

Trade integration and the destination of public expenditures*

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Abstract

We analyze the efficiency of the pattern of public spending when two asymmetric economies are not perfectly integrated and the private sector is imperfectly competitive. We show the low productivity country set higher net-of-tax subsidies for firms. Moreover, the effects of trade integration is not symmetric on the composition of public spending. While households located in the low productivity country are the net contributors of their public sector regardless of trade costs, residents of the more advanced country may shift from a position of net contributors to net recipients when trade costs become low enough. Moreover, when the distribution of profits is geographically widespread, we isolate two main externalities suggesting that a coordinated policy increasing the public spendings for households in both countries will be beneficial. However when profits remain in the economy, the global welfare would be improved by a coordinated reduction in subsidy for firms in the low productivity country and an increase in subsidy for firms in the high productivity country.

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1 Introduction

Countries may affect business location decisions in essentially two ways: by implementing an attractive tax policy, and by developing a favorable economic environment. Many models show that trade integration and the increasing mobility of capital likely intensify the tax competition to attract firms and imply too low levels of public expenditures (for a survey see Wildasin and Wilson, 2003). However little attention has been given to the impact of economic integration on the pattern of public spending despite the obvious policy relevance of the subject. Indeed, on the one hand, because tax competition could be harmful, tax coordination is now high on the political agenda of the OECD countries (and especially in UE). This could make the subsidies competition for internationally mobile firms more vigorous. According to UNCTAD (1996), there are more and more countries offering a greater variety of incentives to attract and retain foreign investments flows, or to keep their own firms from going abroad. Among the most frequent incentives, we can cite various forms of tax exemptions (corporate tax, property tax, sales tax,...), cash grants, land acquisitions for firms or the development of enterprise zones as well as loans, loan guarantees, assistance with firm-specific job training funds and infrastructure subsidies (see examples in the appendix where governments have paid large location subsidies). On the other hand, the location of multinational firms seems to be driven by spatial differences in public inputs or subsidies (Bénassy-Quéré, Goyalraja and Trannoy, 2005; Head, Ries and Swenson, 1999). Consequently, there is a risk that more economic integration combined with more tax coordination modify the destination of public expenditures in favour of firms and to the detriment of households which are less geographically mobile.¹

A recent theoretical literature deals with the impact of competition between jurisdictions on the composition of public spending. From a traditional model of tax competition without trade, Keen and Marchand (1997) argue that fiscal competition may indeed lead to systematic distortions of the pattern of public spending. Governments spend too much in public input for firms compared to public good for households. This result may not hold when residents are mobile because a shift of public good provision devoted to workers in favor to firms may induce a labor outflow (Matsumoto, 2000). A similar result is obtained by Borck (2004) by distinguishing mobile and immobile workers. However, these models consider that the location of cap-

¹There are some contrasting empirical results on this question. Concerning the OECD countries, Garrett and Mitchell (2001) suggest that welfare state would be uncompetitive and trade openness would force governments to be more and more generous with firms (the efficiency hypothesis). At the opposite, for a large panel of countries, Rodrick (1998) concludes on a positive correlation between trade integration and public spending devoted to immobile households. This is the compensation hypothesis for which in the short-term, trade integration increases economic insecurity and calls for more welfare efforts in favor of households.

ital is only driven by public policies (through taxation and expenditures). One need to consider as well incentives to location coming from the private market forces whose strength is shaped by economic integration. We know that firms producing under imperfect competition have a strong incentive to agglomerate when trade costs become low enough in order to exploit scale economies (Krugman, 1991, Ottaviano, Tabuchi and Thisse, 2002, Combes and Overman, 2005). Such mechanisms modify strategic tax policies. The government of the country where firms are concentrated can tax the 'agglomeration rent' that firms enjoy without inducing relocation, as shown by Ludema and Wooton (1998), Kind et al. (1998) and Ottaviano and Van Ypersele (2005) from different models of economic geography.² However, none of these papers studies the impacts of changing trade costs on the pattern of public spending.

The main purpose of the present paper is to analyze the role played by trade integration in the destination of public expenditures. We also determine whether the coordination of public spending for firms is necessary. To explore these questions, we elaborate an economic geography framework à la Ottaviano, Tabuchi and Thisse (2002). Two countries compete to attract firms in an environment of imperfect competition with barriers to trade. Our model is close to Ottaviano and van Ypersele (2005) since we consider asymmetric competition between governments to attract mobile plants (a country has a comparative advantage in terms of productivity) and two tax instruments (a tax on the workers' wage and a tax on firms' profit). However, unlike Ottaviano and van Ypersele (2005), we consider that tax revenues can be shared between an individual subsidy to mobile firms and an other one to immobile households.

Our main results can be summarized as follows. First, the low productivity country set higher net of tax subsidy for each firm than the other country. Further, the most generous country in terms of subsidy per firm is not necessary the country with the highest budget devoted to the firms in its jurisdiction because the high productivity countries hosts the majority of internationally mobile firms despite of lower individual subsidies. Indeed, the high productivity country spends more for firms than the low productivity country when that trade costs are low enough and corporate tax rates are high enough. However, we show that households located in the low productivity country are the net contributors of the public policy, regardless of trade costs, while households located in the high productivity country are the net recipients, provided that its productivity is high enough or trade costs are low enough. In other words, the effects of trade integration is not symmetric on the composition of public spending. Low trade barriers favor the agglomeration of firms and the decline of individual subsidies for firms,

²These models assume a purely decentralized tax system. See Riou (2005) for an economic geography model with a tax policy in multilevels governments.

raising total tax revenues in this country and, thus, allowing its residents to remain the net recipients of the public policy. On the other hand, whatever the level of trade integration the country having a locational disadvantage is subject to strong pressures to attract firms which always make them the net recipients of the public sectors. As a result, globalization poses numerous governance challenges for developing countries and, to a less extent, for developed countries.

Finally, we determine if the pattern of public spending is efficient from a social optimum point of view. Results depend on whether the profits remain in the economy or not. When profits are not distributed among agents located in the economy, the aggregate welfare would be improved by a coordinated reduction in the provision of subsidies to firms, as suggested by Keen and Marchand (1997). However, when profits remain in the economy, the individual subsidy to firms becomes too low in the high productivity country. Indeed, more subsidies for firms in this country is required in order to increase the degree of agglomeration and, in turn, raises the total profits, increasing the total welfare. Such a result challenges the ability to implement a coordination between countries. Strategic competition creates a “prisoner’s dilemma” providing a rationale for cooperation among countries. Unfortunately, coordination is notoriously difficult to sustain here since the incentive to deviate from the agreement is very strong for countries having a locational disadvantage.

The rest of the paper is organized as follows. The model is developed in the next section. In section 3, we display the location equilibrium for given public policies. Then, in section 4, we determine the level of subsidies for firms in each country arising from Nash competition among benevolent governments. Section 5 proposes a welfare analysis. Section 6 discusses the robustness of our results by considering that profits are distributed among households. The last section concludes.

