution ( $\beta = 0$ ) and the government gives positive weight only to tax revenue.

Given the equilibrium tax rates, total tax revenue for both regions is given by  $R^i = \frac{\omega-1}{\omega} \frac{N}{f(0)}$  for the general case, and  $R^i = \frac{\omega-1}{\omega} \frac{N}{1-\beta}$  for the specified distribution function. The corresponding private surpluses are given by  $\Pi^i = \left[1 - \frac{\omega-1}{\omega} \frac{1}{\gamma f(0)}\right] \gamma N$  for the general case, and  $\Pi^i = \left[1 - \frac{\omega-1}{\omega} \frac{1}{\gamma(1-\beta)}\right] \gamma N$  for the specified distribution function. Consequently, total welfare is given by:

$$\begin{aligned} W^i(R^i, \Pi^i) &= \gamma N + \frac{(\omega - 1)^2}{\omega} \frac{N}{f(0)} \text{ for the general case;} \\ &= \gamma N + \frac{(\omega - 1)^2}{\omega} \frac{N}{1 - \beta} \text{ for the specified case.} \end{aligned} \quad (7)$$

As we can see, total welfare is composed of two terms. The first term represents the maximal private surplus, achievable if both regions were to set taxes to zero. The second term represents the gain from public revenues. More specifically, we can re-write the second term as  $(\omega - 1)\gamma N t_i \epsilon_i = (\omega - 1)R^i$ .

We close this section by discussing how size differences between regions affect the equilibrium. In this case, the common tax rate levied by a region on both domestic and foreign firms depends on its size. Whenever  $n > 1/2$ , the smallest region is more aggressive at lowering its tax rate. This observation confirms many similar results in the literature on tax competition, like in Bucovetsky (1991). In our context, however, small is defined as the region with the least number of domestic firms. The next proposition relates the equilibrium tax rates to differences in regional size.

**Proposition 2:** *Under a non-preferential regime, if region 1 is larger than*

region 2, there exist a unique Nash equilibrium with  $t_1(n) > t_2(n)$ , where

$$\frac{t_1(n)}{t_2(n)} = \frac{1 - F(\gamma[t_1(n) - t_2(n)])}{\frac{1-n}{n} + F(\gamma[t_1(n) - t_2(n)])} > 1. \quad (8)$$

**Proof of Proposition 2:** First, we prove by contradiction that in any equilibrium, whenever  $n > 1/2$ , it must be the case that  $t_1 > t_2$ . Imagine that a combination of tax rates,  $t_2 > t_1$ , solves both best response functions. From (3), we could then show that

$$\frac{1 - F(\gamma[t_2 - t_1])}{t_2} = \frac{n + (1 - n)F(\gamma[t_2 - t_1])}{(1 - n)t_1}. \quad (9)$$

Re-writing the equation above, we obtain

$$\frac{t_1}{t_2} = \frac{\frac{n}{1-n} + F(\gamma[t_2 - t_1])}{1 - F(\gamma[t_2 - t_1])} > 1. \quad (10)$$

Since  $n > 1/2$ , it must be the case that the left-hand side of the equation above is greater than 1. Consequently, we must have that  $t_1 > t_2$ , which is a contradiction. The same contradiction does not apply for values of  $t_1 > t_2$ . Moreover, when  $t_2 = 0$ , then  $t_1(0) > 0$ . We also know that  $\frac{\partial t_1(t_2)}{\partial t_2} < 1 < \frac{1}{\frac{\partial t_2(t_1)}{\partial t_1}}$ , so consequently there exist a unique Nash equilibrium where  $t_1(n) > t_2(n)$ . The ratio  $\frac{t_1(n)}{t_2(n)}$  in equation (8) can be derived as above. **QED**

This difference in tax rates can be explained by looking at the tax base elasticities for both regions. In equilibrium, both elasticities are equalized ( $\epsilon_1 = \epsilon_2$ ).<sup>2</sup> Having fewer domestic firms gives the small region a strategic advantage, because attracting new firms has a proportionally bigger impact on the small region's tax revenue. Consequently, the two elasticities are equalized when the small region sets the lower tax rate.

For the case of a uniform cost distribution, the best-response functions given by equation (3) can be used to state the equilibrium tax rates as follows:

**Corollary to Proposition 2:** *Under a non-preferential regime, whenever region 1 is larger than region 2, and moving costs uniformly distributed, there*

---

<sup>2</sup>This equality follows from equations (4) and (8).

exists a unique Nash equilibrium where:

$$\begin{aligned} t_1(n) &= \left[ \frac{\omega - 1}{3\omega - 2} \right] \left[ \frac{n\omega + (\omega - 1)}{\omega\gamma n} \right]; \\ t_2(n) &= \left[ \frac{\omega - 1}{3\omega - 2} \right] \left[ \frac{(1 - n)\omega + (\omega - 1)}{\omega\gamma n} \right]. \end{aligned} \quad (11)$$

When governments care only about tax revenue ( $\omega = \infty$ ), then the tax rates becomes  $t_1(n) = \frac{1+n}{3\gamma n}$  and  $t_2(n) = \frac{2-n}{3\gamma n}$ . Figure 2 represents the asymmetric Nash equilibrium when moving costs are uniformly distributed. The best-response functions are discontinuous at  $t_1 = t_2$ , and can cross only for values such that  $t_1 > t_2$ .

