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Trade integration and the destination of subsidies

Nelly Exbrayat, Carl Gaigné, Stéphane Riou

1 Introduction

European countries are increasingly subject to two constraints on the management of their public policy. The first one is the constraint on budget deficits, forcing governments to control their total expenditures. The second one is the opinion shared by most of the European countries, that competition in corporate taxes would be harmful. Indeed, during the last twenty years, in a context of deeper trade integration and capital mobility, governments have significantly reduced their statutory corporate tax rates to promote their attractiveness (see Devereux, Griffith and Klemm, 2002). In a pessimistic scenario, this race to the bottom would result in a lower level of tax income and suboptimal public expenditures for immobile households (Zodrow and Mieszkowski, 1986). Under the assumption that governments are aware of these negative effects, we can anticipate that, in the future, statutory corporate tax rates will be less frequently manipulated to attract the firms. Thus, the existence of these two constraints suggests that the analysis of the allocation choice of public expenditures is particularly relevant. This is the question we raise in this article.

1 We wish to thank for their comments and suggestions participants at the 53rd congress of the RSAI in Toronto, at the workshop ‘regional agglomeration, growth, and multi-level governance’ in Ghent, at the workshop ‘EU countries in fiscal competition’ in Mannheim and at the 21st annual congress of the EEA in Vienna.

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5 For example, the Code of Conduct for business taxation adopted by the European Union requires member states to refrain from introducing any new harmful tax measures such as an effective level of taxation which is significantly lower than the general level of taxation in the country concerned.

6 The average statutory corporate tax rate in the EU-15 members was 33.5% in 2001 and 28% in 2006. We observe a similar tendency for the main new entrants (Hungary, Poland, Czech Republic and Slovakia): 28% in 2001 and 18% in 2006 (source: OECD tax database).
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 prevent their own firms from going abroad. These incentives can take various forms: plant location subsidies, land acquisitions for firms, job training funds or employment subsidies. Many subsidy wars in emerging and rich countries are also reported in Charlton (2003). Moreover, the state aid scoreboards regularly published by the European Commission show that subsidy policies are not specific to a group of countries but are widespread in all member states. If old member states spend more in absolute value, there is no significant gap with new members when state aids are evaluated in percentage of GDP (in 2006, 0.45% in France, 0.69% in Germany, 0.45% in Poland and 0.51% in Czech Republic). It is also worth noting that the highest plant location subsidies are often paid in countries or regions with high unemployment (for instance, Eastern Germany, Southern Italy). Hence, focusing only on the tax side when debating attractiveness is misleading. As Benassy-Quéré, Gobalraja and Trannoy (2007) show, both capital tax and the provision of public inputs matter for the location of FDI so that the coexistence of high tax-spending countries and low tax-spending ones is possible. Thus, Benassy-Quéré et al. (2007) conclude that international competition might lead the first group of countries to increase their level of public spending for firms with a cost in terms of household-specific public goods.

This raises the question of the influence of economic integration on the composition of public spending. There are some contrasting empirical results on this question. Garrett and Mitchell (2001) suggest that globalization has forced governments of OECD countries to decrease their welfare effort in terms of public expenditures (the efficiency hypothesis). In contrast, using a large panel of countries, Rodrik (1998) concludes with a positive correlation between trade integration and public spending devoted to immobile households. This is reminiscent of the compensation hypothesis according to which in the short-term, trade integration increases economic insecurity and calls for more welfare efforts in favor of households. As empirical studies point out, it is difficult to know which hypothesis is the most relevant because the efficiency and compensation effects might neutralize each other.

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7 For example, in 1996 the British government paid Hyundai a grant of $190,000 per employed worker for its $5.7 billion investment in Scotland. In 2001, 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 (see Charlton, 2003).

8 In 2004, Germany spent more than 17 milliards euros in State Aid, France 8 milliard euros, and Poland 3 milliards euros (European Commission, 2005). Member states have additionally many other policy tools to attract the firms that are not listed by the European Union. For example in France, the firms received 65 milliards euros in public funds, under 6 000 various forms among which 630 at the national level and 22 at the European level (Inspection Générale, 2007).

