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## Regional Integration, Subsidy Competition and the Relocation Choice of MNCs

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# Regional Integration, Subsidy Competition and the Relocation Choice of MNCs\*

Facundo Albornoz and Gregory Corcos

## Abstract

Regional integration makes relocation a more attractive option for Multinational Corporations (MNC), influencing in turn the provision of investment incentives by member countries. We examine in this context the effects of subsidy competition. To do so, we model the strategic interaction between two governments offering subsidies to a MNC facing different location alternatives, which involve relocation and plant closure. Our welfare analysis shows that the combination of regional integration and subsidy competition may lead to suboptimally high levels of subsidization. We also discuss how the desirability of harmonizing subsidies (by banning them), and the net gains from integration crucially depend on technological differences, ownership, and on corporate tax rates. For instance, a simple agreement on avoiding subsidies generally raises welfare if the MNC belongs to an extra-regional country. This is not the case for a regional MNC. Lastly, we find that the gain from regional subsidy coordination increases with integration.

**KEYWORDS:** multinational corporations, regional integration, FDI, subsidy competition, location choice

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# 1 Introduction

The relationship between trade integration and competition for foreign direct investment, and consequently the location of Multinational Corporation (MNC) subsidiaries, has attracted the attention of both academics and policymakers.

Numerous theoretical models of tax and subsidy competition have focused on the location strategies of MNCs, discussing the positive and normative aspects of incentive provision.<sup>1</sup> However, this literature has almost overlooked the impact of incentives on the relocation of existing operations, rather than the location of new activities. This should matter for two reasons. First, a thorough analysis of the determinants of relocation should take into account the possibility of keeping existing subsidiaries as an alternative to relocation, in the sense of reallocating operations over countries.<sup>2</sup> Second, the threat of relocation may trigger a specific type of subsidy wars, whose welfare effects have to be assessed.

This question is made particularly relevant by the proliferation of regional trade agreements. We contend that the new trade environment modifies the reasons for the existence of different subsidiaries, which induces new location strategies involving relocation. We study competition for Foreign Direct Investment (FDI) in that context.

We can illustrate the importance of the question we address with a few examples. For instance, Mercosur<sup>3</sup> offers many illustrations of the coincidence between regional integration, changes in location patterns and intense subsidy competition. Before integration, MNCs operated subsidiaries in both Brazil and Argentina (Anlló and Ramos, 2006), mostly to “escape” from trade protection and high transportation costs. More often than not, the subsidiaries had similar operations, used similar technologies, and sold similar products on each national market (Gatto, Kosacoff, and Sourrouille, 1984). Regional integration, taking the form of a Customs Union in 1995, encouraged MNCs to use one of the member countries as an export platform to serve the region (Kosacoff, 2000), relocating either part of the production or even a full plant.<sup>4</sup>

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<sup>1</sup>The next section offers a literature review.

<sup>2</sup>In this paper relocation will always be defined as the closure of a plant joint with the reallocation of operations to an existing plant in another country.

<sup>3</sup>A regional trade agreement (RTA) signed by Argentina, Brazil, Venezuela, Paraguay and Uruguay. Its purpose is to promote free trade and the fluid movement of goods, peoples and currency.

<sup>4</sup>According to the financial newspaper *Ambito Financiero* (September 20, 2001 issue), several MNCs relocated their production from Argentina to either Brazil or Uruguay between late 1998 and 2000. Examples range over several industries, such as the car parts (ZF, Echlin,

Facing the possibility of relocation, member governments, either national or local, increased the provision of investment incentives, most notably in Argentina and Brazil.<sup>5</sup> We may even mention the case of Delphi, a producer of electronic car parts, that relocated from Argentina to Brazil in 1998 and back to Argentina in 2000, influenced by subsidy schemes (Ambito Financiero, September 20, 2001 issue).

Interestingly, subsidies are routinely offered to induce as well as to prevent relocation. For instance, in 1998, Siemens maintained its activities in Brazil, declining production subsidies worth US\$ 2 million conditional on installing a plant in Cordoba, Argentina (La Nacion, April 26, 2000). Similarly, Piqueras, a producer of medical tools had contemplated relocation after an offer of a 10-year subsidy scheme by the Brazilian government. The company finally gave up its plans, as the Argentinean government quickly countered the Brazilian initiative by offering a renewable purchase of the annual production (La Nacion, March 17, 2000). This issue goes beyond Mercosur. In 2000 Nissan threatened to relocate the production of some car models between two of its existing plants, from Sunderland (UK) to Barcelona (Spain). The relocation was avoided thanks to a US\$ 58 million subsidy from the British government (Financial Times, September 21, 2000). In 1997, VW received a subsidy of US\$ 180,000 per worker from the German State of Lower Saxony to avoid relocation to the Czech Republic (Oman, 2000, p. 71). Finally, in France, the highly-publicized threat of relocation exerted by Hewlett Packard motivated the adoption of a general 'defensive' incentive package in the 2006 budget.

All these examples show (1) that the relocation of MNC activities within a region triggers competition among governments and (2) that this process is reinforced by trade integration. We offer a positive and normative analysis of the matter.

To this purpose, we model a production subsidy competition game between two governments. We choose to focus on unit (rather than lump-sum) subsidies for several reasons. First, unit subsidies reduce the deadweight loss from imperfect competition, an important feature of multinational activity. We show how competition between governments can lead to excessive subsidy expenditure, even in this optimistic view where the optimal subsidy is not zero.

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THA), electrical equipment (Enertec), or metallic components industries (Amp, Cablesa, Dynacast SA).

<sup>5</sup>With, respectively, 22% and 40% of FDI in the manufacturing sector being subject to incentives from the central State. Some sectors were more specifically targeted by authorities, especially the automobile and the computer industry, as suggested by the creation of state-funded programmes dedicated to these industries (Chudnovsky and López, 2001) ; (Chudnovsky and López, 2002).

Second, though corporate tax reductions are universally employed, in practice packages typically involve tax reductions on a variety of other tax bases (see excellent surveys in UNCTAD, 1996, Oman, 2000, pp. 26-27 and Charlton, 2003). Production subsidies can therefore be seen as a rough approximation of existing investment promotion practices.<sup>6</sup> Third, while lump-sum subsidy models offers substantial gains in tractability, this comes at the cost of introducing discontinuity in the variables of interest. This makes the discussion less transparent and more dependent on functional forms, particularly those of demand and welfare functions. Finally, our work can be compared with and complement lump-sum tax competition models, as surveyed in the next section.<sup>7</sup>

To tackle the problem of subsidy competition in the shadow of MNC relocation, we consider a region consisting of two countries,  $A$  and  $B$ , that are served by a multinational firm. The multinational may operate production facilities in both  $A$  and  $B$  (the “ubiquity” regime), or may concentrate production in  $A$ , supplying  $B$  through exports from  $A$  (the “concentration” regime). The former will prevail in situations where the main motive for location is to jump over tariffs and avoid transport costs. The latter involves setting an export platform. A trade agreement will reinforce the export platform motive. Welfare-maximizing governments may offer production subsidies to the multinational should it produce locally.