The Corollary to Proposition 2 helps us identify some important patterns. First, if governments place additional weight on tax revenue relative to private surplus (higher  $\omega$ ), then tax rates in both regions increases. As we know from Proposition 2, the small region sets a lower tax rate than the larger one. We can now further see that both regions set lower tax rates as heterogeneity increases. More heterogeneity makes the smaller region more aggressive, and since tax rates are strategic complements, both regions set lower tax rates. Moreover, as heterogeneity increases, the difference in tax rates, as defined as  $\Delta_{12}^t = t_1 - t_2$ , also grows. This implies that more heterogeneity also leads to more movement of firms.

With uniform moving cost, the difference in tax rates is  $\Delta_{12}^t = \frac{\omega - 1}{3\omega - 2} \frac{2n - 1}{\gamma n}$ , and the two regions' tax revenues are given by:

$$\begin{aligned} R^1 &= \frac{2N}{n} \left[ \frac{\omega - 1}{\omega} \right] \left[ n - (2n - 1) \frac{\omega - 1}{3\omega - 2} \right]^2; \\ R^2 &= \frac{2N}{n} \left[ \frac{\omega - 1}{\omega} \right] \left[ (1 - n) + (2n - 1) \frac{\omega - 1}{3\omega - 2} \right]^2. \end{aligned} \quad (12)$$

When governments care only about tax revenue ( $\omega = \infty$ ), the expressions above can further simplified to  $R^1 = 2N \frac{(1+n)^2}{9n}$  and  $R^2 = 2N \frac{(2-n)^2}{9n}$ . For this last case, tax revenues for both regions diminish when regions become more heterogenous. However, this is not necessarily the case in general. For example, under the uniform distribution, when  $\omega$  is sufficiently close to one, the large region's tax revenue increases when regions become more heterogenous. It is gaining in tax base, but the tax rate is not following enough to offset the change.

## 4 Preferential Regime

Under a preferential tax regime, each region  $i$  taxes its existing domestic firms and newly-arrived foreign firms at different rates,  $t_i$  for domestic firms and  $\tau_i$  for the foreign firms. When  $t_i \geq \tau_j$ , a firm in region  $i$  will stay in region  $i$  if  $[1 - t_i]\gamma \geq [1 - \tau_j]\gamma - c$ , or  $c > (t_i - \tau_j)\gamma$ . On the other hand, if  $t_i \leq \tau_j$ , all domestic firms stay. In addition, firms in region  $j$  move to region  $i$  whenever  $c < (t_j - \tau_i)\gamma$ . Total tax revenue in region  $i$ ,  $R^i(t_i, \tau_i, t_j, \tau_i)$ , is given by:

$$\begin{aligned}
 R^i(\cdot) &= N_i [1 - F((t_i - \tau_j)\gamma)] \gamma t_i \quad \text{if } t_i > \tau_j \ \& \ \tau_i \geq t_j; \\
 &= N_i [1 - F((t_i - \tau_j)\gamma)] \gamma t_i + N_j F((t_j - \tau_i)\gamma) \gamma \tau_i \quad \text{if } t_i > \tau_j \ \& \ \tau_i < t_j; \\
 &= N_i \gamma t_i \quad \text{if } t_i \leq \tau_j \ \& \ \tau_i \geq t_j; \\
 &= N_i \gamma t_i + N_j F((t_j - \tau_i)\gamma) \gamma \tau_i \quad \text{if } t_i \leq \tau_j \ \& \ \tau_i < t_j.
 \end{aligned} \tag{13}$$

Total surplus from domestic and foreign firms  $\Pi^i(t_i, \tau_i, t_j, \tau_j)$  located in region  $i$  is given by

$$\begin{aligned}
 \Pi^i(\cdot) &= N_i [1 - F((t_i - \tau_j)\gamma)] \gamma (1 - t_i) \quad \text{if } t_i > \tau_j \ \& \ \tau_i \geq t_j; \\
 &= N_i [1 - F((t_i - \tau_j)\gamma)] \gamma (1 - t_i) \\
 &\quad + N_j F((t_j - \tau_i)\gamma) \gamma (1 - \tau_i) - N_j \int_0^{(t_j - \tau_i)\gamma} cf(c)dc \quad \text{if } t_i > \tau_j \ \& \ \tau_i < t_j; \\
 &= N_i \gamma (1 - t_i) \quad \text{if } t_i \leq \tau_j \ \& \ \tau_i \geq t_j; \\
 &= N_i \gamma t_i + N_j F((t_j - \tau_i)\gamma) \gamma (1 - \tau_i) - N_j \int_0^{(t_j - \tau_i)\gamma} cf(c)dc \quad \text{if } t_i \leq \tau_j \ \& \ \tau_i < t_j.
 \end{aligned} \tag{14}$$