Despite the obvious policy relevance of the subject, there is no theoretical contribution dealing with the relationship between economic integration and the destination of public expenditures. Recently, some economic geography models have provided a new analysis of public policies. By assuming imperfectly integrated economies and increasing returns to scale, this literature shows that a race to the bottom in taxation of capital is not unavoidable and the tax policies depend on the level of trade costs (see Baldwin and Krugman, 2004; Andersson and Forslid, 2003; Ludema and Wooton, 2000; Kind, Midelfart-Knarvik and Schjelderup, 2000; Ottaviano and van Ypersele, 2005)\(^\text{10}\). Nevertheless, this literature focuses on the tax policy and does not investigate what the choice of public spending would be for a given tax policy. Conversely, Keen and Marchand (1997) and Matsu- moto (2000) analyze the way competition among governments distorts the pattern of public spending, but with the assumption that the economies are perfectly integrated.

Our model is based on the monopolistic competition framework with mobile firms and immobile households developed by Ottaviano and Van Ypersele (2005). Public spending has two possible allocations: a direct subsidy to households or a wage subsidy to mobile firms. Shipping the good produced in the monopolistic competitive sector is costly and we assume that the labor productivity in this sector is different among countries. Governments are benevolent, they choose the allocation of their public spending so as to maximize the welfare of the households. We neutralize tax competition by assuming exogenous capital and labor taxes in order to isolate the impact of trade integration on the choice of public spending. Nevertheless, with part of the tax base being mobile, tax revenues collected in each country are endogenous.

We show that the firms receive a lower net of tax subsidy in the high-productivity country than in the low-productivity one. Despite this less generous policy, the former country can host a larger share of firms, so that its total spending for firms can be higher than in the low-productivity country when trade costs are low enough. In this case, households are the net-contributors to the budget in both countries. The welfare analysis suggests that the second-best optimum requires an increase in the subsidy to households in both countries when the economies are weakly integrated or the productivity gap is low or the share of capital incomes redistributed outside the two economies is high.

The rest of the paper is organized as follows. The model is developed in the next section. In section 3, we investigate the spatial distribution of firms, the resulting subsidy equilibrium and the composition of public

\(^{10}\)See the chapter 4 in the book of Baldwin et al. (2003) for an exhaustive presentation of the contribution of the New Economic Geography literature to the analysis in the tax policies.
spending. The welfare analysis is presented in section 4. The last section concludes.

2 Model

We consider two countries \( r = 1, 2 \) with a uniform spatial distribution of workers \( (l_1 = l_2) \). The private sector consists of a modern industry (\( M \)) and a traditional one (\( T \)), using only labor as production factor. Workers are immobile between countries but mobile across sectors. There is a fixed number of \( n \) mobile firms in the M-industry that produce a continuum of varieties of a horizontally differentiated product under increasing returns to scale \(^{11}\). The T-industry produces a homogenous good (the numéraire) under constant returns to scale. The public sector in each country is represented by a benevolent government. Public expenditures have two possible allocations: a wage subsidy for firms \( (f_r) \) or an individual subsidy for immobile residents \( (h_r) \). They are financed through a lump-sum tax on households and firms.

2.1 Consumption

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

\[
\begin{align*}
    u &= \alpha \int_0^n q(i) \, di - \frac{\beta - \delta}{2} \int_0^n [q(i)]^2 \, di - \frac{\delta}{2} \left[ \int_0^n q(i) \, di \right]^2 + q_C \\
\end{align*}
\]

where \( \alpha > 0 \) and \( \beta > \delta > 0 \). In this expression, \( \alpha \) measures the intensity of preferences for the differentiated product. The condition \( \beta > \delta \) implies that workers have a preference for variety. The budget constraint can then be written as follows:

\[
\begin{align*}
    \int_0^n p(i) q(i) \, di + q_0 = \bar{q}_0 + y_r
\end{align*}
\]

where \( p(i) \) is the consumer price of variety \( i \), \( y_r \) is the net income of a worker residing in country \( r \) and \( \bar{q}_0 \) its initial endowment in numéraire which is supposed to be large enough for his/her consumption of the numéraire to be strictly positive at the market outcome.

Given the assumption of symmetry between varieties, solving the consumption problem yields the demand functions for a representative variety

\(^{11}\) Behrens and Picard (2005) also consider a fixed number of firms.
produced in country $r$ from a consumer living in country $s$ with $s \neq r$ ($q_{rs}$): 

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

(3)

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

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

(4)

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

### 2.2 Private sector

The firms from the traditional sector produce a homogeneous good (the numéraire) 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 as well as the wage rate in that sector are equal to unity in each country. As workers are mobile across sectors, the wage rate is also equal to 1 in the modern sector in both countries.