2 A simple model of location and trade

We consider an economy made of two countries, labelled $r = 1, 2$. There are two sectors, a private sector and a public sector. The private sector consists of a modern industry (M) and a traditional one (T). The M-sector produces a continuum of varieties of a horizontally differentiated product under increasing returns, using workers as the only input. The T-sector produces a homogenous good (the numéraire) under constant returns, using also workers as the only input. Firms of the M-sector can be considered as multinationals and mobile between countries. It is well-known that this category of firms largely benefits from subsidy policies (see, Charlton, 2003). Indeed, various benefits are waiting from the attraction of multinational firms: jobs, productivity spillovers, market access spillovers (eg. Blomström

and Kokko, 1998). Workers are not mobile between countries but are mobile between private sectors and their spatial distribution is uniform ($L_1 = L_2 = L$). Countries only differ in productivity in the modern industry. The public sector consists of two governments providing a subsidy to mobile firms (f_r) and a subsidy to immobile households (h_r). While the subsidy to immobile households can be viewed as a social spending, the public policy for firms can include the most direct instruments by which a country reduces the cost of doing business within its boundaries (see. the appendix). These public interventions have effects on the location choice but do not directly affect labor and capital productivity³.

2.1 Consumption

Preferences are identical across workers and, following Ottaviano et al. (2002), are captured by a quasi-linear quadratic utility given by:

$$u(.) = \alpha \int_0^n q(i) di - \frac{\beta - \delta}{2} \int_0^n [q(i)]^2 di - \frac{\delta}{2} \left[\int_0^n q(i) di \right]^2 + q_O \quad (1)$$

where $\alpha > 0$ and $\beta > \delta > 0$. In this expression, α measures the intensity of preferences for the differentiated product with respect to the numéraire. The condition $\beta > \delta$ implies that workers have a preference for variety. Finally, $q(i)$ is the quantity of variety $i \in [0, n]$ and q_O the quantity of the numéraire. Each worker is endowed with $\bar{q}_O > 0$ units of the numéraire. The initial endowment is supposed to be large enough for her/his consumption of the numéraire to be strictly positive at the market outcome. Her/his budget constraint can then be written as follows:

$$\int_0^n p(i) q(i) di + q_O = \bar{q}_O + y_r \quad (2)$$

where $p(i)$ is the consumer price of variety i and y_r is the workers's net income residing in country r with

$$y_r \equiv w_r + h_r - \rho_r$$

with w_r the wage prevailing in country r , h_r is the amount of the subsidy for each inhabitants living in country r and ρ_r means the unit tax rate on wages. Given the assumption of symmetry between varieties, solving the consumption problem yields the demand functions for a representative variety located in r from region r (q_{rr}) and region s with $s \neq r$ (q_{rs}):

$$q_{rr} = a - (b + cn) p_{rr} + cP_r \quad q_{rs} = a - (b + cn) p_{rs} + cP_s \quad (3)$$

³Contrary to our assumption, most of the papers on the pattern of public spendings based on traditional models of tax competition assume that public inputs complement particular private factors of production (see Matsumoto, 2004, Keen and Marchand, 1997).

where $a \equiv \alpha b$, $b \equiv 1/[\beta + (n-1)\delta]$ and $c \equiv \delta b/(\beta - \delta)$ and p_{rr} (resp., p_{rs}) is the price of a variety located in region r to consumers of region r (resp., s). Finally,

$$P_r = n_r p_{rr} + n_s p_{sr} \quad P_s = n_r p_{rs} + n_s p_{ss} \quad (4)$$

are the price indices (i.e., n times the average price) of varieties in region r and in region s , respectively, with n_r and n_s the number of varieties/firms located in r and s .

2.2 Private sector

There are two private sectors. The traditional sector produces a homogeneous good under perfect competition and constant returns to scale. One unit of output requires one unit of labor. The T-good is traded without cost between countries so that its price is the same everywhere. This makes that good the natural choice for the numéraire, which implies that the price of the T-good (p^T) and, the equilibrium wage of immobile workers (w^T) are equal to one everywhere. The T-sector is not taxed since equilibrium profits are zero.

The modern sector supplies varieties under increasing returns to scale and monopolistic competition. There exists a one-to-one correspondence between firms and varieties. Firms of M-sector compete within a large group of firms. The total mass of firms in this sector is fixed and is equal to n . We consider a market structure with monopolistic competition in which entry is restricted instead of being free. Thus, firms have a market power and will earn positive profits which will be taxed by governments. For a firm located in country r , the production of any variety requires a country-specific fixed amount ϕ_r of labor L with

$$\phi_2 > \phi_1$$

In other words, we assume that country 1 has an advantage in terms of productivity.

Varieties of M-good are traded at a cost of τ units of the numéraire per unit shipped between the two countries. As firms bear trade costs, profits of a representative firm in region r are as follows:

$$\pi_r = p_{rr} q_{rr} L_r + (p_{rs} - \tau) q_{rs} L_s - \phi_r - t_r + f_r \quad \text{with } r \neq s \quad (5)$$

where L_r (resp., L_s) is the number of workers located in country r (resp., s), t_r is the unit tax in region r and f_r is the subsidy for each firm established in country r . Note that because labor is mobile between sectors, the wage rate is fixed to 1 in the M-sector. Nevertheless, this will be verified only if the sector T is always active in both regions. Then, we have to ensure that

a single location alone cannot supply the world demand in the homogeneous good. The condition is $1 < 2q_O$.⁴

When producers maximize profits, they take the price indices as given. Nevertheless, the market as a whole has a non negligible impact on each firm's choice in that each firm must account for the distribution of all firms' prices through an aggregate statistics (the price index) in order to find its equilibrium price. Thus, the market solution is given by a Nash equilibrium with a continuum of players in which prices are interdependent. We assume that markets are internationally segmented so that each firm chooses a delivered price which is specific to the country in which its variety is sold. The profit-maximizing prices are the same obtained by Ottaviano et al. (2002) and are given by

$$p_{rr} = \frac{1}{2} \frac{2a + \tau c(n - n_r)}{cn + 2b} \quad p_{rs} = p_{ss} + \frac{\tau}{2} \quad (6)$$

Freight absorption by firms located for instance in country r is a decreasing function of their relative number. The reason is that as n_r falls, the market in region s becomes more crowded pushing down local prices. As a result, the elasticity of demand for firms located in r rises on foreign sales while falling on domestic ones. The result is that they find convenient to reduce their operating margins on foreign sales while increasing them on domestic sales (Brander and Krugman, 1983).

By inspection, it is readily verified that p_{rr} is increasing in τ because the local firms are more protected against foreign competition. By contrast, $p_{rs} - \tau$ is decreasing because it is now more difficult for firms to sell on the foreign market. As firms' prices net of trade costs are to be positive for any distribution of workers, we assume throughout this paper that

$$\tau < \tau_{trade} \equiv \frac{2a}{2b + cn}. \quad (7)$$

This condition also guarantees that it is always profitable for a firm to export to the other region.