The government in region  $i$  maximizes  $W(R^i, \Pi^i) = \omega R^i + \Pi^i$  by choosing  $t_i$  and  $\tau_i$  for given values of  $t_j$  and  $\tau_j$ . Note that this Nash game can be characterized as two separate Nash games: the governments compete for firms located in region  $i$  through the choices of  $t_i$  for region  $i$  and  $\tau_j$  for region  $j$ , and they compete for firms located in region  $j$  through the choice of  $t_j$  for region  $j$  and  $\tau_i$  for region  $i$ . For region  $i$ , the best-response functions,  $t_i(\tau_j)$  and  $\tau_i(t_j)$ , are given by:

$$\begin{aligned}
 \frac{\omega - 1}{\omega} \left[ 1 - F((t_i(\tau_j) - \tau_j)\gamma) \right] &= \gamma t_i(\tau_j) f(t_i(\tau_j) - \tau_j)\gamma \quad \text{if } t_i > \tau_j; \\
 t_i(\tau_j) &= \tau_j \quad \text{if } t_i \leq \tau_j.
 \end{aligned} \tag{15}$$

$$\begin{aligned}\frac{\omega-1}{\omega}F((t_j-\tau_i(t_j))\gamma) &= \gamma\tau_i(t_j)f((t_j-\tau_i(t_j))\gamma) \quad \text{if } \tau_i < t_j; \\ \tau_i(t_j) &= t_j \quad \text{if } \tau_i \geq t_j.\end{aligned}\tag{16}$$

First-order conditions for the foreign tax rates are similar.

To interpret these conditions, recall that each region sets its tax base elasticity equal to  $\frac{\omega-1}{\omega}$ . Denote by  $\epsilon_i^d(t_i) = -(t_i/B_i^d)(\partial B_i^d/\partial t_i)$  the elasticity of the domestic tax base  $B_i^d$  with respect to tax  $t_i$ , and by  $\epsilon_i^f(\tau_i) = -(\tau_i/B_i^f)(\partial B_i^f/\partial \tau_i)$  the elasticity of the foreign tax base  $B_i^f$  with respect to tax  $\tau_i$ . These tax base elasticities are given by:

$$\begin{aligned}\epsilon_i^d(t_i) &= \gamma t_i \frac{f(t_i - \tau_j)\gamma}{1 - F(t_i - \tau_j)\gamma} \quad \text{if } t_i > \tau_j; \\ &= 0 \quad \text{if } t_i \leq \tau_j.\end{aligned}\tag{17}$$

$$\begin{aligned}\epsilon_i^f(\tau_i) &= \gamma \tau_i \frac{f(t_j - \tau_i)\gamma}{F(t_j - \tau_i)\gamma} \quad \text{if } \tau_i < t_j; \\ &= 0 \quad \text{if } \tau_i \geq t_j.\end{aligned}\tag{18}$$

When  $t_i \leq \tau_j$ , region  $i$ 's tax base becomes perfectly inelastic, as region  $i$  retains all its firms. Region  $i$  therefore raises its tax rate  $t_i$  until it equals  $\tau_j$ . Whether it raises it further will depend on the value of  $\tau_j$ . See Fig. 3, for example, where  $t_i(\tau_j) > \tau_j$  except at high values of  $\tau_j$ . In this latter case, the high values of  $t_i$  needed to exceed  $\tau_j$  imply a domestic tax base elasticity above  $\frac{\omega-1}{\omega}$ , implying that  $t_i$  must be lowered to satisfy the first-order condition for  $t_i$ .

To guarantee the existence and the uniqueness of equilibrium tax rates, we must look at the slopes of the best-response functions. Lemma 2 states those conditions.

**Lemma 2:** *Whenever  $f'(c)/f(c) \in [-1/\gamma, 1/\gamma]$ , the best-response functions are monotonically upward sloping, with a slope less than one. Then an equilibrium exists and is unique.*

**Proof of Lemma 2:** The slopes of the best-response functions are given by:

$$\begin{aligned}\frac{\partial t_i(\tau_j)}{\partial \tau_j} &= \frac{f((t_i - \tau_j)\gamma) + \gamma t_i f'((t_i - \tau_j)\gamma)}{2f((t_i - \tau_j)\gamma) + \gamma t_i f'((t_i - \tau_j)\gamma)} \quad \text{if } t_i > \tau_j; \\ &= 0 \quad \text{if } t_i \leq \tau_j.\end{aligned}\tag{19}$$

$$\begin{aligned}\frac{\partial \tau_i(t_j)}{\partial t_j} &= \frac{f((t_j - \tau_i)\gamma) - \gamma \tau_i f'((t_j - \tau_i)\gamma)}{2f((t_j - \tau_i)\gamma) - \gamma \tau_i f'((t_j - \tau_i)\gamma)} \quad \text{if } \tau_i < t_j; \\ &= 0 \quad \text{if } \tau_i \geq t_j.\end{aligned}\tag{20}$$

See Lemma 1 for the rest of the proof, as both proofs are almost identical. **QED**

Unlike the non-preferential regime, the best-response functions do not depend on regional size in the preferential case. Thus, heterogeneity in size has no influence on the equilibrium tax rates, though it will influence tax revenues. If there are no other differences between regions, then the unique equilibrium involves identical tax policies between regions. An important feature of the equilibrium is that a region's foreign firms will enjoy lower tax rates than its domestic firms, even though there is no heterogeneity between domestic and foreign firms. The next proposition identifies the equilibrium tax rates.