We then investigate how these subsidies and the multinational’s location choice change as trade barriers between  $A$  and  $B$  are reduced. To understand the logic behind our model, assume first that trade barriers between  $A$  and  $B$  are prohibitively high so that the multinational operates plants in both countries. Suppose further that each government can capture the multinational’s profit from local operations. In this case, each government will subsidize production so as to offset the distortion caused by the multinational’s monopoly power.

Next, suppose that trade barriers are eliminated. In the absence of production subsidies, the multinational would concentrate production in the country

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<sup>6</sup>In addition, nominally lump-sum subsidies that are conditional on capacity and that are delivered over the life cycle of the production unit work closely to production subsidies. These two points were also made by Hanson (2001), even though he does not formally address competition between governments.

<sup>7</sup>This complementarity is partly reflected in the existing literature. While some papers focus on the more tractable case of lump-sum profit tax reductions (Haufler and Wooton, 1999; Barros and Cabral, 2000), some others study the effect of marginal-cost-reducing subsidies (Janeba, 1998; Hanson, 2001). Dupont and Martin (2006) actually offer a comparative analysis of both instruments in a footloose capital model.

that has the lowest production cost, by convention  $A$ . The threat of losing the plant may induce  $B$  to offer a higher production subsidy than it would do otherwise, which may force  $A$  to also raise its subsidy. We investigate the outcome of such subsidy competition, and examine the associated welfare effects.

We find that, first, a country not too backward technologically may manage to block potential relocation by offering high subsidies. However, this should lead to welfare losses for the region. Second, competition should be more intense between symmetric countries, resulting in excessively high amounts of subsidies. Third, the choice of subsidies by competing governments typically overlooks a positive externality on foreign consumers and a negative externality on foreign producers.

The perception of welfare losses associated with subsidization is a cause of concern, for this may jeopardize the benefits from regional integration processes. The communication from the EU commission (Official Journal C 70 of 19.03.2002) provides a clear example of a recent increase in the EU effort to control subsidy wars within the region. On the other hand, the implementation of some sort of coordination on subsidies belongs to the current agenda of talks on Mercosur's future.<sup>8</sup>

In this respect, our model allows for two alternative forms of subsidy coordination: one in which  $A$  and  $B$  commit to *laissez-faire*, in the form of zero subsidies ("harmonization"), and one in which  $A$  and  $B$  offer subsidies that maximize their joint welfare ("regionally optimal subsidies"). We show that the advantage of setting regionally optimal subsidies increases with trade liberalization. Indeed, as integration proceeds, more efficient relocation opportunities are distorted away. Moreover, we identify circumstances under which a zero-subsidy regime dominates subsidy competition.

More specifically, we find the following results. First, subsidy competition entails excessive subsidization. The combination of regional integration and subsidy competition leads to an excess of subsidization, even in an imperfect competition framework where subsidies improve allocative efficiency. Second, subsidy competition gives scope for regional coordination. Conflicts of interest between integrating countries create a potential gain from regional policy coordination. Such a need for coordination depends on intra-regional trade barriers. We find the gains from coordination to be magnified by regional integration. Third, harmonization is potentially welfare improving. Under certain conditions, a weak form of regional coordination, such as the harmonization of production subsidies to zero within the region, is enough to

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<sup>8</sup>As reported by *Página 12*, an Argentinean newspaper (June 28, 2005 issue). See also Polónia Rios, 2003.

improve welfare compared to subsidy competition. Finally, regional characteristics matter. Our results depend on regional asymmetries, profit repatriation rates, and MNC ownership. Hence policy implications of our analysis need not be the same in regional unions that differ along these dimensions.

The remainder of this paper is organized as follows. Section 2 discusses the related literature. We introduce the model and discuss properties of the equilibrium in section 3. In Section 4 we apply our model to a simple case of subsidy competition for the location of an extra-regional MNC. Section 5 presents the case of an MNC originating from the region. Section 6 concludes.

## 2 Related Literature

There has been a great deal of interest in the effects of competition between governments for the location of MNC operations. Investment incentives have been found to be influential, as illustrated by the abundant case-study evidence mentioned above. This finding has also received support from quantitative evidence in Head, Ries, and Swenson (1999), who analyze the role of investment incentives in the location decisions of Japanese MNCs across US states.

In theory, governments may have various motives to offer fiscal or investment incentives to MNCs, which allows for different approaches. First, agglomeration effects may create locational rents, part of which may be captured by taxing jurisdictions (see *inter alia* the core-periphery models of Ludema and Wooton (2000) and Baldwin and Krugman (2004), and footloose capital models by Ottaviano and van Ypersele (2005) and Dupont and Martin (2006)).

Second, social and private returns on FDI may differ because of local positive externalities to the presence of an MNC (for a review, see Blomström and Kokko, 2003). For instance Barros and Cabral (2000) focus on the reduction of unemployment attributable to FDI.<sup>9</sup> Fumagalli (2003) applies a similar argument to horizontal technological externalities, and obtains a similar result.<sup>10</sup>

How integration modifies investment decisions has also been extensively studied in the literature. Norman and Motta (1996), Neary (2002), for in-

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<sup>9</sup>In their model, this is an assumption rather than a result, justifiable in their partial equilibrium setting. As an implication, competition is positive as the country suffering the most from unemployment wins the bidding contest for the MNC. The gain in employment for this country outweighs the expense in subsidies, and competition has a positive effect on allocative efficiency.

<sup>10</sup>With sufficiently large technological differences between countries, the least advanced country should win the contest, as opposed to what would happen without incentives, and that should improve overall welfare. Besides, subsidies also bias the export vs. (extra-regional) FDI decision towards FDI, again improving regional welfare.

stance, show that economic integration not only increases FDI, but may also shape location patterns. Further integration towards the completion of a single market may cause MNC location decisions to be determined by the interplay between a ‘tariff-jumping motive’ and an ‘export-platform motive’. The tariff-jumping motive biases the location decision towards operating as many subsidiaries as there are countries in the single market, while the export-platform motive pushes for serving the whole market from a single member country. Building a model of the export vs. FDI decision on these insights, Raff (2004) shows that a regional free trade agreement may lead to lower profit tax rates as well as external tariffs. His work is complementary to ours in the sense that he considers lump-sum subsidies that have no effect on allocative efficiency.