Each variety is produced by a single firm in the modern sector. We assume that the production of any variety requires a country-specific fixed amount $\phi_r$ of labor $l$ with

$$\phi_2 - \phi_1 = \theta > 0$$

In other words, we assume that country 1 has an advantage in terms of productivity in the modern sector. Moreover, varieties of the M-good are traded at a cost of $\tau$ units of the numéraire per unit shipped between the two countries. As firms bear these trade costs, profits of a representative firm in country $r$ are as follows:

$$\pi_r = p_{rr}q_{rr}l + (p_{rs} - \tau)q_{rs}l - \phi_r(w_r - f_r) - t_r$$

(5)

where $t_r$ is the unit tax in country $r$ and $f_r$ is the subsidy received by a firm established in country $r$ for each worker it employs.

---

12 The traditional sector is perfectly competitive and firms in this sector are immobile. Hence, governments have no incentive to give them a subsidy.

13 This result holds when the sector $T$ is active in both countries, which we suppose to be checked.

14 It is necessary to normalize the marginal cost to zero in order to get analytical results when solving for the subsidy choices made by governments. This assumption is also made by Ottaviano and Van Ypersele (2005).

15 As the subsidy is linked to employment, it is not a simple tax deduction. This kind of subsidy is more and more advocated. For example, a recent report on government aid to private firms in France indicates that 43% of the public funds allocated to firms are aimed at decreasing the labor cost (cf. Inspection Générale, 2007).
As we consider a large number of firms, producers take the price indices as given when they maximize net profits. However, as each firm sells its own variety, it has some monopolistic market power. Thus, each firm must account for the distribution of all firms’ prices through the price index in order to find its equilibrium price. The market solution is given by a Nash equilibrium. This equilibrium is such that each firm chooses a delivered price which is specific to the country in which its variety is sold so that markets are internationally segmented. The profit-maximizing prices (5) are given by

\[ p_{rr}^* = \frac{2a + \tau c(n - n_r)}{2(cn + 2b)} \]
\[ p_{rs}^* = p_{ss}^* + \frac{\tau}{2}. \] (6)

Domestic prices decrease as the number of local firms rises, because of a competition effect that acts as a dispersion force. Moreover, prices depend on the level of trade costs. Observe that domestic price \( p_{rr}^* \) decreases with trade integration because it reduces the protection of domestic firms from competition on the foreign market. On the contrary, the price for exportation \( (p_{rs}^* - \tau) \) is increasing with trade integration as it becomes easier to penetrate the foreign market.

Finally, we assume that:

\[ \tau < \tau_{trade} \equiv \frac{2a}{2b + cn} \]
so that the foreign demand is positive whatever the spatial distribution of firms.

### 2.3 Governments

In each country, a benevolent government maximizes the aggregated welfare of its residents given by:

\[ W_r = l(S_r + 1) + l(h_r - \rho_r) + \gamma \frac{\pi_r n_r + \pi_s n_s}{2} \] (7)

where \( \gamma \in [0, 1] \) is the share of firms owned by residents of both countries.\(^16\)

As each one of these countries is equally populated, we assume that the distribution of firm ownership between these countries is symmetric. The last term of (7) thus defines the share of profits distributed to residents in each country. The variable \( \rho_r \) denotes the lump-sum tax paid by each worker while \( h_r \) is the subsidy he/she receives. Finally, the consumer’s surplus in country \( r \) is given by:

---

\(^16\) Our model has a partial equilibrium flavor as we consider the possibility that part of the profits are repatriated outside the economy. Nevertheless, even in the specific case where all firms are owned by residents (that is, when \( \gamma = 1 \)), the model still has a strong partial equilibrium flavor since, as Ottaviano et al. (2002) point out, the quasi-linear utility function removes income effects from the model and prevents the labor market from having an impact of sales made by modern firms.
As we are interested in the pattern of public expenditures, we consider taxes as given. Public expenditures and tax revenues are respectively given by \( G_r \equiv h_r l + \phi_r f_r n_r \) and \( T_r \equiv \rho_r l + t_r n_r \). Despite the exogeneity of taxes, observe that tax revenues are endogenous as the firms are mobile. Moreover, since the budget constraint requires that \( G_r = T_r \), we get:

\[
(h_r - \rho_r) l = (t_r - \phi_r f_r) n_r
\]

As taxes are exogenous, we will deal with the net subsidy received by firms \( E_r \) and workers \( H_r \), that is:

\[
E_r \equiv \phi_r f_r - t_r
\]

\[
H_r \equiv h_r - \rho_r
\]

The redistributive property of governments’ public policy appears through the equality (8). Indeed, as soon as workers receive a positive net subsidy \( H_r > 0 \), they are the net beneficiary of the public funds and as a consequence the increase in their subsidy raises the net contribution of firms to the public funds.