2.3 Public sector

We consider that each country maximizes the aggregate welfare of workers/consumers living in its jurisdiction given by

$$W_r = S_r L + (1 + h_r - \rho_r) L \quad (8)$$

⁴An other condition indicates that full agglomeration of the modern sector in one region is not sufficient to promote equilibrium in the labor market of this region, that is $L > 2\phi_r N$ where $\phi_r N$ is the number of workers employed in the modern sector when a core-periphery configuration emerges.

with S_r is the consumer's surplus in country r given by

$$S_r = \frac{a^2 n}{2b} - a(n_r p_{rr} + n_s p_{sr}) + \frac{b + cn}{2}(n_r p_{rr}^2 + n_s p_{sr}^2) - \frac{c}{2}(n_r p_{rr} + n_s p_{sr})^2$$

where prices are given by (6). An increasing number of firms located in country r raises the surplus of workers living in this country since the price of local varieties decreases and less varieties are imported. Unlike Keen and Marchand (1997), in our benchmark case, there are no indirect effects of the public spending to firms on the level of the capital rent which would be internalized by the government. A major argument is that ownership of plant of multinational corporations is usually geographically widespread. Thus it will have a very marginal impact on the residents' welfare that governments can neglect. Observe that this assumption is supported by Keen and Marchand (1997) who consider that it would also be beneficial to assume a case of foreign direct investments when analyzing the pattern of public spending. However, in section 6, we will analyze the configuration where profits are distributed among households so that profits become a component of the national welfare.

Public funds have two possible allocations: an individual subsidy for firms (f_r) or for immobile residents (h_r) so that

$$G_r = h_r L_r + f_r \lambda_r n \quad (9)$$

where G_r is the level of public expenditures in country r and $\lambda_r = n_r/n$ is the share of firms located in country r with $\lambda_r + \lambda_s = 1$. To finance these public spending, two tax instruments are used: a unit tax rate on profits (t_r) and a unit tax rate on wages (ρ_r). Therefore, in each country, tax revenues are expressed as follows:

$$T_r = t_r \lambda_r n + \rho_r L_r. \quad (10)$$

Given the budget constraint, $G_r = T_r$, using (10) and (9) leads to the following equality:

$$(h_r - \rho_r)L_r = (t_r - f_r)\lambda_r n. \quad (11)$$

This means that, when the grants net of profit tax rate are positive in country r ($t_r - f_r < 0$), workers living in this country are the net contributors in the redistribution system ($h_r - \rho_r < 0$) and vice-versa.

Because we focus on the composition of public spending and not on the level of public expenditures, we assume that the level of tax rates in each country is exogenous (because of a tax coordination among countries, for example). However, tax revenue in each country remains endogenous since it depends on the spatial distribution of tax base (see (10)).

2.4 Sequence of events

There are two types of actors in our model: firms and governments. In the first stage, each government chooses simultaneously its individual subsidy for firms f_r taking as given the decision of the other government, and anticipating the private sector outcomes and the resulting location equilibrium. In stage 2, given the preferences announced by the governments, firms choose their place of production. All players have a perfect information and the game is solved by a sub-game perfect equilibrium involving backward induction beginning with the last stage.

3 Location and subsidies

The location of firms is governed by the spatial differences in net profits, given by

$$\pi_r = \Pi_r - \phi_r - t_r + f_r \quad (12)$$

where Π_r are the operating profits earned by a firm established in country r with

$$\Pi_r \equiv (b + cn) (p_{rr})^2 L + (b + cn) (p_{rs} - \tau)^2 L$$

where we have introduced (3) and (4) in (5). While the difference in productivity favors the clustering of firms in the high productivity country, agglomeration intensifies price competition among firms, favoring the spatial dispersion of production. A spatial equilibrium exists when $\pi_r = \pi_s$. This leads to the following location equilibrium:

$$\lambda^* = \frac{1}{2} + A(\tau)(f_1 - t_1 - f_2 + t_2 + \theta) \quad (13)$$

where

$$\theta \equiv \phi_2 - \phi_1 > 0 \quad A(\tau) \equiv \frac{2b + cn}{cnL\tau^2(b + cn)} > 0$$

It is straightforward to check that $\partial\lambda^*/\partial\theta > 0$ and $\partial^2\lambda^*/\partial\theta\partial\tau < 0$. In other words, the high productivity country is more and more attractive when trade costs decline. Such a result is similar to one obtained with a home market effect. The attractiveness effect of the country having the highest market size increases with the degree of economic integration (see Ottaviano and Thisse, 2004).

4 Endogenous subsidy for firms

The objective of each national government is to maximize (8) with respect to f_r with

$$W_r = S_r L + t_r \lambda_r n - f_r \lambda_r n + L$$

where we have introduced (11) in (8), taking as given the decision of the other government. National welfare includes the consumers' surplus living in country r (LS_r), the direct net benefits of the public policy for households ($t_r \lambda_r n - f_r \lambda_r n$), and the labor income (L). For each country, first-order condition is expressed as follows

$$\frac{dW_r}{df_r} = \underbrace{L \frac{\partial S_r}{\partial \lambda_r} \frac{\partial \lambda_r}{\partial f_r}}_{\text{Surplus effect}} + \underbrace{t_r n \frac{\partial \lambda_r}{\partial f_r}}_{\text{Tax revenue effect}} - \underbrace{\left(\lambda_r n + f_r n \frac{\partial \lambda_r}{\partial f_r} \right)}_{\text{Sharing effect}} = 0$$

Clearly, each country has incentives to raise subsidies for firms in order to increase, on the one hand, the consumer's surplus ($dS_r/df_r > 0$) *via* a rise in λ_r (*surplus effect*) and, on the other hand, the tax revenue ($t_r n \partial \lambda_r / \partial f_r > 0$) *via* a rise in tax base (*tax revenue effect*). Nevertheless, each country has two incentives to diminish subsidies for firms (*sharing effects*). Firstly, a high subsidy for firms has a direct negative effect since it reduces the level of public spending devoted to households ($-\lambda_r n$). Secondly, through an attractiveness effect, being generous with firms increases the number of firms to be subsidized ($-f_r n \partial \lambda_r / \partial f_r < 0$).

At Nash equilibrium, we have

$$f_1^* = t_1 - B\theta + C(\tau) \quad (14)$$

$$f_2^* = t_2 + B\theta + C(\tau) \quad (15)$$

where

$$B \equiv \frac{8b + 5cn}{2(12b + 7cn)} \in (1/3, 1/2)$$

$$C(\tau) \equiv \frac{aL\tau(b + cn)^2}{(2b + cn)^2} - \frac{L(b + cn)\tau^2(b^2 + 3bcn + c^2n^2)}{2(2b + cn)^2} > 0$$

Some calculations show that we have $f_1^* > f_2^*$ when $\theta < \tilde{\theta} \equiv (t_1 - t_2)/(2B)$. Clearly, identifying the country providing the highest level of individual subsidy for firms requires to compare the productivity gap with the relative taxation of firms. We first consider the case where profit tax burden is higher in the country exhibiting a location advantage. This is the more reasonable restriction since empirical evidences reveal that corporate tax rates have always been higher in the most industrialized countries with

high productivity as shown by Baldwin and Krugman (2004) for the European Union. Thus, the condition $\theta < \tilde{\theta}$ suggests that a firm located in the high productivity countries receives a higher level of subsidy only if their productivity advantage is low enough compared with their tax disadvantage. Intuition behind this result is straightforward. A country combining a weak productivity advantage with high tax pressure has to give a more generous subsidy for firms to sustain its attractiveness. When the productivity wedge becomes high enough, the high productivity country does not need to set higher subsidy for each firm in order to compensate higher corporate tax rate.