The tax competition literature (see the survey by Wilson, 1999) generally concludes that competition leads to inefficiently low levels of taxes and public good provision. While in the context of FDI the arguments mentioned above suggest a role for corrective taxation, it is worth examining the case for regional fiscal coordination. Hauffer and Wooton (2006) investigate the effects of a regionally coordinated profit tax or location subsidy to a monopolistic and globally mobile firm. In their model, optimal regional coordination depends on the relative desirability of extracting rents from existing investors with respect to attracting new investors.<sup>11</sup> We address a complementary question: how do the gains from coordination depend on the level of regional integration? This question deserves some attention, especially for policy purposes, since regional coordination might be costly to implement. We identify conditions on regional characteristics for integration to increase the benefits of regional coordination, or, put another way, the net gains from building regional institutions.

Our model features several points of departure from the literature that might be summarized as follows. First, we study the interplay between regional integration and competition for firms that *already* produce in the region.<sup>12</sup> When investments are made in a non-integrated region and sunk at the time of regional integration, the creation of a regional export platform in one of the countries may be worthwhile. Our study therefore complements the literature discussed above, which mainly analyses pure auctions for new

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<sup>11</sup>For investments whose realization does not rely upon any kind of coordination, a coordinated tax allows for appropriating location rents from the firm. On the other hand, a coordinated tax reduction will attract investment that would not take place when countries act non-cooperatively. Depending on which motive dominates, regional coordination may result in an increase or reduction in tax levels.

<sup>12</sup>Some studies assess potential losses from the relocation of manufacturing operations from Northern to Southern countries, as in Fontagné and Lorenzi (2005). However, work on relocation within regional unions seems to be lacking.



investments. We obtain a wealth of possible equilibria. Some of them display limit-subsidization. We show that subsidies under these types of equilibria are greater than welfare maximizing subsidies. This normative assessment of subsidy competition allows us to identify under which circumstances gains from regional integration exceed losses from fiercer subsidy competition. Second, we include the geography of capital in the analysis by allowing for two different types of ownership (intra- or extra-regional) and taxation of MNC repatriated profits. Note that the tax rate parameter could also be seen as a particular measure of the social value of MNC investments, as will be discussed below. We will obtain qualitatively different results for both types of MNCs, which we will discuss. Lastly, we put the normative discussion on subsidy competition into perspective by measuring regional welfare in alternative policy settings: a mutual ban on subsidies (what we will call harmonization) and an agreement on the subsidy levels that maximize regional welfare (what we will call coordination). We also study how welfare differences vary with the extent of regional integration and assess the potential net gains to coordination.

### 3 The Subsidy Game

#### 3.1 Setup of the Model

Formally, the region consists of 2 countries, A and B, whose markets are assumed to be segmented with a linear inverse demand function:

$$D_A(p) = D_B(p) = D - p$$

An extra-regional MNC has monopoly power over both markets. Consistent with our discussion of location decisions, the firm faces two alternative location regimes, reflecting the conflicting influences of the tariff-jumping motive and the export-platform motive. On the one hand, the MNC may want to operate one subsidiary in each country, jumping over tariff barriers: we call this location choice *Ubiquity* (U for short). On the other hand, it may prefer to build an export platform in a single country, to serve the other country through exports: we call this *Concentration* (C). Without loss of generality we will only allow for Concentration in country A, which amounts to calling A the country that ‘wins’ the bidding game. Because we focus on relocation decisions, the strategy U will be the original choice of the MNC, while trade integration may lead to a switch to regime C. Consistent with that view, we assume that fixed production costs are already sunk when the MNC decides whether to relocate.

The two countries are assumed to be identical except in one dimension, that is production costs. With constant returns to scale, cost differences and an intra-regional tariff  $t$ , the costs of serving the home market  $j$ , and the export market  $k$ , respectively, equal:

$$\begin{aligned}C_j(q_{j,D}) &= (\alpha_j - s_j) q_{j,D} \\C_j(q_{j,X}) &= (\alpha_j - s_j + t) q_{j,X}\end{aligned}$$

where  $s_j$ 's denote unit production subsidies from host government  $j$ ,  $q_{j,D}$  denotes production in  $j$  for the local market, and  $q_{j,X}$  denotes production in  $j$  for the export market. Our assumption on production costs simply amounts to  $\alpha_A \leq \alpha_B$ . Notice that non-negativity of outputs requires subsidies to be bounded below by  $-(D - \alpha_A)$ .

With linear demand and cost functions, monopoly profits in each market  $j$  will simply be equal to  $\pi^{j,D} = (q_{j,D})^2 = \frac{1}{4}(D - \alpha_j + s_j)^2$  if the market is served by regional production and  $\pi^{j,X} = (q_{j,X})^2 = \frac{1}{4}(D - \alpha_j + s_j - t)^2$  when market  $k$  is served by means of exports from  $j$ . As markets are segmented, regional profits ( $\Pi$ ) are simply the sum of profits made in each market.

Denote by  $\phi$  the corporate tax rate in both countries. We take this variable as exogenous in the analysis. This assumption is consistent with the partial equilibrium nature of the model. Our focus is on subsidies offered in a particular industry, rather than general corporate tax rate levels in host countries. In the context of relocation of existing activities, we see exogeneity as a relatively realistic assumption.

Note that other interpretations of the  $\phi$  variable are possible. First, this could be the share of profits that are reinvested in the host country. This is quantitatively important for developing countries with imperfect capital markets where a significant part of investment is self-financed. Second, it may represent the distribution of part of the affiliate's profits to local residents.<sup>13</sup>

This variable therefore captures the share of the MNC's profit captured by the host government. From the MNC headquarters' viewpoint,  $(1 - \phi)$  measures the repatriation rate, that is the fraction of profit repatriated to the headquarters. A second assumption we make, for the sake of simplicity, is that corporate tax rates be equal between the two countries. This assumption seems simplistic but may find support from evidence of convergence in corporate tax

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<sup>13</sup>In another interpretation,  $\phi$  could represent a non-appropriable (proportional to profit) externality to the host country, whose generating process we do not model. For instance,  $\phi\pi^j$  could be the benefit from an investment in training  $j$ 's local workforce. In this interpretation, profit functions would be slightly different, but their comparison would not be affected.

rates, for example in the EU (Devereux, Lockwood, and Redoano, 2004). Still, this will allow us to focus on competition in subsidies.