**Proposition 3:** *Under a preferential regime, there exists a unique Nash equilibrium where domestic tax rates,  $t_i = t_j = t^p$ , are greater than the foreign tax rates,  $\tau_i = \tau_j = \tau^p$ , with:*

$$\begin{aligned}t^p &= \left( \frac{\omega - 1}{\omega \gamma} \right) \left( \frac{1 - F(\gamma[t^p - \tau^p])}{f(\gamma[t^p - \tau^p])} \right) \\ \tau^p &= \left( \frac{\omega - 1}{\omega \gamma} \right) \left( \frac{F(\gamma[t^p - \tau^p])}{f(\gamma[t^p - \tau^p])} \right) \\ \frac{\tau^p}{t^p} &= \frac{1 - F(\gamma[t^p - \tau^p])}{F(\gamma[t^p - \tau^p])}.\end{aligned}\tag{21}$$

**Proof of Proposition 3:** Given the first-order conditions, no solution can be found for value of  $t_i < \tau_j$  or  $t_j < \tau_i$ . Consequently, the domestic tax rate for region  $i$ , and the foreign tax rate for region  $j$  are such that  $t_i > \tau_j$ . Equation (21) is derive directly from the first-order conditions. **QED**

**Corollary to Proposition 3:** *Under a preferential regime with moving costs uniformly distributed, there exists a unique Nash equilibrium where:*

$$t^p = \left[ \frac{\omega - 1}{\omega\gamma} \right] \left[ \frac{2\omega - 1}{3\omega - 2} \right], \text{ and } \tau^p = \left[ \frac{\omega - 1}{\omega\gamma} \right] \left[ \frac{\omega - 1}{3\omega - 2} \right]$$

As we see in Figure 3, a region always sets a lower tax rate on foreign firms compared to domestic firms, independently of  $N_1$  and  $N_2$ . Note that if regions care only about tax revenue, then  $t^p = \frac{2}{3\gamma}$  and  $\tau^p = \frac{1}{3\gamma}$ . Preferential tax treatment is always used to attract foreign firms. To better understand this result, we can examine the tax-base elasticities. In equilibrium, the domestic and foreign tax base elasticities are positive, and are equalized. Imagine that  $\tau_i$  was to be smaller than  $t_j$ , but only by a very small amount. Region  $i$  would then attract almost no firms from region  $j$ . Reducing  $\tau_i$  further would then change its foreign tax base by a large proportion. This implies a large foreign tax base elasticity  $\epsilon^f(\tau_i)$ . On the other hand, region  $j$  would lose few domestic firms. Increasing its tax rate on domestic firms would only reduce its domestic tax base by a small proportion. This implies a small domestic tax base elasticity  $\epsilon^d(t_j)$ . As the gap in tax rate increases, both elasticities converges to the point where there are equal, and  $\tau_i < t_i$ .

Two important differences arise under the preferential tax treatment. First, as we have seen, each region's tax policy does not depend on its size. Second, firms move in both directions. Firms in region 1 with low moving cost seek low foreign tax rate in region 2, and at the same time, firms in region 2 with low moving costs seek the low foreign tax rate in region 1. For the uniform and homogenous regions case, where only tax revenue receives weight in the objective function, a total of  $N/3$  firms move from each region, creating a sum of moving costs equal to  $2N \int_0^{1/3} cdc = \frac{N}{9}$ . In the general case, where both tax revenue and private surplus enter the objective function, the difference in tax rates,  $t^p - \tau^p = \frac{\omega-1}{3\omega-2} \frac{1}{\gamma}$ , is smaller, but still positive, producing a sum of moving costs given by:

$$Moving\ Costs = N \left( \frac{\omega - 1}{3\omega - 2} \right)^2 \tag{22}$$

Note too that this cost figure does not depend on the size difference between regions; size determines only the proportion of total movers coming from each jurisdiction. We later compare these moving costs with those for the

non-preferential regime, where firms move from the large region to the small region, since the latter has the lower tax rate.