Now assume tax harmonization ($t_1 = t_2$) or a higher profit taxation in the low productivity country. This is mechanically associated with higher subsidy in the low productivity country. In other words, since tax harmonization offset pure fiscal incentives of the location choices, the government of the low productivity country has to increase its subsidy for firms to a higher level than the high productivity one in order to unless partially compensate its productivity disadvantage.

Further, whatever the corporate tax rates, it is easy to check that $f_2^* - t_2 > f_1^* - t_1$. The subsidy net of profit tax rate is higher in the low productivity country, regardless of the productivity gap. We can also observe that $\partial(f_1^* - t_1)/\partial\theta < 0$ and $\partial(f_2^* - t_2)/\partial\theta > 0$. An increasing advantage in productivity in country 1 reduces the net of tax subsidy for each firm. In other words, a convergence of the productivity levels implies also a convergence of net of tax subsidies for each firm.

Finally, we address the relation between trade integration and the equilibrium level of the subsidy allocated to firms. It is straightforward to check that the level of subsidy for firms is a bell-shaped function of the level of trade integration since we have $df_r^*/d\tau = dC(\tau)/d\tau$ which is positive when $\tau < a(b + cn)/(b^2 + 3cn + c^2n^2)$ and negative otherwise. Two opposite forces are at work, which are not linked to the levels of the corporate tax rate and the productivity wedge (since $C(\tau)$ does not depend on these parameters). On the one hand, the positive impact of the number of firms in a country on the surplus of consumers living in this country grows with τ . On the other hand, the positive impact of f_r on the mass of firms in country r decreases with τ . Hence, starting from a low levels of trade cost, increasing trade costs favor a race to the top in subsidies, since government must promote higher subsidies to attract a given number of firms in order to raise the consumers' surplus. Beyond a threshold value of trade costs, it becomes too costly to go on offering higher subsidies because the additional number of firms becomes low while the direct cost supported from this policy by households is more and more important.

To summarize,

Proposition 1 *The country having the lowest productivity sets higher net*

of tax subsidies for each firm established in its jurisdiction.

We now analyze the impact of subsidy competition on the international allocation of the modern sector. Introducing (14) and (15) in (13) gives

$$\lambda^* = 1/2 + \theta(1 - 2B)A(\tau) > 1/2 \quad (16)$$

so that a majority of firms are located in the high productivity country even though net of tax subsidies for firms are higher in the low productivity country. Similarly to tax competition models with market size effect (see. Ottaviano and Van Ypersele, 2005), our framework also exhibits an 'agglomeration rent' so that the country offering an economic advantage can apply a less attractive policy and accommodates a more than proportional share of firms. Additionally, competition in grants cannot prevent full agglomeration of the mobile production when the productivity wedge is high enough. Indeed, trivial calculations show that $\lambda^* = 1$ when $\theta \geq \theta_{aggllo}$ with

$$\theta_{aggllo} \equiv \frac{1}{2(1 - 2B)A(\tau)} \quad (17)$$

Hence, the productivity wedge threshold beyond which all firms are located in the high productivity country is decreasing with the degree of economic integration. More generally, a fall in trade barriers favors the location of firms in the high productivity country.

Since $\lambda^* > 1/2$, it is worth stressing that the most generous country in terms of subsidy for each firm is not necessary the country with the highest budget devoted to the total number of firms located in its area. Indeed, $\Delta^f \equiv f_1^*\lambda^*n - f_2^*(1 - \lambda^*)n > 0$ can hold under specific conditions. Some calculations show that

$$\Delta^f = [A(\tau)(1 - 2B)(t_1 + t_2 + 2C(\tau)) - B]\theta n + (t_1 - t_2)n/2$$

Assume first that tax rates on profits are equal in both countries ($t_1 = t_2 \equiv t$, so that $f_2^* > f_1^*$). The total funds devoted to firms are higher in the high productivity country when $t > \bar{t}(\tau)$ where

$$\bar{t}(\tau) \equiv \frac{B}{2(1 - 2B)A(\tau)} - C(\tau) > 0 \quad \text{and} \quad \frac{d\bar{t}(\tau)}{d\tau} > 0.$$

Hence, when tax harmonization prevails, the budget devoted to firms is higher in the high productivity country when the corporate tax rate is high enough or trade costs are low enough. Indeed, $\Delta^f > 0$ implies that $\lambda^*/(1 - \lambda^*) > f_2^*/f_1^*$. Trivial calculations reveal that f_2^*/f_1^* decreases with t while the spatial distribution of firms is not affected by the level of tax burden when tax harmonization prevails. Hence, public expenditures for firms will likely be larger in the high productivity country when profit tax rates achieve

high values. In other words, even though subsidies for each firm increase with corporate tax rate in each country, the positive impact of increasing tax burden on the public spending for firms is less important in the low productivity country since this country attracts a minority of firms. In addition, when countries are strongly integrated this relationship between taxation and public expenditures for firms is strengthened. Indeed, low trade costs favor the spatial concentration of firms in the high productivity country, and, in turn, the number of recipients of the subsidy.

Finally, when we consider that corporate tax rates are higher in the high productivity country, $\Delta^f > 0$ becomes more likely. Hence, our previous results do not change qualitatively and are summarized in the following proposition.

Proposition 2 *The high productivity country spends more for firms than the low productivity country, provided that both trade costs are low enough and corporate tax rates are high enough.*

Finally, we analyze the impact of subsidy competition on the budget devoted to households. Observe that $f_2^* - t_2 > 0$ is always checked. This implies that $h_2^* - \rho_2 < 0$, according to (11). This means that the tax burden for households (resp., firms) is higher (resp., lower) than their subsidies in the low productivity country. In other words, workers are the net contributors in the redistribution system of the low productivity country, regardless of trade costs. Hence, even though public expenditures for firms in this country may be lower than the high productivity country, firms located in the low productivity country are always the net recipient. Whatever the level of trade integration, the low productivity country is subject to the pressure to attract firms which always makes them the net recipients.

On the other hand, we have $f_1^* - t_1 < 0$ when

$$\theta > C(\tau)/B \equiv \hat{\theta}.$$

Hence, firms located in the high productivity country have a tax rate superior to subsidies, provided that the productivity wedge is high enough or trade costs take extreme values (recall that $C(\tau)$ is described by a bell-shaped curve with respect to τ). For instance, if the trade integration process is sufficiently advanced, the less vigorous subsidy competition may benefit to households in the high productivity country who can become the net recipients of the public policy. Similarly, when trade integration is low, subsidy competition is weak and the number of firms to be subsidized is reduced. This result gives an illustration of how trade integration may place immobile households living in more industrialized countries in different positions.