Regional MNC profits are reported in Table 1. The relative advantage of one regime over the other depends on the internal tariff ( $t$ ), technological differences ( $\alpha$ 's) and subsidies ( $s_j$ ).

Table 1: MNC profits by location regime

| Regime | Profits  |
|--------|--|
| U      | $\Pi_U(s_A, s_B) = \frac{(1-\phi)}{4} [(D - \alpha_A + s_A)^2 + (D - \alpha_B + s_B)^2]$     |
| C      | $\Pi_C(s_A, s_B) = \frac{(1-\phi)}{4} [(D - \alpha_A + s_A)^2 + (D - \alpha_A + s_A - t)^2]$ |

We now turn to the determination of subsidies. As governments' decisions depend crucially on their objective functions, we measure national welfare by the sum of consumer surplus (CS), some part of the MNC's producer surplus (PS), and government surplus (GS), i.e. tariff revenue minus subsidy expenditure. Table 2 displays welfare functions for each type of location regime and ownership.

Table 2: Welfare functions by location regime

| Country | Regime | Welfare                                      |  |  |
|---------|--------|--|--|--|
|         |        | CS   | PS   | GS                                     |
| A       | U      | $\frac{1}{2} (\frac{D-\alpha_A+s_A}{2})^2$   | $\phi (\frac{D-\alpha_A+s_A}{2})^2$                                    | $-s_A (\frac{D-\alpha_A+s_A}{2})$      |
| A       | C      | $\frac{1}{2} (\frac{D-\alpha_A+s_A}{2})^2$   | $\phi [(\frac{D-\alpha_A+s_A}{2})^2 + (\frac{D-\alpha_A+s_A-t}{2})^2]$ | $-s_A (\frac{2A-2\alpha_A+2s_A-t}{2})$ |
| B       | U      | $\frac{1}{2} (\frac{D-\alpha_B+s_B}{2})^2$   | $\phi (\frac{D-\alpha_B+s_B}{2})^2$                                    | $-s_B (\frac{D-\alpha_B+s_B}{2})$      |
| B       | C      | $\frac{1}{2} (\frac{D-\alpha_A+s_A-t}{2})^2$ | 0  | $t (\frac{D-\alpha_A+s_A-t}{2})$       |

Note that when  $\phi = 0$ , the government simply maximizes consumer surplus plus net fiscal revenues. By contrast, when  $\phi = 1$ , the government maximizes total surplus, including fiscal revenues.

Given our assumptions on market structure and demand, concavity of total welfare functions with respect to subsidies is always assured. Therefore, a welfare maximizing subsidy for each regime exists.

We model the interaction between governments and the MNC as a two-stage non-cooperative game. The timeline goes as follows:

- In the first stage, governments  $A$  and  $B$  choose their subsidy levels  $s_A$  and  $s_B$ .

- In the second stage, the MNC chooses a location regime  $R$  between alternatives  $U$  and  $C$ .

This formalization captures both the non-cooperative aspect of subsidy competition and the ability enjoyed by governments to commit credibly to a certain amount of subsidies.<sup>14</sup>

Formally, the solution to the subsidy game will be denoted by a *triple* composed of a location regime chosen by the MNC and two amounts of unit subsidies offered by the governments  $\{R, s_A, s_B\}$ .<sup>15</sup> We now turn to the governments' objective function to characterize the set of optimal subsidies.

## 3.2 Characterization of Equilibria

The two-stage game is solved by backward induction, looking for sub-game perfect equilibria.

### 3.2.1 In the second stage

The MNC chooses its location  $R$  so as to maximize its regional profits, which we may write as the best-reply function  $R^* = R(s_A, s_B)$  satisfying

$$\Pi^{MNC}(s_A, s_B, R^*) \geq \Pi^{MNC}(s_A, s_B, R)$$

for all  $R \neq R^*$  in  $\{U, C\}$ .

This best-reply function may be illustrated by a straight line in  $\{s_A, s_B\}$  space. In general, the profit differential between Ubiquity and Concentration, conditional on subsidies  $s_A$  and  $s_B$ , is given by (see Table 1):

$$\Delta\Pi(s_A, s_B) = (1 - \phi) \left[ \frac{1}{4}(D - \alpha_B + s_B)^2 - \frac{1}{4}(D - \alpha_A + s_A - t)^2 \right]$$

We may express this basic comparison between profits from home-based exports and local operations by computing subsidy pairs that leave the MNC

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<sup>14</sup>Credibility is an important assumption, as in one case government A would gain from renegeing on its commitment. In real economic situations, reputational concerns with respect to potential investors (beyond the scope of this paper) may arguably be enough to alleviate the credibility problem.

<sup>15</sup>Notice that, due to the shape of the objective functions, decisions on subsidies exhibit neither strategic substitutability nor strategic complementarity. A rival subsidy will constraint a government's offer simply because it will affect the MNC's second-stage location incentives.

indifferent between locations. Denote by  $\widetilde{s}_A(s_B)$  the function plotting the indifference subsidy from government A for a given  $s_B$ , and  $\widetilde{s}_B(s_A)$  the inverse function. Straightforward calculations yield:

$$\widetilde{s}_A(s_B) = s_B + \alpha_A - \alpha_B + t$$

### 3.2.2 In the first stage

Governments choose their subsidy levels simultaneously. At a sub-game perfect equilibrium, a government's subsidy maximizes its continuation payoff given the other government's subsidy. Note that when subsidies make the MNC indifferent, we consider Ubiquity as the *status quo*. Recall that each government's objective function is composed of:

$$W_j(s_j, s_k, R(s_j, s_k)) = \frac{CS_j(s_j, s_k, R(s_j, s_k)) + PS_j(s_j, s_k, R(s_j, s_k))}{GS_j(s_j, s_k, R(s_j, s_k))} \quad (1)$$