With tax rates independent of regional size, size difference influences tax revenue only directly. For the uniform case, tax revenues are

$$\begin{aligned} R^1 &= 2N \frac{\omega^r - \omega^p}{\omega^r} \frac{n(2\omega^r - \omega^p)^2 + (1-n)(\omega^r - \omega^p)^2}{(3\omega^r - 2\omega^p)^2}; \\ R^2 &= 2N \frac{\omega^r - \omega^p}{\omega^r} \frac{(1-n)(2\omega^r - \omega^p)^2 + n(\omega^r - \omega^p)^2}{(3\omega^r - 2\omega^p)^2}. \end{aligned} \quad (23)$$

Thus, we find that  $R^1$  rises with  $n$ , whereas  $R^2$  falls with  $n$ . In this sense, an increase in size heterogeneity favors the large region in terms of generating more tax revenues. Both regions are losing the same percentage of firms to the other region, since the loss is based on the common difference in tax rates, but the large region is ending up with a higher fraction of domestic firms and a lower fraction of foreign firms. At each of the (low) moving cost possessed by the movers, fewer firms are moving from the small region to the large region than are moving in the reverse direction. Letting  $\lambda$  denote the fraction of firms that move from each region, the equilibrium numbers of domestic and foreign firms in each region is

$$\begin{aligned} \text{Number of domestic firms} &= Nn(1-\lambda) \text{ for region 1;} \\ &= N(1-n)(1-\lambda) \text{ for region 2.} \\ \text{Number of foreign firms} &= N(1-n)\lambda \text{ for region 1;} \\ &= Nn(1-\lambda) \text{ for region 2} \end{aligned}$$

The mover fraction  $\lambda$  is less than one-half under uniform moving costs. As a result, the larger number of domestic firms for the large region more than offsets the smaller number of foreign firms. Moreover, the larger number of domestic firms is facing the higher tax rate, creating a greater beneficial transfer of income from private firms to the government. Finally, the smaller number of foreign firms are the only ones incurring the wasteful moving costs, which is reducing private surplus. Putting these observations together, we conclude that the weighted sum of tax revenue and private surplus is greater in the larger region than in the smaller region. Finally, if we look at the

value of this weighted sum per firm, it is also higher in the large region, since a higher fraction of that region's firms are the domestic type.

The total loss from tax competition does not depend on the relative sizes of the regions, either in the form of reduced revenue or reduced welfare (weighted sum of tax revenue and private surplus). But our analysis suggests that the smaller region bears the greater loss, in either absolute or per capita terms.

## 5 Comparing the two systems

We now compare the preferential and non-preferential regimes. The literature has focused almost exclusively on differences in total tax revenue. But our regional objective function generalizes much of the literature by including both tax revenue and the private surplus going to existing firms. However, more weight is placed on tax revenue than on private surplus, so any straight transfer of income from the private sector to the government will raise this measure of regional welfare, if this transfer involves no tax-induced behavioral changes. In the case of a symmetric equilibrium for identical regions, the equilibrium taxes induce no change in the number of firms in each region, or their distribution of moving costs. However, we saw that the preferential regime induces wasteful movements of firms between regions. This will be a disadvantage of the preferential regime, even if it generates higher tax revenue.<sup>3</sup>

Consider first the special case of a uniform distribution of moving costs. Adding up the revenue for the preferential case, given by (23), we obtain

$$R^1 + R^2 = 2N \left( \frac{\omega - 1}{\omega} \right) \left[ \frac{(2\omega - 1)^2 + (\omega - 1)^2}{(3\omega - 2)^2} \right] < 2N \left( \frac{\omega - 1}{\omega} \right) \quad (24)$$

From (12), total revenue under the non-preferential regime is

---

<sup>3</sup>Note too that governments in our model do not take into account this wasteful mobility, because they care only about the surplus of their existing firms in equilibrium. Thus, the surplus of new firms that might be induced to enter the region is not counted, and the exit of firms from the region in response to a marginal policy change does not impact surplus because these marginal firms are indifferent about where to locate.

$$R^1 + R^2 = 2N \left[ \frac{\omega - 1}{\omega} \right] \frac{1}{n} \left\{ \left[ n - (2n - 1) \frac{\omega - 1}{3\omega - 2} \right]^2 + \left[ (1 - n) + (2n - 1) \frac{\omega - 1}{3\omega - 2} \right]^2 \right\}; \quad (25)$$

where the terms involving  $(2n - 1)$  for  $n > 1/2$  reflect the shift in tax base from region 1 to region 2 as a result of region 1's higher tax rate. If the two regions have the same size, then this expression reduces to

$$R^1 + R^2 = 2N \left( \frac{\omega - 1}{\omega} \right) \quad (26)$$

Comparing (26) with (24), we see that tax revenue is higher under the non-preferential case, at least with identical regions. In fact, the difference becomes substantial when governments care only about tax revenue, which is the case on which the literature has focused. Setting  $\omega = \infty$  in (24) then gives the following revenue for the preferential case:

$$R^1 + R^2 = 2N \frac{5}{9} \quad (27)$$

In other words, moving from the non-preferential regime to the preferential regime reduces revenue by four-ninths, while also introducing wasteful commuting costs. This is a substantial loss. Recall also that there is only wasteful mobility of firms in the preferential case when sizes are identical. On the other hand, the term in the square brackets in eq. (24) goes to zero as  $\omega$  goes to one. Thus, the relative revenue loss from moving to a preferential regime goes to zero as the weight given to tax revenue goes to the weight on private surplus. Of course, all tax rates are converging to zero in this case. But this means that wasteful difference in tax rates under the preferential regime is also becoming small, thereby making the two tax regime similar.