### 3 Nash subsidies and location equilibrium

The model consists in a sequential game involving two main players, firms and governments. In the first stage, each government simultaneously chooses its wage subsidy for firms \( f_r \) taking as given the decision of the other government, and anticipating the impact of its decision on the private sector outcome and the location equilibrium. In stage 2, given the choices announced by 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.

#### 3.1 Location equilibrium

The location of firms in sector \( M \) is governed by the spatial difference in net profits evaluated at equilibrium prices. At the location equilibrium, no firm is incited to change its location. Let \( \lambda \equiv n_1 / n \) denote the share of firms located in country 1. Formally, an interior equilibrium \( \lambda^* \in (0;1) \) occurs if and only if \( \Delta(\lambda^*) = \pi_r(\lambda^*) - \pi_1(\lambda^*) = 0 \). The location forces driving this location equilibrium are the following. For given taxes and subsidies, the productivity advantage of country 1 makes it more attractive. Nevertheless,
the spatial concentration of firms comes at a price of fiercer competition, which damages gross profits and incites firms to disperse. Thus, the location equilibrium is given by:

$$\lambda^* (f_1, f_2) = \frac{1}{2} + (E_1 - E_2 + \theta) A(\tau)$$

with

$$A(\tau) = \frac{(2b + cn)}{cnl (b + cn) \tau^2}.$$

Henceforth, we do not consider the case where all firms agglomerate in the high-productivity country, which is empirically less relevant, by assuming that the following inequality holds:

$$\theta < \frac{1}{2A} + E_2 - E_1.$$

Intuitively, the attractiveness of country 1 increases with the net subsidy for firms decided by its government $E_1$. Nevertheless, trade integration increases firms’ sensitivity to these subsidies $(\partial^2 n_r/\partial E_r \partial \tau < 0 \ \forall r=1,2)$, and thus improves governments’ ability to improve the attractiveness of their country through the allocation of their public expenditures. The impact of the productivity level on the location choice is more ambiguous. While the productivity advantage of country 1 improves its attractiveness for given levels of net subsidies $(\partial n_1^*/\partial \theta > 0)$, it also attenuates the total amount of net subsidies received by each firm in this country. Finally, as firms located in country 2 hire more workers, everything else being equal a marginal increase in the wage subsidy in this country attracts more firms $(\partial n_2^*/\partial f_2 > \partial n_1^*/\partial f_1 > 0)$.

### 3.2 Nash subsidies

Governments simultaneously choose the allocation of their public expenditures that maximizes the national welfare (7), given (8), (11) and $\pi_1(\lambda^*) = \pi_2(\lambda^*)$. Because taxes are exogenous and the budget is balanced, the policy problem faced by governments is one-dimensional: their choice of the net subsidy to firms automatically determines the subsidy to workers required to satisfy the budget constraint.

---

17 This asymmetry does not exist in models of tax competition as the level of taxation is not index-linked to the amount of production factors.

18 As equations (7) and (13) show, what matters for the analysis is the amount of net subsidy received by each firm $(E_f)$. Because variables $\theta$, $f$, and $t$, are exogenous, we would get qualitatively similar results in this subsection by assuming that governments compete through the level of gross wage subsidy $(f)$. Nevertheless, we prefer to consider that governments choose the level of net subsidy to firms so as to get more general results about the composition of public expenditures (see section 3.3).
constraint (8) to substitute the subsidy to workers, we get the following first-order condition:

\[
\frac{dW_r}{dE_r} = \left( \frac{\partial S_r}{\partial n_r^*} \frac{\partial n_r^*}{\partial E_r} \right) - n_r^* \frac{\partial n_r^*}{\partial E_r} + \frac{\partial \pi_r^*}{\partial E_r} = 0.
\]

By attracting new firms, an increase in the level of net subsidy to firms raises the number of varieties produced on the domestic market and intensifies price competition (surplus effect). The sign of the redistributive effect depends on whether the firms are net recipients \((E_r > 0)\) or net contributors \((E_r < 0)\) of the public funds. The impact of an increase in \(E_r\) on profits received by residents (profit effect) is also not obvious. If an increase in the net subsidy to firms directly improves its net profit, it also indirectly intensifies price competition and thus damages its gross profit. The net effect is finally positive.