#### Government B's best reply

By defining  $s_B^{opt}(U) = \arg \max_{s_B} \{W_B(s_A, s_B, U)\}$  we obtain

$$s_B^{opt}(U) = \frac{2\phi - 1}{3 - 2\phi}(D - \alpha_B)$$

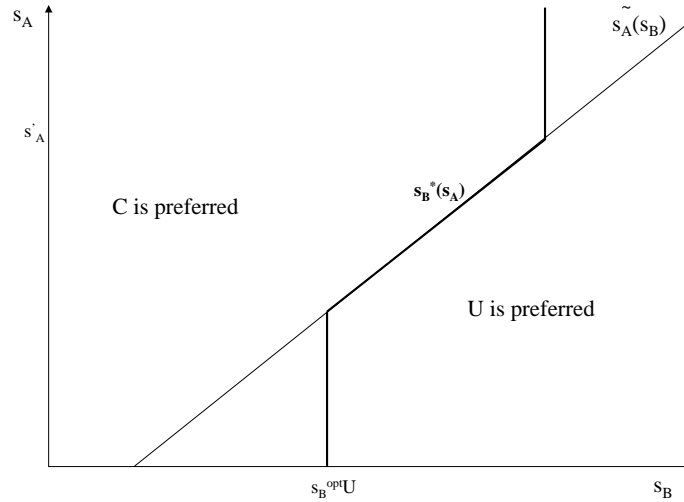
This is government B's best-reply to all  $s_A$  lower than  $\widetilde{s}_A(s_B^{opt}(U))$ , which, it should be noted, *does not depend on the other government's subsidy*. That is, some part of the best-reply function will be vertical. Whenever  $s_A \geq \widetilde{s}_A(s_B^{opt}(U))$ , B should choose between facing relocation or setting a limit subsidy inducing Ubiquity. The latter must be  $\widetilde{s}_B(s_A)$ , since this is the lowest subsidy inducing Ubiquity and above  $s_B^{opt}(U)$  we are on the decreasing part of the bell-shaped welfare curve. Lastly, above a certain subsidy set by government A, it may well be that country B prefers Concentration since high subsidies from A increase consumer surplus in B.

To see this in more detail, let us compute the subsidy from government A that makes government B indifferent between Concentration and Ubiquity. Denote it by  $s'_A$ . Using Table 2, the particular subsidy level such that  $W_B(s_B^{opt}(U), U) = W_B(s_A, C)$  is given by:

$$s'_A = \left( \frac{2}{\sqrt{3 - 2\phi}} \right) \sqrt{(D - \alpha_B)^2 + (3 - 2\phi)t^2} - (D - \alpha_A) - t$$

Any subsidy higher than  $s'_A$  makes Concentration more desirable than Ubiquity for government B.

Figure 1: Government B's best-reply schedule



Summarizing, we have the following best-reply schedule for government B, pictured in Figure 1 :<sup>16</sup>

$$s_B^*(s_A, R^*(s_A, s_B)) = \begin{cases} s_B^{opt}(U) & \text{if } s_A \leq \widetilde{s}_A(s_B^{opt}(U)) \\ \widetilde{s}_B(s_A) & \text{if } s'_A \geq s_A > \widetilde{s}_A(s_B^{opt}(U)) \\ \text{any } s_B \text{ s.t. } s_B < \widetilde{s}_B(s'_A) & \text{if } s_A > s'_A \end{cases}$$

### Government A's best reply

We proceed in a similar manner by defining

$$s_A^{opt}(U) = \frac{2\phi - 1}{3 - 2\phi}(D - \alpha_A)$$

$$s_A^{opt}(C) = \frac{4\phi - 3}{7 - 4\phi}(D - \alpha_A) + 2t \frac{1 - \phi}{7 - 4\phi}$$

It is more difficult to determine government A's best-reply function. This is because technology and ownership differences make the model asymmetric.

<sup>16</sup>The function is defined over the real interval, thus allowing for negative subsidies (taxes). For expositional simplicity we choose to plot them in the positive quadrant.

In general, the shape of A's best-reply function will depend on welfare comparisons between locations U and C.<sup>17</sup> We show below that in general government A's best-reply schedule has a three-part structure.

First, against that interval of  $s_B$  where  $s_A^{opt}(C)$  yields Concentration, that subsidy is clearly a best-reply to  $s_B$  if it welfare-dominates Ubiquity with suboptimal subsidies.

Second, consider the interval  $[\widetilde{s}_B(s_A^{opt}(C)); \widetilde{s}_B(s_A^{opt}(U))]$ . Government A's best-reply depends on the comparison between welfare under U and C. Because welfare functions are bell-shaped,  $W_A(\cdot, s_B, C)$  decreases in  $s_A$  above  $s_A^{opt}(C)$ . Similarly,  $W_A(\cdot, s_B, U)$  increases in  $s_A$  below  $s_A^{opt}(U)$ . Recall also that when profits are equal across location alternatives, U is chosen. Therefore,  $\widetilde{s}_A(s_B) + \varepsilon$  dominates all other (greater) subsidies conducive to C, while  $\widetilde{s}_A(s_B)$  dominates all other (lower) subsidies conducive to U. Government A's best-reply must therefore be one of these subsidies. By continuity, there must be a switch at  $\underline{s}_A > s_A^{opt}(C)$  such that  $W_A(\underline{s}_A, C) = \max_{s_A} \{W_A(s_A, s_B^{opt}(U), U)\}$ . This threshold subsidy may be equal to  $s_A^{opt}(U)$ , or to another level, leading to a discontinuity in the best-reply schedule. This defines the second part of the three-part best-reply schedule.

Lastly, consider that interval of  $s_B$  where  $s_A^{opt}(U)$  yields Ubiquity. By construction, that subsidy is clearly a best-reply to  $s_B$  as it welfare-dominates Ubiquity with suboptimal subsidies.

Intuitively, the three-part structure comes from the fact that no location regime unambiguously welfare-dominates the other for all possible subsidy levels. The shape of the optimal subsidy therefore depends on the rival's subsidy. In the following section, we will enumerate conditions on welfare functions and subsidies that put more structure on best-reply schedules and allow for a precise characterization of equilibrium.

Summarizing, we obtain the following best-reply function for government A:

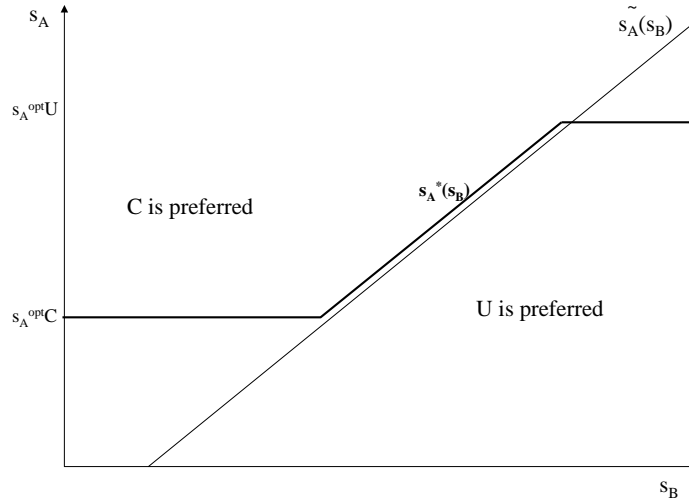
$$s_A^*(s_B, R^*(s_A, s_B)) = \begin{cases} s_A^{opt}(C) & \text{if } s_B \leq \widetilde{s}_B(s_A^{opt}(C)) \\ \widetilde{s}_A(s_B) - \varepsilon & \text{if } \widetilde{s}_B(\overline{s}_A) \geq s_B > \widetilde{s}_B(s_A^{opt}(C)) \\ s_A^{opt}(U) & \text{if } s_B > \widetilde{s}_B(\overline{s}_A) \end{cases}$$

where  $\varepsilon$  may be arbitrarily small.