Let us now vary regional sizes. An interesting question is, what happens in the limit as  $n$  goes to one, implying that the number of domestic firms in region 2 is going to zero? If we compare (24) with (25) in this limiting case, we see that they are identical. This result is easy to explain. When region 2 has almost no domestic firms, then its optimal strategy under the non-preferential regime is to set almost the the same tax it would choose under the preferential regime, where it can distinguish between domestic and foreign firms for tax purposes. Meanwhile, region 1 attracts almost

no foreign firms from region 2, because there are almost none, so its non-preferential tax is basically a tax on only domestic firms. Thus, region 1 sets this tax at almost the same level as its tax on domestic firms in the preferential regime. With the tax difference between region 1 and region 2 nearly the same as the difference between domestic and foreign tax rates under the preferential regime, the total number of firms that are switching regions is almost the same as under the preferential regime. Thus, we may conclude that tax revenue and wasteful moving costs are almost the same, implying almost identical private surpluses.

To conclude, while we saw that the welfare gain from switching to a non-preferential regime is likely to be substantial in the case of identical regions, this gain completely disappears in the limit as one region becomes infinitesimally small. Since this latter case corresponds to small tax havens, the suggestion here is that limiting preferential treatment of tax bases may not be adequate to significantly control tax evasion in practice.

But is there always at least some positive welfare gain from the switch to a non-preferential regime? Continuing to assume a uniform distribution of moving costs, two exceptions can be identified. First, we have not ruled out the possibility that the welfare gain not only goes to zero as  $n$  goes to one, but that the welfare gain may actually become negative on the way to  $n = 1$ . Our calculations show that it is possible for the switch to a non-preferential regime to lower tax revenue, but only for values of the welfare weight  $\omega$  close to one. For there to be a drop in tax revenue at  $n = .8$ , for example,  $\omega$  must be below 1.14. Note too that moving costs are never greater in the non-preferential case, because the difference in tax rates is never greater than the difference between domestic and foreign rates in the preferential case.

More important is the case of non-uniform distributions of moving costs. The next proposition identifies distributions for which a preferential tax regime may generate larger tax revenues.

**Proposition 4:** *With identical regions, the preferential tax regime generates more tax revenues if the distribution of moving costs features a sufficiently decreasing density distribution function; more precisely, if and only if:*

$$\frac{f(\gamma[t^p - \tau^p])}{f(0)} < [1 - F(\gamma[t^p - \tau^p])]^2 + F(\gamma[t^p - \tau^p])^2. \quad (28)$$

A sufficient condition for the preferential tax regime to generate more tax

revenues is that  $f'(c) < 0$  for all  $c$ , and

$$\frac{f(0)}{f(1)} \geq 2. \quad (29)$$

**Proof of Proposition 4:** With homogenous regions, tax revenue for region  $i$  under a preferential tax regime is given by

$$R^i = N \frac{\omega - 1}{\omega} \frac{[1 - F(\gamma[t^p - \tau^p])]^2 + F(\gamma[t^p - \tau^p])^2}{f(\gamma[t^p - \tau^p])}. \quad (30)$$

Tax revenue  $R^i$  is larger than tax revenue under a non-preferential tax regime,  $R^i = (\omega - 1)/(\omega f(0))$ , only if condition (28) is satisfied. Since the right-hand side of the condition is less one, it must be the case that  $f(\gamma[t^p - \tau^p]) < f(0)$ , and so the density function must be sufficiently decreasing. Since,  $[1 - F(\gamma[t^p - \tau^p])]^2 + F(\gamma[t^p - \tau^p])^2 \geq 1/2$ , a sufficient sufficient condition is that  $\frac{f(0)}{f(1)} \geq 2$ . **QED**

Note that the uniform distribution of moving costs definitively does not satisfy this condition. With the distribution function,  $f(c) = (1 - \beta) + 2\beta c$ , which we specified earlier, it would be sufficient that  $\beta < -1/3$  for the preferential regime to generate more tax revenue. At the same time, it is sufficient that  $\beta > -1/(1 + 2\gamma)$  to ensure the existence and the uniqueness of all equilibria. these conditions are very restrictive sufficient conditions. Thus, it is clear that the necessary conditions can be satisfied in cases where  $\gamma > 1$ .

When the distribution of moving costs features a decreasing density, many firms are easily attracted, even for small differences in tax rates between two regions. Home bias behavior in investment decisions, as described in Haupt and Peters (2005), would correspond to a distribution function which does not satisfied this condition, because few firms would be willing to move under this assumption. Many other reasons can account for distribution functions that would either satisfied or not satisfy the condition stated in Proposition 5. Consequently, this model can nest both Keen (2001) and Haupt and Peters (2005) models.