The Nash equilibrium is described by the following levels of net subsidy for firms:

\[
E_1^* = -B\theta + C(\tau) \quad \text{and} \quad E_2^* = B\theta + C(\tau)
\]

(12)

where \(0 < B < 1/2\) and \(C(\tau) > 0\) (for admissible values of \(\tau\) and \(\gamma\)) are given by:

\[
B = \frac{8b + cn(5 - 2\gamma)}{2(12b + cn(7 - 2\gamma))}
\]

\[
C(\tau) = \frac{2a(b + cn)^2}{2b + cn} \frac{\tau}{2} - \frac{(b + cn)(c^2n^2(1 - \gamma/2) + bcn(3 - \gamma) + b^2)}{2b + cn} \frac{\tau^2}{2}
\]

Clearly, governments are incited to pay subsidies inversely proportional to the productivity level in their country\(^{19}\). Thus, at the Nash equilibrium, the government of country 2 chooses the highest level of net subsidy to firms:

\[
E_2^* - E_1^* = 2B\theta > 0.
\]

Indeed, the low-productivity country sets a more generous public policy for each firm in order to limit its productivity disadvantage. Consequently, a reduction in the productivity wedge between countries decreases the international difference in net subsidies to firms \((\partial(E_2^* - E_1^*)/\partial\theta > 0)\). Additionally, the more important the share of profits that remains in the economy, the more similar the levels of net subsidy to each firm are in each

---

\(^{19}\) With the expression \(E_1^*\), we can define a condition on \(\theta\), ensuring that at the Nash equilibrium, the net cost of employing a worker is still positive \((1 - f' > 0)\). For countries 1 and 2 respectively, these conditions are given by \(\phi_1 > I_1 - B\theta + C\) and \(\phi_2 > I_2 + B\theta + C\). We assume they are fulfilled throughout the analysis.
country \((\partial B/\partial \gamma < 0)\). Governments are prompted to pay high net subsidies to each firm as a large share of profits is redistributed to residents \((\partial E_r^*/\partial \gamma > 0)\), and this incentive is more important for the high-productivity country. Indeed, as this country is intrinsically more attractive, its government public policy has a bigger impact on the equilibrium net profit (common to both countries).

Moreover, the amounts of net subsidy to firms follow a bell-shaped relationship with respect to the level of trade cost since we get:

\[
\frac{\partial E_r^*}{\partial \tau} \triangleq 0 \quad \text{when} \quad \tau \equiv \frac{a(b + cn)}{b^2 + c^2n^2(1 - \gamma/2) + bcn(3 - \gamma)}
\]

with \(\tilde{\tau} < \tau_{\text{trade}}\). Thus, starting from prohibitive trade costs, trade integration first leads governments to rise its net subsidy to each firm as their location choice is becoming more sensitive to changes in the public policy \((\partial^2 n^*/\partial E_r \partial \tau < 0)\). Nevertheless, below a level \(\tilde{\tau}\) of trade cost, an additional decline in its level then pushes governments to decrease the amount of net subsidy they pay to each firm. Indeed, in that case the welfare gain resulting from an increase in \(E_r\) is too low compared with the negative redistributive effect on residents.

Inserting the expressions of \(E_1^*\) and \(E_2^*\) into the location equilibrium (11), we get:

\[
\lambda^*(E_1^*, E_2^*) = \frac{1}{2} + \theta(1 - 2B)A(\tau) > \frac{1}{2}
\]

with \(d\lambda^*/d\tau < 0\). This corresponds to an interior equilibrium \((\lambda^* < 1)\) if and only if:

\[
\theta < \frac{1}{2(1 - 2B)A(\tau)} \equiv \theta_{\text{aggl}} > 0
\]

Clearly, we observe a partial agglomeration of firms in the high-productivity country, even if the level of net subsidies to firms is lower than in the other country. Thus, our analysis confirms a well-known result in the tax competition literature based on a new economic geography framework. Indeed, Ottaviano and van Ypersele (2005) show that even if capital taxation is higher in the country benefiting from a larger market size, this country is still a net importer of capital. A productivity gap has qualitatively the same impact as a difference in market size on the public expenditure policy. As firms are mobile and produce in an imperfectly competitive and imperfectly integrated market, most of them are incited to locate in the country benefiting from a locational advantage (here, a lower production cost) despite a lower level of net subsidy than in the other country.
To summarize:

**Proposition 1** The government of the low-productivity country sets a higher level of net subsidy for each firm than in the high-productivity country, but attracts a minority of firms.