Figure 2 shows government A's best-reply map.

<sup>17</sup>Both welfare functions are bell-shaped, and take their maximum values at  $s_A^{opt}(U)$  and  $s_A^{opt}(C)$ . As may be seen from (2) and (2), the comparison between these subsidies hinges on parameter values. To save space, we will only address here the case where  $s_A^{opt}(C)$  is lower than  $s_A^{opt}(U)$ . The opposite case lends itself to a similar reasoning.

Figure 2: Government A's best-reply schedule



We now turn to the conditions for existence of an equilibrium in the sequential game.

### 3.2.3 Existence of Equilibrium

Careful examination of the potential intersections of both best reply schedules leads us to investigate the existence of the four following types of candidate equilibria :

- A *U1* equilibrium yielding Ubiquity where the vertical part of B's reply intersects the horizontal part of A's reply in the Ubiquity zone (upper left of Figure 3).
- A *C1* equilibrium yielding Concentration where the vertical part of B's reply intersects the horizontal part of A's reply in the Concentration zone (upper right of Figure 3).
- A *C2* equilibrium yielding Concentration, with both governments bidding higher subsidies than in the *C1* equilibrium levels (lower left of Figure 3).
- A *U2* equilibrium yielding Ubiquity, with government B bidding a higher subsidy than in the *U1* equilibrium in order to prevent concentration in country A (lower right of Figure 3).



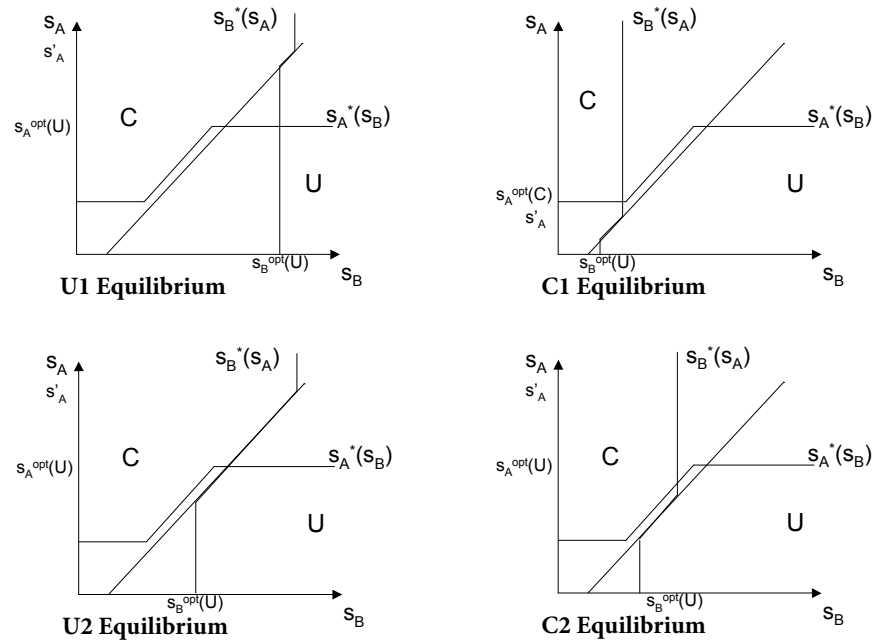


Figure 3: The four types of equilibria of the subsidy game

Figure 3 illustrates how best-reply curves intersect, leading to four types of equilibria.

Let us now identify the conditions for existence of subgame-perfect equilibria in the subsidy game.

**Proposition 1** *There exists a unique equilibrium in the subsidy game, for a given set of parameter values. The actual equilibrium type depends on the logically sufficient set of conditions described in Appendix A1, particularly in Figure A1.<sup>18</sup>*

**Proof.** See Appendix A1. ■

We now discuss the intuition behind and the implications of our first Proposition.

<sup>18</sup>All appendices for this paper are available on the same bepress website as the paper itself.

### 3.3 Discussion

We have now fully characterized the equilibria of this game. As can be seen in Appendix A1, Conditions 1 – 6 and the tree diagram enable us to easily determine the prevailing equilibrium for different levels of regional integration, ownership, tax rates and regional technological differences.

Despite a simple formalization, we have ended up with a wealth of subgame-perfect equilibria. This results from the sequential game setup. In a simultaneous game, only U1 and C1 equilibria would appear. To make this clearer, notice that at equilibria U1 and C1, no player has an incentive to deviate in a unilateral way. Indeed, for the MNC the regime is optimal given the subsidy pair; for governments, by construction, the equilibrium subsidies maximize welfare conditional on the chosen location regime. By contrast, at equilibria U2 and C2 at least one player has an incentive to deviate. Indeed, at equilibrium C2, government A would rather post a lower subsidy (equal to  $s_A^{opt}(C)$ ), if it were guaranteed that government B posts a low enough subsidy and that the MNC chooses Concentration. Government A's capacity to commit to the subsidy is essential to the existence of such an equilibrium outcome. Similarly, at equilibrium U2, government B would rather set a lower subsidy (equal to  $s_B^{opt}(U)$ ), if it were guaranteed that government A plays its optimal subsidy and that the MNC chooses Ubiquity.

In that sense, the existence of equilibria U2 and C2 stems from governments' capacity to make credible offers to mobile investors. We define the subsidies offered at each of these equilibria as *excessive*, in the sense that they exceed the levels maximizing national welfare.

As we will argue, trade liberalization makes the emergence of these equilibria likelier, causing subsidization to increase substantially. Indeed, deepening integration favors the export-platform motive, increasing governments' willingness to subsidize beyond their optimal levels, resulting in an efficiency loss. In our view, this concurs with an observed rising trend of subsidy spending from governmental agencies, mentioned in the Introduction.