In addition, it is easy to check that, when $\theta < \hat{\theta}$, the net contribution of households to public spending is always inferior in the high productivity country. Indeed, the international difference in public expenditures for

households is given by $\Delta^h = (h_1 - \rho_1)L - (h_2 - \rho_2)L$, or equivalently by

$$\Delta^h = B\theta + (1 - 2\lambda^*)C(\tau) = \theta[B - 2(1 - 2B)A(\tau)C(\tau)] > 0$$

Indeed, because $\lambda^* > 1/2$, the high productivity country raises more public funds what implies a lower contribution of household living in this country to public budget. Consequently, *the high productivity country spends more both for firms and households than the low productivity country, provided that corporate tax rates are high enough ($t > \bar{t}(\tau)$).*

To sum up,

Proposition 3 *Regardless of trade costs, households located in the low productivity country are net contributors of the subsidies for firms. In contrast, households living in the high productivity country are net recipients of the public funds provided that its productivity is high enough and/or trade costs reach extreme values.*

5 On the optimality of subsidies

Another question, fundamental as well, is to determine whether the subsidy competition among countries leads to inefficiently high subsidization of firms at the expense of the households. From a traditional model of tax competition without coordination, Keen and Marchand (1997) show that competition for mobile capital leads to over-provision of public inputs. More precisely, starting from the non-cooperative equilibrium, and holding tax rates constant, their analysis reveals that welfare would be improved by a coordinated reduction in the provision of local public inputs and a corresponding increase in the public provision of local public goods benefiting immobile consumer. Such a result emerges because all externalities in the framework developed by Keen and Marchand (1997) imply too high level of public input. In a given country, the capital outflow induced by a rise in the amount of public input in other countries affects welfare through three routes: (i) capital rent falls (ii) wage rate decreases (iii) tax revenues decline.

In our framework, the first two externalities are absent since firm owners are assumed to be located outside the economy and the wage rate does not depend on the location of firms. However, our model exhibits an externality passing through the consumption of private commodities. Recall that the consumer's surplus in each country varies positively with the mass of firms. Consequently, because the difference in subsidies to firms matters for the location choice of their production, an externality passes through the consumers surplus. When deciding its level of subsidies to firms, a country does not internalize the indirect effect on the surplus of consumers located in other countries. We also have an externality passing through public funds devoted to households. However, this externality is not symmetric. Recall

that we have $(h_1^* - \rho_1)L = (t_1 - f_1^*)\lambda^*n$ and $(h_2^* - \rho_2)L = (t_2 - f_2^*)(1 - \lambda^*)n$. Because $f_2^* - t_2 > 0$, an outflow of firms from the low productivity country leads to higher level of subsidies for households. In contrast, in the high productivity country, a decreasing mass of firms implies a falling amount of public spending for households living in this country, provided that $\theta > \hat{\theta}$.

To quantify these externalities, we successively focus on the aggregated consumers' surplus and the aggregated direct net benefits of the public policy to households, the sum of these two components being the total welfare, given by

$$W_T \equiv W_1 + W_2 = L(S_1 + S_2) + (t_1 - f_1)\lambda^*n + (t_2 - f_2)(1 - \lambda^*)n$$

Let first consider the aggregate consumers' surplus $S_T \equiv L(S_1 + S_2)$. To determine the non-optimality of the decentralized subsidy policies arising from the surplus, we introduce the values of each Nash grant f_1^* , f_2^* in dS_T/df_r and evaluate the sign of the resulting expressions. Some calculations reveal that

$$\left. \frac{dS_T}{df_2} \right|_{\text{Nash}} > 0 \quad \left. \frac{dS_T}{df_1} \right|_{\text{Nash}} < 0$$

which suggest that a coordinated policy focusing on the consumer surplus alone would reduce the subsidy to firms in the high productivity country while increasing it in the other country. Intuition behind this result is straightforward and related with the location equilibrium. Indeed, the coordinated policy would induce a lower level of agglomeration suggesting that the location of production at the decentralized equilibrium is too agglomerated. When deciding its level of grants, each country does not internalize that it affects the consumer surplus of the other country. Consequently, more dispersion of mobile firms is needed to maximize the global consumers' surplus.

Now consider the externalities arising from the supply of subsidies devoted to households. Set H_T the total direct net benefits of the public funds to households where

$$H_T \equiv \lambda^*n(t_1 - f_1) + (1 - \lambda^*)n(t_2 - f_2).$$

It is straightforward to check that

$$\text{sign} \left\{ \left. \frac{dH_T}{df_1} \right|_{\text{Nash}} \right\} = \text{sign} \{ -1 + 2\theta(4B - 1)A(\tau) \} \geq 0 \text{ when } \theta \geq \ddot{\theta}$$

and

$$\text{sign} \left\{ \left. \frac{dH_T}{df_2} \right|_{\text{Nash}} \right\} = \text{sign} \{ -1 - 2\theta(4B - 1)A(\tau) \} < 0$$

with

$$\ddot{\theta} \equiv \frac{(12b + 7cn) cn L \tau^2 (b + cn)}{2(4b + 3cn)(2b + cn)} < \theta_{aggllo}$$

Clearly, focusing on the consumer's surplus or the direct net benefits of the public policy for households may lead to divergent coordinated policies. While f_2 may be excessive when we only observe the total direct net effect of the public funds for households, it may be considered as too low from the consumer's surplus point of view. Similarly, f_1 can reach too high values for the aggregate consumer surplus while the externality may work in an opposite direction concerning the direct net effect of subsidy for households. On this last point, it is worth to note the significant influence of trade costs. For low enough trade costs such that $\theta > \ddot{\theta}$, the coordinated policy will improve the aggregate direct net benefits of the public policy for households by advocating more subsidies to firms in country 1 and the opposite for country 2. Such a policy consists in promoting higher agglomeration of the tax base in the high productivity country by expecting that the lower level of subsidy to households in country 1 and the loss in tax base in country 2 will be more than compensated by the increasing tax base in country 1 and by the decreasing net contribution to the public policy by households living in country 2. This effect will be stronger, the higher the tax base elasticity to f_r will be. Since this elasticity decreases with τ , low trade costs could imply a coordinated policy in favour of firms located in the high productivity country in order to raise the total direct net benefits of the public policy for workers.