## 6 Concluding Remarks

In this paper, we have investigated the relative merits of preferential vs. non-preferential tax regimes in a model of tax competition. The literature on

this topic contains two views of the meaning of preferential tax treatment. The more common view is that governments distinguish between different types of capital, or firms, according to their mobility characteristics. But the literature on optimal taxation in an open economy emphasizes the difficulties involved in making such distinctions. Preferential treatment must be based on observable characteristics of firms that may be only loosely associated with mobility differences.<sup>4</sup> Thus, preferential tax regimes often consist of the foreign-owned portion of a tax base being taxed at a lower rate than the domestic-owned portion, a behavior that is also labeled “discrimination.” Some countries – e.g. Canada and the US – have signed mutually advantageous tax treaties, which would be jeopardized if one or the other actor were to start discriminating. In addition, the prohibition of the asymmetric treatment of foreign and domestic firms has been included in treaties in the EU and the OECD. Both the EU and the OECD are active in trying to reduce the extent of discrimination among their members.<sup>5</sup>

We have adopted this second view in a 2-region model with domestic firms and foreign firms, distinguished by their region of origin. Using this model, we have found that the non-preferential regime can yield substantially more tax revenue than the preferential regime. However, we have also seen that revenue, and welfare, will be higher when the number of firms with low moving costs is relatively high. Since this is thought to be increasingly the case in the modern world economy, our results call into question the benefits of the nondiscrimination principal in OECD guidelines for international taxation. Finally, we also find that any benefits of nondiscrimination disappear when the size difference between the competing regions becomes large, as in the case tiny tax havens.

---

<sup>4</sup>Hong and Smart (2010) assume that all firms must face the same statutory tax rates, and they analyze the use of tax havens to achieve desirable differences in effective marginal tax rates. Hagen, Osmundsen, and Schjelderup (1998) work with a model where a firm’s mobility is related to the size of its investment, in which case it is optimal to impose a nonlinear tax on investment.

<sup>5</sup>On this, see OECD (1998).

## 7 References

- Bucovetsky, S. (1991), "Asymmetric tax competition," *Journal of Urban Economics* **30**, 167–181
- Bucovetsky, S. and A. Hauffer (2008), "Tax competition when firms choose their organizational form: Should tax loopholes for multinationals be closed?" *Journal of International Economics* **74**, 188–201.
- Gordon, R.H., and J.B.Cullen (2012), "Income redistribution in a Federal system of governments" *Journal of Public Economics*, in press.
- Haupt, A. and W. Peters (2005), "Restricting Tax Preferentials to Avoid Harmful Tax Competition," *Regional Science and Urban Economics* **35**, 493–507.
- Hong, Q. and M. Smart (2010), "In Praise of Tax Havens: International Tax Planning and Foreign Direct Investment," *European Economic Review* **54**, 82–95.
- Janeba, E., and W. Peters (1999), "Tax Evasion, Tax Competition and the Gains from Nondiscrimination: The Case of Interest Taxation in Europe", *Economic Journal* **109**, 93–101.
- Janeba, E., and M. Smart (2003), "Is Targeted Tax Competition Less Harmful Than Its Remedies," *International Tax and Public Finance* **10**, 259–280.
- Kanbur, R., and M. Keen (1993), "Jeux sans frontières: Tax Competition and Tax Coordination when regions Differ in Size," *American Economic Review* **83**, 877–892.
- Keen, M. (2001), "Preferential Regimes Can Make Tax Competition Less Harmful," *National Tax Journal* **54**, 757–762.
- Konrad, K.A. (2007), "Mobile Tax Base as a Global Common", mimeo Free University of Berlin.
- Konrad, K. A. and D. Kovenock, (2009). "Competition for FDI with vintage investment and agglomeration advantages," *Journal of International Economics*, **79**, pages 230–237.
- Marceau N., S. Mongrain and J.D. Wilson (2010), "Why Do Most Regions Set High Tax Rates on Capital?" *Journal of International Economics* **80**, 249–259.
- Osmundsen, P., K. P. Hagen, and G. Schjelderup, (1998), "Internationally Mobile Firms and Tax Policy," *Journal of International Economics* **45**, 97–113.

- Peralta S., X. Wauthy, and T. van Ypersele (2006), “Should Regions Control International Profit Shifting?”, *Journal of International Economics* **68**, 24–37.
- Wilson, J.D. (2005), “Tax Competition with and without Preferential Treatment of a Highly-Mobile Tax Base,” *In* J. Alm, J. Martinez-Vasquez, and M. Rider, Editors, *The Challenge of Tax Reform in a Global Economy*, Springer.
- Wilson, J.D. (1996), “The Tax Treatment of Imperfectly Mobile Firms: Rent-Seeking, Rent-Protection, and Rent-Destruction,” *in* *The Political Economy of Trade Policy*, edited by Feenstra, Grossman and Irwin, MIT Press, 225–244.
- Wilson, J.D. and D. Wildasin (1996), “Imperfect Mobility and Local Government Behavior in an Overlapping-Generations Model,” *Journal of Public Economics* **60**, 177–198.