In what follows, which equilibrium eventually obtains will depend on three features of the regional union: technological asymmetries between countries ( $\alpha_i$ ), the corporate tax rate ( $\phi$ ), and internal trade barriers ( $t$ ). For instance, an equilibrium with Concentration is more likely to occur whenever asymmetries are substantial, tax rates are high, and trade barriers are low. To focus on regional integration, it also straightforwardly appears that sufficiently high levels of  $t$  imply an equilibrium with Ubiquity (U1 to be more specific). In Appendix A1, we discuss in more detail how threshold tariffs depend on parameter values (see Table A1 in particular). What is interesting to keep in mind

is that deepening regional integration is likely to make the region switch to another equilibrium.

A final remark concerns the costs of operating subsidiaries. In our model, fixed production costs are sunk when the MNC decides whether to concentrate production. Therefore, Ubiquity does not entail any duplication, while Concentration does not entail any additional fixed costs. This should be thought of as a focus on delocation decisions. In addition, we do not take liquidation costs into account. However, as will become clear later, introducing liquidation costs would only reinforce excessive ubiquity. More generally, these simplifying assumptions allow our conclusions not to rely on the comparison between arbitrary values of these fixed costs.

We are now in a position to study the effect of regional integration and subsidy coordination on the decision to relocate, using our general framework.

## 4 Applications

We seek to establish MNC location in equilibrium and its welfare consequences under different regional policy schemes. Public policy towards FDI may take various forms, according to the degree of regional coordination. We define the following alternative policy options :

- Subsidy competition, under which governments freely set subsidy levels to influence the MNC's location choice according to national interest.
- Harmonization, under which governments commit themselves to offering zero subsidies (in other words, banning subsidies).
- Coordination, under which countries set subsidies to the levels that maximize regional welfare, mimicking a supranational social planner.<sup>19</sup>

We can turn now to our analysis of the location equilibrium. Intuitively, in the absence of trade, a MNC would set up an affiliate in each nation:<sup>20</sup> for a large enough tariff, the tariff-jumping motive dominates the export platform motive. Lower tariffs allow the MNC to concentrate production in the most convenient country and serve both markets from there. When subsidy competition is avoided by either regional harmonization or coordination, it

<sup>19</sup>'Regionally optimal' subsidies, conditional on each regime  $R$ , are denoted by  $s_j^{reg}(R)$  and maximize the sum of both countries' national welfare for a given location regime (a formal treatment is given in Appendix A2).

<sup>20</sup>Remember that we do not consider the possibility of exports from outside the region.

straightforwardly follows that full regional integration ( $t = 0$ ) implies Concentration.

The case of subsidy competition requires careful analysis of the set of equilibria. This leads us to determine the MNC location choice at full integration, as summarized in the following Proposition.

**Proposition 2** *Under perfect trade integration, subsidy competition prevents efficient relocation, except for the special case of large regional asymmetries and high levels of repatriation rates.*

**Proof.** The result follows from evaluating conditions 1 – 6 expressed in Table A1 at  $t = 0$ , which we defer to Appendix A2. ■

The intuition lies in the fact that the subsidy that country B has to pay to avoid relocation is higher the greater the regional asymmetries and that the gain from preserving the MNC activities decreases in the repatriation rate. It is interesting to note that in the case of a symmetric region, the equilibrium would be  $U1$ , or the status quo location. The slightest difference in technologies leads to a  $U2$  equilibrium, and excessive subsidies.

Does this result imply that countries should necessarily avoid offering subsidies? To answer this question, we compare subsidy competition and the weakest form of coordination we consider (harmonization) from a regional welfare point of view. According to the literature we should expect subsidy competition to be welfare-improving with respect to no intervention. However, we find that this is not necessarily the case.

**Corollary 1** *Harmonization is generally welfare-improving over subsidy competition.*

**Proof.** The proof is referred to Appendix A3. ■

Competitive (decentralized) subsidization enables the high-cost country's government to influence location decisions. We have just shown that, in a vast spectrum of cases, the MNC will not relocate production even under perfect integration ( $U2$  equilibrium). This entails two potential sources of welfare losses: the cost of excessive subsidization and the inefficient allocation of production in the region.

Whether the decentralized outcome (equilibrium  $U2$ ) welfare-dominates the harmonized outcome ( $C1$ ) depends on local production cost differences. We show in the proof that a moderate difference suffices for harmonization to improve on decentralized competition. For intermediate levels of profit repatriation, the result holds even for negligible differences in technology.

The result also suggests that subsidy competition may jeopardize the gains from regional integration as this process would invigorate competition for MNC location. We need now to have a closer look at whether the cost of subsidy competition may offset the benefits of regional integration.

**Corollary 2** *Subsidy competition reduces the gains from regional integration, potentially leading to welfare losses.*

**Proof.** See Appendix A4. ■

The result simply assesses that the cost of subsidy competition may induce losses from integration. Recall that the welfare comparison involved perfect integration with subsidies and autarky with subsidies. This ‘sophisticated’ autarkic benchmark might be more relevant for governments considering regional integration while being aware of potential losses from subsidy competition. Integration creates a possibility of relocation off the equilibrium path, leading to higher subsidy levels, and welfare losses.

Another consequence of the fact that harmonization may be a better policy than subsidy competition is that even weak coordination rules between partner countries may be required in order to enjoy fully the benefits from trade integration. This is undoubtedly interesting for policy matters.

Harmonization seems to be a focal point from a policy point of view; however, this should only be a natural first step in a broader three-policy comparison. Indeed, in a theoretical analysis of MNCs enjoying market power in sub-regional markets, the zero subsidy benchmark is no reference from a welfare viewpoint. In our model, a non-zero subsidy level maximizing regional welfare always exists. This leads us to examine the admittedly extreme case of both governments coordinating on regional-welfare maximizing subsidy levels. This will provide an upper bound on the extent of potential gains from coordination.

Having defined a measure of these gains from coordination, we may now examine how they vary with trade integration, recalling that trade barriers are exogenous to our model. We do this in two steps: first, we consider a move from autarky to freer trade; second, we examine how the gains from coordination vary with further integration.

**Proposition 3** *The regional welfare gains from coordination increase monotonically with regional trade integration:*

- *starting from autarky, a tariff decrease that is sufficient to affect the location choice creates a gain from coordination, i.e. a positive difference in regional welfare between subsidy coordination and competition;*

- *welfare gains from coordination decrease monotonically with the tariff.*

**Proof.** See Appendix A5 for the first part and A6 for the second part. ■

As we know, the  $U1$  equilibrium prevails under autarky, while all other equilibria are conditional on trade integration. Therefore, there is no scope for gains from coordination under autarky. In contrast, integration may cause a welfare change due to the divergence between national governments' and a supranational authority's welfare objectives, be it simply a change in subsidy levels or even a change in location. In other words, a reduction of trade barriers starting from autarky raises the extent of welfare gains from coordination.