Let now evaluate which externality is dominant. To identify this, we introduce the values of each Nash subsidies resulting from non-cooperative policies in dW_T/df_r . For the low productivity country we have

$$\left. \frac{dW_T}{df_2} \right|_{\text{Nash}} < 0$$

while we obtain

$$\left. \frac{dW_T}{df_1} \right|_{\text{Nash}} \leq 0 \text{ for all } \theta \text{ such that } \lambda \leq 1$$

for the other country. Hence like Keen and Marchand (1997), our framework displays a compositional inefficiency in the public policy which may be solved by an increase in the public spending devoted to immobile consumers in both countries. To sum up

Proposition 4 *The level of individual subsidies for firms is too high in each country.*

Our previous analysis raises the question whether the pattern of public spending is efficient from the social optimum point of view. We have shown that immobile residents enjoy a gain from a coordinated policy. It is straightforward to see that the resulting decrease in the subsidies to firms is Pareto-improving for each country. Indeed, it will be the case if, around the Nash subsidies for firms, the following inequalities are checked:

$$\begin{cases} dW_1 = \frac{\partial W_1}{\partial f_1} df_1 + \frac{\partial W_1}{\partial f_2} df_2 > 0 \\ dW_2 = \frac{\partial W_2}{\partial f_1} df_1 + \frac{\partial W_2}{\partial f_2} df_2 > 0 \end{cases} \quad (18)$$

Recalling that $dW_r/df_r = 0$ at the Nash equilibrium and $df_{r,s} < 0$, these inequalities are checked when $dW_r/df_s < 0$ which is a corollary of the social optimum analysis since

$$\left. \frac{dW^T}{df_r} \right|_{\text{Nash}} = \left. \frac{dW_s}{df_r} \right|_{\text{Nash}} < 0$$

Nevertheless, decomposing dW_s/df_r allows to go further in the identification of the two externalities that each government generates for the other one. Indeed, we have

$$\begin{cases} \left. \frac{dW_1}{df_2} \right|_{\text{Nash}} = \underbrace{L \left. \frac{dS_1}{df_2} \right|_{\text{Nash}}}_{-} + \underbrace{\left. \frac{dH_1}{df_2} \right|_{\text{Nash}}}_{+ \text{ if } \theta < \hat{\theta}} < 0 \\ \left. \frac{dW_2}{df_1} \right|_{\text{Nash}} = \underbrace{L \left. \frac{dS_2}{df_1} \right|_{\text{Nash}}}_{-} + \underbrace{\left. \frac{dH_2}{df_1} \right|_{\text{Nash}}}_{+} < 0 \end{cases}$$

Considering first the externality acting through the consumer surplus, the effect is unambiguously negative because of the tax base erosion effect induced by an increase of the other country's subsidy to firm. Now consider the externality arising from the direct net effect of the public policy. Since households of the low productivity country are always the net contributors to the public system, an erosion of their tax base may be advantageous for them. Thus, by increasing its level of subsidy and its attractiveness, the high productivity country generates a positive externality. The same mechanism with the same causes may occur in the last country as long as the households living there are the net contributors of the public policy that is, provided that the productivity advantage is low enough and/or trade costs are relatively high. Otherwise, beyond $\hat{\theta}$, this externality acts in the opposite direction. Households living in the most productive country becomes net recipients and suffer from a higher attractiveness of the other country. In other words, the direction of this externality perceived by the high productivity country depends on the ability of its government to make firms the net contributors of the public policy. Finally, despite the ambiguous sense of the externality

arising from the sign of dH_r/df_s , an unilateral increase in subsidy for firms generates an overall negative externality. Indeed, the outflow of tax base is too harmful for consumer's surplus to be counteracted by the potential positive effect arising from the direct net benefits of the public policy for households.

6 On the role of profit distribution

Until now, we have made the assumption that the property of capital was geographically widespread so that capital incomes benefiting to households in each country were ignored. To extend our model and evaluate the robustness of our main findings, we consider that all profits are equally distributed to households. We assume that each resident owns an equal share of the total stock of capital. Therefore, as in Keen and Marchand (1997), we introduce an externality passing through the capital income. Considering this externality, we could expect that the incentive to increase subsidies to firm will be more important because an unilateral rise in the subsidy will increase their income.

The objective of each national government is to maximize W'_r with respect to f_r , where

$$W'_r = S_r L + (t_r - f_r)\lambda_r n + L + (\pi_r \lambda_r n + \pi_s \lambda_s n)/2. \quad (19)$$

Because, from the location stage we know that $\pi_1 = \pi_2$, (19) becomes

$$W'_r = S_r L + (t_r - f_r)\lambda_r n + L + \pi_r n/2$$

leading to the following first-order condition

$$\frac{dW'_r}{df_r} = L \frac{\partial S_r}{\partial \lambda_r} \frac{\partial \lambda_r}{\partial f_r} + \frac{\partial \lambda_r}{\partial f_r} t_r n - \frac{\partial \lambda_r}{\partial f_r} f_r n - \lambda_r n + \underbrace{\frac{n}{2} \frac{d\pi_r}{df_r}}_{\text{profit effect}} \quad (20)$$

where

$$\frac{d\pi_r}{df_r} = \frac{\partial \Pi_r}{\partial \lambda_r} \frac{\partial \lambda_r}{\partial f_r} + 1$$

The surplus effect as well as tax revenue and sharing effects have the same expression determined in section 4. The profit effect is a new term, encapsulating two effects: a direct effect and an indirect effect. An increase in f_r raises directly the net profit. In other words, the direct effect is positive. On the other hand, increasing subsidies for each firm reduce operating profits because we have $\partial \Pi_r / \partial \lambda_r < 0$ and $\partial \lambda_r / \partial f_r > 0$. Attracting more firms thanks to a generous level of subsidy strengthens the competition on the domestic market and pushes down prices and operating profits. As a result,

the net effect of increasing subsidies for firms on profits seems ambiguous because the indirect effect is negative while the direct effect is positive. However, some calculations reveal that $d\pi_r/df_r > 0$ when $f_r = f_r^*$ so that taking into account the profits creates an incentive to raise subsidies for each firm in each country. Indeed, solving the first order condition, we get the following level of Nash subsidies

$$f_1^{*'} = t_1 - B'\theta + C'(\tau) > f_1^* \quad f_2^{*'} = t_2 + B'\theta + C'(\tau) > f_2^*$$

where

$$B' \equiv \frac{8b + 3cn}{2(12b + 5cn)} < B$$

$$C'(\tau) \equiv \frac{a\tau L(b + cn)^2}{(2b + cn)^2} - \frac{L(b + cn)\tau^2(b^2 + 2bcn + c^2n^2/2)}{2(2b + cn)^2} > C(\tau)$$

In other words, the structure of equilibrium subsidy for firms remains identical, even if we have introduced profits in the national welfare. As a result, our main qualitative results obtained in section 4 (see Propositions 1, 2 and 3) remain checked. However, it is worth stressing that these new incentives arising from the distribution of profits are not symmetric. The high productivity country faces with higher incentive to raise subsidies for each firm than the low productivity country since we have

$$(f_1^{*'} - f_1^*) - (f_2^{*'} - f_2^*) = 2(B - B')\theta > 0$$

Consequently, the spatial distribution of production becomes more uneven when profits remain in the economy, even though these profits are equally distributed among workers.