The net subsidies received by households are given by:

\[ H_1^* = -\frac{E_1^* \lambda^*}{l} n \quad \text{and} \quad H_2^* = -\frac{E_2^* (1 - \lambda)^*}{l} n. \tag{14} \]

They have the opposite sign to \( E_r^* \). Intuitively, the households are net beneficiary (resp. net contributors) of the public funds if the firms are net contributors (resp. net recipients). Thus, since firms located in country 2 are always net recipients of the public funds (\( E_2^* > 0 \)), the households living in this country pay always more taxes than the amount of subsidies they receive (\( H_2^* < 0 \)). In country 1, the status of households with respect to the public expenditure policy is more ambiguous. It is indirectly related to the international productivity wedge on the one hand, and to the level of trade costs on the other hand. Indeed, we get

\[ H_1^* \left\{ \begin{array}{ll} > 0 & \text{if and only if:} \\
< 0 & \text{if and only if:} \\
\theta & \leq C (\tau) / B. \end{array} \right. \]

Moreover, we can easily check that

\[ \theta_{\text{agglo}} > C (\tau) / B \] if and only if:

\[ \tau > \tilde{\tau} \equiv \frac{2a(b + cn)}{b^2 + c^2n^2(9/4 - \gamma) + bcn(5 - \gamma)} < \tau_{\text{trade}}. \]

Thus, as soon as \( \tau < \tilde{\tau} \) (so that \( \theta_{\text{agglo}} < C (\tau) / B \)), we get \( H_1^* < 0 \) for all interior equilibria. Stated differently, the households of the most productive country are net contributors of the public funds when economies are integrated enough. Above the threshold \( \tilde{\tau} \) of trade costs, both configurations can emerge depending on the size of the productivity wedge and the level of trade costs. To sum up:

**Proposition 2** For all interior equilibria, the households living in the low-productivity country are always net contributors of the public funds. By contrast, the households living in the high-productivity country become net recipients of the public funds provided that trade costs and/or the productivity advantage are high enough.

### 3.3 Composition of public expenditures

We now analyze the aggregated amount of public expenditures allocated to firms and households in each country. Let \( \Delta E \equiv \lambda^* nE_1^* - (1 - \lambda^*)^* nE_2^* \) denote the international difference in aggregated net subsidies to firms. We get:

\[ \Delta E \equiv n\theta \left[ -B + 2AC (1 - 2B) \right]. \]
with

\[ \Delta E > 0 \] if and only if \( \tau \leq \hat{\tau} \).

Clearly, the level of trade costs matters crucially for the comparison of public funds devoted to firms. Even if the net subsidy received by each firm is lower in the high-productivity country \( E_1^* < E_2^* \), the overall budget devoted to firms can be higher in this country. Intuitively, this case occurs when trade costs are low because the attractiveness of country 1 is strengthened as trade integration proceeds. As \( \Delta H = H_1^* l - H_2^* l = -\Delta E \) and \( H_1^* < 0 \) when \( \tau < \hat{\tau} \), this configuration also corresponds to a situation where households living in the high-productivity country contributes more to the financing of public expenditures than do households living in the other country. Observe also that since \( \partial \hat{\tau} / \partial \gamma > 0 \), this case occurs at an all the more early stage of trade integration since the share of profits that remains in the economy is high enough. Indeed, two effects are at work: we previously saw that an increase in \( \gamma \) raises the level of subsidy received by each firm in both countries, and that it decreases the international difference in the level of net subsidy so that firms are more incited to locate in the high-productivity country. Both effects raise the total budget devoted to firms in the high-productivity country and enlarge the interval of trade costs for which households living in this country contribute up to a higher amount to the public expenditures than do households in the other country. By contrast, above a level \( \hat{\tau} \) of trade costs, the total budget devoted to firms becomes higher in the low-productivity country even if the number of firms to subsidize is always lower in this country.

To summarize:

**Proposition 3** The total subsidies allocated to firms (resp. households) are higher (resp. lower) in the low-productivity country, except when trade costs are too low \( (\tau < \hat{\tau}) \).