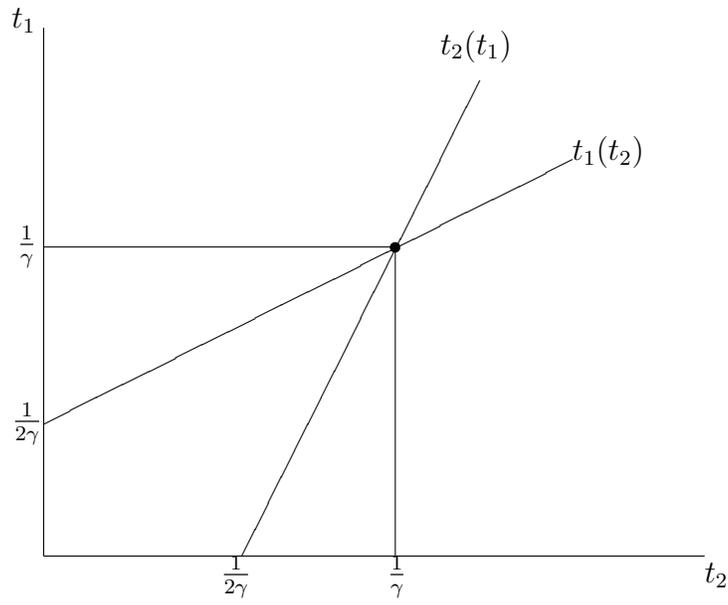


Figure 1: Symmetric equilibrium with uniform distribution, and homogenous regions

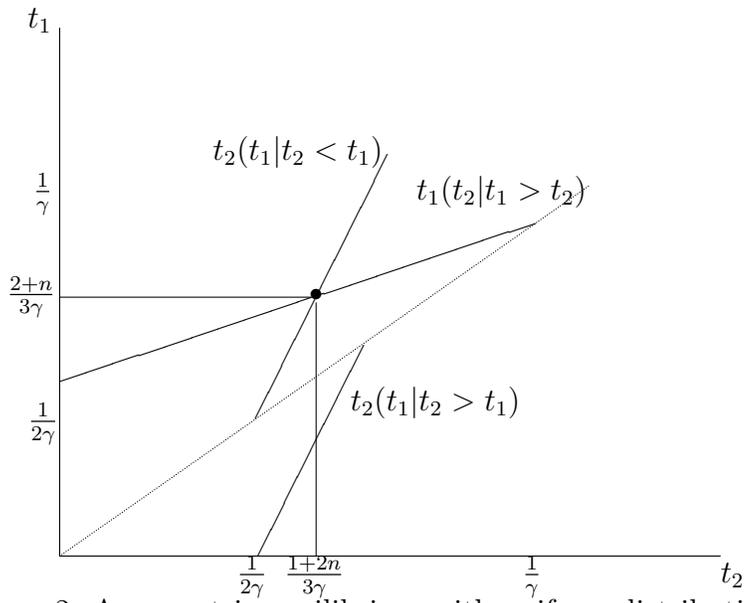


Figure 2: Asymmetric equilibrium with uniform distribution when  $n < 1$

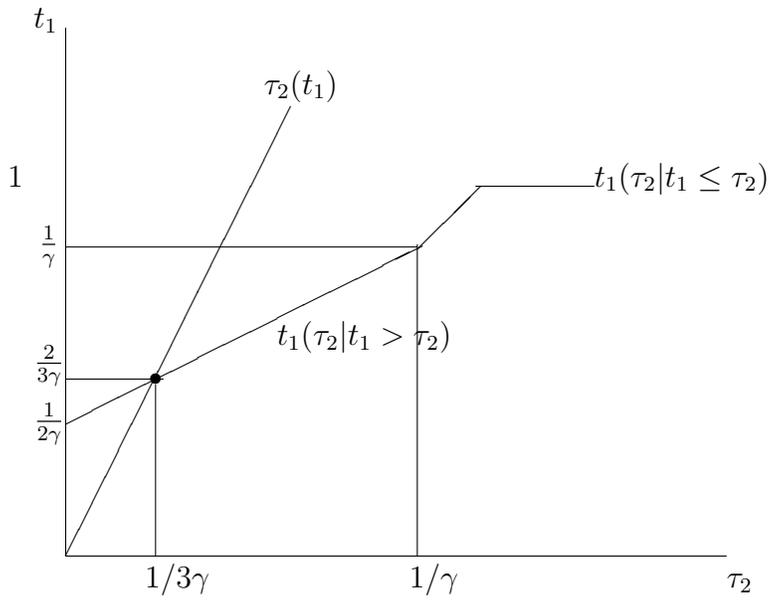


Figure 3: Preferential taxes  $t_1$  and  $\tau_2$  for uniform moving costs.