To sum up

Proposition 5 *The distribution of profits among households increases the level of subsidy for firms, especially in the high productivity country.*

Although the distribution of profits does not imply significant changes in the subsidies competition, we expect that this assumption can modify the welfare analysis. Indeed, introducing profits in the expression of the global welfare makes disappear the direct net effects components H_T . Indeed, the expression of the aggregate welfare is now given by :

$$W_T' \equiv W_1' + W_2' = LS_T + \Pi_T n$$

where $\Pi_T \equiv (\Pi_1 - \phi_1)\lambda^{*'} + (\Pi_2 - \phi_2)(1 - \lambda^{*'})$. In other words, while there is no more an externality passing through the direct net effect of the subsidy policy, a new externality from gross profits must be taken into account in the welfare analysis. Let first consider the aggregated consumers' surplus.

We introduce the values of each Nash grant $f_1^{*'}, f_2^{*'}$ in $\partial S_T / \partial f_r$ and evaluate the sign of the resulting expressions:

$$\left. \frac{\partial S_T}{\partial f_1} \right|_{\text{Nash}} < 0 \text{ and } \left. \frac{\partial S_T}{\partial f_2} \right|_{\text{Nash}} > 0$$

This externality goes in the same direction as in the previous section: a coordinated policy focusing on the consumers' surplus alone would reduce the subsidy to firms in the high productivity country while increasing it in the other country. Consequently, more dispersion of mobile firms is needed to maximize the global consumers' surplus, wherever capital owners are located.

Now consider the externalities arising from total gross profits $(\Pi_r - \phi_r)$. It is straightforward to check that

$$\left. \frac{\partial \Pi_T}{\partial f_1} \right|_{\text{Nash}} > 0 \text{ and } \left. \frac{\partial \Pi_T}{\partial f_2} \right|_{\text{Nash}} < 0$$

The signs of these externalities indicate that gross profits would be increased if a coordinated policy was implemented by lowering subsidy for firms in the low productivity country while increasing it in the high productivity country. In other words, the spatial difference in the level of subsidy for firms must diminish in order to increase gross profits. Indeed, the total gross profits increase with the level of agglomeration in the high productivity country. Clearly, externalities from the consumers' surplus and the level of profits distributed go in opposite directions. While improving the consumer surplus would require a lower (resp. higher) subsidy to firms in the high productivity country (resp. low productivity country), focusing on the aggregate profits leads to the opposite recommendation. Stated differently, higher levels of total operating profits require more agglomeration while higher levels of total surplus need more dispersion.

A question of main interest is now to isolate the dominant externality. Remember that when we ignore the profit income the recommendation about a coordinated policy is clear-cut: both countries should spend more for households in terms of individual transfer. The introduction of profit incomes has important consequences since, the recommendation is no more identical for the two countries. Indeed, we get

$$\left. \frac{\partial W'_T}{\partial f_1} \right|_{\text{Nash}} > 0 \text{ and } \left. \frac{\partial W'_T}{\partial f_2} \right|_{\text{Nash}} < 0$$

Thus, the aggregate welfare would be higher if the high productivity country was choosing a higher level of subsidy than the Nash equilibrium and at the opposite if the low productivity country was less generous with firms. In other words, non cooperative policies leads to too high levels of subsidy in the low productivity country while the subsidy for firms in other country

achieves too low values. Clearly, the externality from the surplus is more than compensated by the externality arising from the profits. Hence, taking into account the fact that profits are a component of the national welfare affects the welfare analysis, even though the positive analysis keeps similar. This result arises from the fact that total profits increases with the mass of firms in the high productivity country, implying much higher levels of subsidy for firms in this country. However, we can easily expect that this profit effect declines, becoming weaker than the surplus effect, when the distribution of profits becomes more and more geographically widespread and is not fully internalized inside the two economies.

To summarize,

Proposition 6 *Assume that all profits are distributed among households. Starting from the non-cooperative equilibrium, and holding tax rates constant, global welfare is improved by a coordinated reduction in subsidy for firms in the low productivity country and an increase in subsidy for firms in the high productivity country.*

This finding is different from the result obtained by Keen and Marchand (1997) since they show that public expenditures for firms are too high when capital incomes accrue entirely to consumers. There are many differences between the Keen and Marchand model and that used here so that a direct comparison is very hard. However, we see two key distinctions. Firstly, the externality arising from the capital rent is always negative in Keen and Marchand (1997) since consumers receive only the rents arising in the jurisdiction in which they reside. Thus, residents always loose in terms of welfare when a more generous policy for firms in a foreign country induces a capital outflow. Since residents receive capital income from both countries, this externality is cancelled in our framework. Secondly, when countries are asymmetric, the location of firms among countries influences the aggregate profits. In other terms, there exists a level of agglomeration of firms which maximizes the level of profits received by residents. This is at the origin of the externality arising from the profits: when they non cooperatively choose their level of subsidy to firms, countries do not internalize the effects on the aggregate profits passing through agglomeration. This is why the international wedge in subsidy in favor of firms located in the low productivity country seems to be too large to promote enough agglomeration in the high productivity country.⁵

⁵Haufler and Wooton (2003) have a similar conclusion. Incorporating local ownership of the firm does not change the outcome of the subsidy competition but affects the magnitude of the gains from tax coordination.

7 Conclusion

With economic integration and international tax coordination agreements, the level of public funds allocated to companies becomes a key element in the location of mobile production. Hence, national governments have a stronger incentive to compete in subsidy to attract firms. As a result, such a non cooperative behavior could induce a rise in public funds for firms at the expense of households.

In this paper we have considered asymmetric competition in subsidies for firms when tax revenues are devoted to both residents and mobile firms. Interestingly, we have shown that promoting tax harmonization leads the country having the lowest productivity to set higher subsidies for firms. Indeed, the high productivity country will be the most generous for firms only when it suffers from a tax disadvantage and only benefits from a weak productivity advantage. Moreover, trade integration has very different effects on the role of immobile households in the public sector of each country. While households located in the low productivity country seem to be the net contributors of their public sector regardless of trade costs, residents of the other country can shift from a position of net contributor to net recipient -for a given productivity advantage- when trade costs are low enough.

When profits are not redistributed inside the two economies, we identify two main externalities which make the Nash equilibrium in subsidies an inefficient equilibrium. Even if these two externalities may act in opposite directions, we show that a coordinated policy promoting an increase of the public spending devoted to households in both countries will be beneficial, as suggested by Keen and Marchand (1997). Nevertheless, when the distribution of profits is a component of national welfare, the externality arising from profits may make that the government of the high productivity country is not enough generous with firms while the level of subsidy in the low productivity country is always too high from the global welfare point of view. Such a result occurs when the weight of profits in the welfare function is high enough.