We now analyze the impact of trade integration on \( \Delta H \) and \( \Delta E \). We get:

\[ \frac{\partial \Delta H}{\partial \tau} > 0 \quad \text{and} \quad \frac{\partial \Delta E}{\partial \tau} < 0 \]

When trade costs are high enough so that \( \Delta H > 0 \) and \( \Delta E < 0 \), trade liberalization leads countries to have a more similar structure of public expenditures. This reduction partly comes from the reallocation of firms toward the high-productivity country induced by trade integration. By contrast, when trade costs take sufficiently low values so that \( \Delta H < 0 \) and \( \Delta E > 0 \), a further decline in trade cost exacerbates the international difference in the structure of public expenditures. The strong attractiveness of the high-productivity country makes its budget allocated to firms heavier and, at the same time, increases the net contribution of households in this country com-
pared to those living in the other country. Thus, in the last stage of integration, trade agreements could improve the situation of households living in the low-productivity country with respect to the public policy as compared to households living in the high-productivity country.

To summarize:

**Proposition 4** Trade integration first reduces and then exacerbates the international difference in the composition of public expenditures.

There are few empirical studies interested in the impact of trade integration on the composition of public expenditures. Dreher *et al.* (2008) show that globalization did not have a significant impact on the composition of public expenditures in OECD countries between 1971 and 2001. By contrast, Sanz and Velasquez (2004) analyze the impact of economic integration on the difference in government expenditure composition between OECD countries over the period 1970-1997. They show the existence of a convergence in the structure of government expenditures. Our analytical result suggests that the deepening of economic integration could then lead to a divergence in the evolution of the public expenditures composition.

### 4 Welfare analysis

We now analyze the public expenditures efficiency from a global point of view. Observe first that we can rewrite the aggregated welfare function as follows:

\[
W_T = W_1 + W_2 = S_T + H_T + \Pi_T
\]

where \( S_T \equiv (S_1 + S_2)l \) describes the total consumers’ surplus, \( H_T \equiv (H_1 + H_2)l \) represents the total net subsidies to households and \( \Pi_T \equiv \gamma (n_1 \pi_1 + n_2 \pi_2) \) gives the total net profits received by these households.

Let us first consider the externality acting through the total consumers’ surplus. So as to define its sign and its magnitude, we calculate \( \partial S_T / \partial E_r \) and evaluate its value at the Nash subsidy equilibrium. We get:

\[
\frac{\partial S_T}{\partial E_1} \bigg|_{\text{Nash}} < 0 \quad \text{and} \quad \frac{\partial S_T}{\partial E_2} \bigg|_{\text{Nash}} > 0.
\]

Thus, increasing the total consumers’ surplus requires a coordinated policy increasing the level of net subsidy to firms in the low-productivity country and decreasing it in the other country. Stated differently, from the consumers’ point of view, there is an excessive agglomeration of firms in the high-productivity country at the decentralized equilibrium. Indeed, when they decide on their levels of net subsidies, governments do not take into account the impact of their choice on the spatial distribution of firms and *in fine* on the consumers’ surplus in the other country.
We now analyze the externality acting through the total net profits made by firms. We can check that:

\[ \frac{\partial \Pi_T}{\partial E_1} \bigg|_{Nash} > 0 \quad \text{and} \quad \frac{\partial \Pi_T}{\partial E_2} \bigg|_{Nash} > 0 \quad \forall \ \theta < \theta^{aggIC} \]

which means that total net profits would be increased by a coordinated policy increasing the level of net subsidy to firm in each country. Intuitively, the strength of this pecuniary externality is increasing in the share of profits redistributed to households of both countries.

Finally, we consider the externality acting through total net subsidies to households. We get:

\[ \frac{\partial H_T}{\partial E_2} \bigg|_{Nash} < 0 \quad \text{and} \quad \frac{\partial H_T}{\partial E_1} \bigg|_{Nash} < 0 \quad \forall \ \theta < \theta^{aggIC} \]

with \( \partial H_T/\partial E_2 \bigg|_{Nash} < \partial H_T/\partial E_1 \bigg|_{Nash} \). Thus, at the decentralized equilibrium, the level of net subsidy received by firms in each country is too high with respect to total net subsidies to households.