The second part of the Proposition states that the derivative of the regional welfare differential between coordination and subsidy competition with respect to  $t$ , the internal tariff, is negative. Therefore the gains from coordination take their maximum at perfect integration. The intuition behind the result and its implication for economic policy are the following: the gain to the coordination of subsidization policies *increases as regional integration proceeds*. Intuitively, an export platform strategy becomes more attractive with deeper regional integration, which raises the payoff to reorganizing the extra-regional MNC's regional production facilities into a single location through subsidies. But we have already discussed that government intervention under subsidy competition generally induces the MNC to choose Ubiquity, so that regional welfare does not depend on trade openness. In that sense, subsidy competition eliminates new location possibilities made possible by integration.

The creation of a supranational institution coordinating subsidy expenses among member States should be all the more desirable as regional integration proceeds. Considering trade policy in conjunction with related policies such as investment incentives, this result confirms that the interaction between both policies may raise the payoff to implementing one particular policy.

## 5 Extension: Competition for a Regional MNC

We now examine whether the origin of the multinational matters for the outcome of subsidy competition. Indeed, we expect subsidization behavior to differ when the MNC comes from within the region. We therefore expect different predictions according to MNC ownership. The welfare effects for the EU and Mercosur, for instance, should be different, as the former has more 'regional' MNCs than the latter. In this section, we consider a version of our model where the MNC comes from country A. We shall compare this 'regional MNC' scenario to that of the previous section.

The model presented in section 3 is straightforwardly extended to the case of a regional MNC. Appendix A7 displays MNC profits and national welfare functions. The subsidy game in the regional MNC case is solved in exactly the same way as before, implying that Proposition 1 also holds. As in the previous section, we analyze the location regime outcome of that game, and the potential gains from coordination. We defer to Appendix A7 the evaluation of Conditions 1-6. As before, the location outcome of the game depends on the extent of profit repatriation and production cost differences. The equilibrium is  $C2$  whenever the repatriation rate and the cost difference are low enough (high value of  $\phi$  and low  $\alpha_B$ ), in a sense defined in Appendix A7. In that case, government B's willingness to subsidize is high enough and the cost disadvantage of producing in B is low enough to make government A commit to large subsidies. Compared to the extra-regional MNC case, government A has an additional interest in hosting the MNC, which translates into a greater ability to 'win' the subsidy contest. With a greater repatriation rate (lower  $\phi$ ) or a more asymmetric region,  $C1$  obtains. Subsidy competition never hinders efficient relocation, unlike in the extra-regional case, but it can make governments offer subsidies in excess of their welfare-maximizing level.

It is interesting to compare the gains from integration in the extra-regional and regional MNC cases. In the former case subsidy competition can prevent relocation but subsidy expenditure increases compared to a prohibitive tariff regime ( $U2$ ). When this occurs, the region incurs a welfare loss, as shown in the previous section. In the latter case subsidy competition does not prevent relocation, while it increases subsidy expenditure. We show in Appendix A7 that this increase does not jeopardize the gains from trade, as defined in our model. This important result reinforces the case for cooperation in regions like Mercosur where the presence of out-of-bloc MNCs is relatively more important.

Finally, we study how the gains from supranational coordination vary with trade integration. As in the previous section, a decrease in the tariff starting from autarky will lead to a change in location outcomes, creating a gain from coordination for the region.<sup>21</sup> We show in Appendix A7 that gains from coordination increase with the tariff at the neighborhood of perfect integration. The non-monotonicity contrasts with our results in the extra-regional case.

To gain some intuition about this result, let us distinguish the  $C1$  and  $C2$  equilibria. In the former case, the only difference between subsidy competition and coordination is the concern for B's consumers by the fictitious social planner. This implies that tariff reductions allow for smaller coordination

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<sup>21</sup>Notice that the reasoning behind the first part of Proposition 3, shown in Appendix A5, does not depend on the origin of the MNC.

subsidies, while competitive subsidies are unaffected, lessening potential gains from coordination. In the case of a  $C2$  equilibrium, a tariff reduction has more complex effects on governments' best responses. Straightforward calculations show that  $C2$  subsidies are decreasing with the level of tariff barriers compared to regionally optimal subsidies, while the latter are consistently higher and increasing. This is intuitive since the  $C2$  subsidy makes B indifferent between locations, which is less costly with low trade barriers ; in contrast, as explained above, regionally optimal subsidies increase with trade barriers. Therefore under subsidy competition, the deviation from the regional optimum benchmark gradually vanishes in the course of trade integration.

## 6 Conclusion

We have investigated the effects of competition in subsidies between governments when regional integration makes relocation more profitable for MNCs. Our starting point has been the analysis of a subsidy game in a two-country model where the reduction of trade barriers enhances national incentives to offer production subsidies. While this game admits a unique equilibrium, its nature changes according to the extent of trade integration. In particular, a low enough tariff causes a switch to an equilibrium characterized by an excess of subsidization: governments commit to subsidy levels beyond those that maximize national welfare, causing either too little or too much relocation.

An excess of subsidization does not necessarily mean that countries are not to gain from regional integration. We identify conditions for this not to be the case: an extra-regional MNC, a region with large asymmetries and high levels of repatriation rates. In other cases, regional integration with investment subsidy competition reduces welfare respect to autarky.

Welfare gains from subsidy harmonization (a ban on subsidies) depend on MNC ownership and regional characteristics. In the case of an extra-regional MNC we show that harmonization generally dominates subsidy competition in terms of regional welfare. This result is conditional on the level of regional asymmetry and profit repatriation. Harmonization makes the region better off when regional asymmetry is sufficiently high. For low levels of asymmetry, repatriation must be in an intermediate range for harmonization to dominate subsidy competition. This is an original result, as well as an interesting one for policy purposes, as it shows that simple harmonization may be the relevant second best policy when regional coordination is difficult to implement.

We show that building the appropriate regional institutions may be crucial for the region to enjoy gains from regional integration: a reduction of trade



barriers, starting from autarky, raises the extent of welfare gains from coordination. In addition, when the MNC is extra-regional, we show that the highest gain to regional coordination is achieved when integration is fully completed. The monotonicity of this gain from coordination with respect to trade costs is interesting, from the point of view of integrating processes among developing countries, often characterized by the presence of extra-regional MNCs. Our result suggests that in a gradual integration process, the cost of building institutions may later be recouped by gains from further integration.

We discuss how our findings depend on firm ownership, regional cost differences, corporate taxation, and to the kind of agreement between countries. However the role of country size, the endogenous determination of repatriation rates and multiple MNCs should be considered in future research.

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