Finally, much attention should be given to the impact of the competition for firms on the destination of public spending. Indeed, tax harmonization which is currently debated by policy makers only focuses on a particular aspect of a more global problem relative to the inefficiencies that emerge when countries compete for firms. Recent reports give clear conclusions about the growth of competition among governments in subsidies to attract foreign investments during the last decade. (see. Charlton, 2003). Far from being a positive-sum game, this subsidies competition would divert public funds away from households leading to over-investments or distorting the allocation of direct investments. In addition, depending on their natural competitive advantage in terms of productivity, countries are not equal within this competition. Low productivity country would be forced to be

always more generous with firms with significant effects on their ability to preserve their welfare state efforts. Because subsidies competition is a kind of prisoner's dilemma, a mechanism limiting the size of incentives to deviate from an international coordination would improve the situation of all countries. As it is suggested by Charlton (2003), promoting transparency of the amounts of incentives allocated by countries would be a promising policy since it would give to governments a higher bargaining power in the negotiations with firms. A more cooperative policy on the levels and forms of incentives is more difficult to set up even if the European Union has made significant efforts these last years. In practice, it is difficult to preserve the stability of these kinds of agreements. However, our paper suggests that the origin of this instability can come from the behavior of countries suffering from a competitive disadvantage for which the use of large incentives is necessary to sustain a given level of attractiveness. These countries having more to loose (in terms of attractiveness) from a coordination on a lower level of subsidy, a monetary compensation would be necessary.

References

- Baldwin R. E. and P. Krugman (2004). Agglomeration, integration and tax harmonization. *European Economic Review* 48(1), 1-23.
- Benassy-Quéré A., N. Goyalraja, and A. Trannoy (2005). Tax competition and public input. CEPII working paper n°2005-08.
- Blomström M. and A. Kokko (1998). Multinational corporations and spillovers. *Journal of economic surveys* 12(3), 247-77.
- Borck R. (2004). Fiscal competition, capital-skill complementarity and the composition of public spending. DIW Berlin Working Paper 504.
- Charlton A. (2003). Incentive bidding for mobile investment: economic consequences and potential responses. OECD Working Paper, n°203.
- Combes P.P. and JH. Overman (2005). The spatial distribution of economic activities in the European Union. Handbook of Urban and Regional Economics, Elsevier-North Holland, Amsterdam.
- Gagné C. and S. Riou (2004). Globalisation, tax competition and fiscal equalization. University of Strathclyde Working Paper.
- Garrett G. and D. Mitchell (2001). Globalization, government spending and taxation in OECD. *European Journal of Political Research*, 39, 145-177.
- Haufler A. and Wooton I. (2005). Regional tax coordination and foreign direct investment. *European Economic Review*, forthcoming.
- Head C.K., J. Ries and D. Swenson (1999). Attracting foreign manufacturing: investment promotion and agglomeration. *Regional Science and Urban Economics* 29, 197-218.
- Kind H., K. Midelfart Knarvik and G. Schjelderup (2000). Competing for capital in a 'lumpy' world. *Journal of Public Economics* 78, 253-274.

- Keen M. and M. Marchand (1997). Fiscal Competition and the Pattern of Public Spending. *Journal of Public Economics* 66, 33-53.
- Krogstrup S., (2003). Are capital taxes racing to the bottom in the European Union ? HEI Working Paper, n°01/2003.
- Keen M., Marchand M., 1997. Fiscal competition and the pattern of public spending. *Journal of Public Economics*, 66, 33-53.
- Ludema R. and I. Wooton (2000). Economic geography and the fiscal effects of regional integration *Journal of International Economics* 52, 331-357.
- Matsumoto M. (2000). A note on the composition of public expenditure under capital tax competition. *International Tax and Public Finance* 7, 691-697.
- Matsumoto M. (2004). The mix of public inputs under tax competition. *Journal of Urban Economics* 56(2), 389-396
- Ottaviano G., T. Tabuchi and J.-F. Thisse (2002). Agglomeration and trade revisited. *International Economic Review* 43, 409-436.
- Ottaviano G. and T. Van Ypersele (2005). Market access and tax competition. *Journal of International Economics* 67, 25-46.
- Riou S. (2005). Transfer and Tax Competition in a System of Hierarchical Governments. *Regional Science and Urban Economics* forthcoming.
- Rodrik D. (1998). Why Do More Open Economies Have Bigger Governments? *Journal of Political Economy* 106(5), 997-1032.
- Sanz I. and F. Velasquez (2004). The evolution and convergence of the government expenditure composition in the OECD countries. *Public Choice* 119, 61-72.
- UNCTAD (1996). *Incentives and Foreign Direct Investment*. Current Studies, Series A, n°30. New York and Geneva: United Nations.
- Wilson J. and D. Wildasin (2003). Tax competition: bane or boon? *Journal of Public Economics* 88, 1065-1091.

Appendix. Illustrations of subsidy competition

Many subsidy wars in emerging and rich countries are reported in Charlton (2003). We provide here some illustrations on the existence of a competition among governments to attract car plants. Case studies of the automobile sector are particularly illustrative. They concern different types of countries (developed countries, developing countries, high productivity countries).

First, Brazil is an interesting case study. One of the first big auto deals occurred in 1995/96 in Brazil when the state of Paraná and the municipality of São José dos Pinhais attracted an investment by Renault involving 500 new jobs. Renault was offered a massive incentive package including a capital contribution of up to \$300 million, interest free loans and a series of local tax breaks as well as a donation of a 2.5 million square meter site, provision

of all the necessary infrastructure and utilities at the site. In addition, in exchange for undertaking investment of a similar size as Renault, Mercedes-Benz secured from the state and the city an equally impressive catalogue of incentives. As well as land, grants and tax breaks, the local authorities were willing to conduct extensive infrastructure development, including the construction of access roads and rail links to the plant and the development of utilities and sanitation (with lower water costs for ten years). Further, in 1997, General Motors and Ford built new factories near Porto Alegre because of generous agreements. General Motors will pay no state sales tax for 15 years. Moreover, the state government is spending around \$67 million to prepare the factory's site. Ford reportedly obtained similar terms.

In Asia, similar grants are observed. In 1996, General Motors announced it wanted to build a \$500 million car plant in Asia. Thailand won the contest by offering a generous package of tax breaks and other incentives (including tax holidays, duty-free import of machinery and equipment, subsidies for training car workers). In addition, Thailand offered a 100 per cent refund on raw materials for car exports and a \$15 million grant towards setting up a GM training institute.

Subsidy competition also concerns more industrialized countries. As with many other countries, the automobile industry in the United States has been at the centre of particularly intense bidding wars. Mercedes-Benz located its new plant (a \$300 million investment) in the rural Alabama because of an incentive package amounted to \$153 million. In the United Kingdom, because of a threat from Nissan Motors to move the production of the Micra model out of its Sunderland plant in the UK, the company received a \$58.5 million grant in order to stay by the UK government in 2001. In France, Toyota received in 1998 a \$57 million package to locate its European production facility in Valenciennes. In 1995, Mercedes-Benz and Swatch decided to build the Smart production plant in Hambach, France, thanks to a grant for almost a third of the \$370 million investment. In Portugal, the government paid a \$680 million grant to Ford and Volkswagen in 1991 to encourage a \$3.1 billion investment in Setubal. As well as the sizeable incentives, Portugal clinched the deal with government support including infrastructure improvements, upgrades to its port rail link, improved local highways and a dedicated water-treatment plant.