To summarize, focusing on the consumers’ surplus, net profits made by firms or the net subsidies to households may lead to different coordinated policies. From the overall welfare point of view, the policy to implement in the high-productivity country is also ambiguous since we get:

\[ \frac{\partial W_T}{\partial E_1} \bigg|_{Nash} \geq 0 \quad \text{when} \quad \theta \geq (1 - \gamma) \theta^{aggIC} \]

with \( \partial \theta^{aggIC}/\partial \tau > 0 \). Regarding the optimality of the Nash subsidy in country 2, we get:

\[ \frac{\partial W_T}{\partial E_2} \bigg|_{Nash} < 0. \]

Thus, the coordinated policy to implement so as to increase aggregate welfare is tightly related to the level of trade costs (\( \tau \)), the productivity wedge (\( \theta \)) and the share of profits remaining in the economy (\( \gamma \)). When trade costs are low and/or the impact of profits on the welfare is high, improving global welfare requires an increase in the level of net subsidy to each firm set up in country 1 and its decrease in country 2. As a consequence, trade integration could induce a too high level of net subsidy to firms at the non-cooperative equilibrium exclusively in the low-productivity country. By contrast, when a large share of profits is repatriated outside the economy, it becomes more likely that the non-cooperative policy results in a too high level of net subsidy to firms in both countries from the global welfare point of view.
Finally, observe that whatever the levels of trade costs and the productivity wedge, the inefficiency of the public policy in the low-productivity country is always more important than in the other country. Indeed, we get:

$$\frac{\partial W_T}{\partial E_1}_{\text{Nash}} > \frac{\partial W_T}{\partial E_2}_{\text{Nash}}.$$  

This result has an important implication with respect to the spatial distribution of firms. It implies that more agglomeration in the high-productivity country is required in order to improve global welfare. This result is close to the one of Ottaviano and Van Ypersele (2005) who use a similar framework. Assuming two countries of different market size, they show that in order to improve the overall welfare, a reduction in the non-cooperative tax gap is necessary as it increases the agglomeration of firms in the largest country. In other words, when a country benefits from a locational advantage, whether it comes from a lower production cost or a larger market size, it seems that the non-cooperative behavior of governments leads to a sub-optimal degree of agglomeration in this country because the government of the other country tries to improve its attractiveness by being more generous with firms.

Our hypothesis of partial redistribution of profits in the economy allows us to complete the welfare analysis of Ottaviano and van Ypersele (2005). Assuming that all profits remain in the economy, they show that capital taxation is always set at an inefficiently high level in the country benefiting from a higher market size and at an inefficiently low level in the other country. Our analysis reveals that if a similar conclusion prevails for the public policy of the low-productivity country, it does not hold for the other country where the level of net subsidy to firms at the Nash equilibrium can become too high from the social welfare point of view when the share of profits repatriated outside the economy is important.

**Proposition 5** At the non-cooperative equilibrium, the public expenditure policy cannot maximize global welfare: (i) in the low-productivity country, the level of net subsidy to firms is too high compared to the level of net subsidy to households; (ii) in the high-productivity country, the level of net subsidy to households is too high compared to the level of net subsidy to firms provided that a large fraction of profits remains in the economy or trade costs are low enough.
5 Conclusion

The design of the international fiscal system is a matter for both researchers and policy-makers. Still, it seems that the public expenditure policy is also challenged by globalization as some recent reports such as Charlton's one (2003) reveal the growing use of subsidies by governments to attract FDI. Hence, the tax policy is just a policy tool among others affected by economic integration and firms' mobility. The general consensus in the European Union that governments should not run into deficits and the international agreements regarding the tax policy give a more strategic nature for governments to the composition of public expenditures. They are incited to spend more for firms in order to attract them. In the EU-25, corporate tax revenues amounted to 2.9% of the GDP in 2004, and governments redistributed state aid to firms up to 0.6% of the GDP mainly in the manufacturing industry (see Haufler and Wooton, 2007, for examples of state aids in the car industry). As a consequence, the non-cooperative behavior of governments can lead to an increase in public expenditures for firms at the expense of social expenditures for households. We show that when countries differ with respect to their level of productivity, trade integration has various effects on the composition of public expenditures in each country. While it is more likely for households living in the high-productivity country to be net recipients of the public funds at an early stage of economic integration, those living in the other country are always net contributors of the public expenditures.

Finally, our results point out that the policy recommendation to improve global welfare strongly depends on the share of profits repatriated to countries uninvolved in the trade agreements. The reallocation of public funds from firms to households is desirable when a large share of profits is repatriated outside the economy. On the other hand, the direction of this reallocation of public expenditures depends on the levels of trade cost and productivity wedge. A more detailed welfare analysis is necessary to draw conclusions since we carried out a welfare analysis at the margin. This would require a more appropriate framework.

Bibliography

