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Subsidy Competition in Integrating Economies*

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July 21, 2005

Abstract

Regional integration affects location decisions of MNCs and therefore influences each member country's provision of investment incentives, which in turn may trigger relocation. As a consequence, subsidy competition increases as integration proceeds. We analyze the welfare consequences of this phenomenon, modelling subsidization as a game between a MNC facing different location alternatives and governments that may deter or induce relocation by means of subsidies. We show that the combination of integration and subsidy competition may lead to an excess of subsidization. We also discuss how the interest of harmonizing subsidies, the net gains from integration crucially depend on technological differences, ownership and the absorption capacity of MNC profits by countries. Lastly, we find that the gain from supranational subsidy coordination increases with integration.

JEL-Classification: F15, F21, F23

Keywords: Multinational Corporations, Regional Integration, FDI, Subsidy Competition, Location Choice

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1 Introduction

Has regionalization shown its limitations? Recent conflicts in regional unions heading for deeper integration suggest that the policy content of regional agreements still is a matter of debate, deserving the attention of theorists in international trade and public economics.

This paper offers a new perspective on the interaction between regional trade integration and subsidy competition between partner countries. We examine how integration triggers excessive provision of investment incentives by member governments, and discuss the desirability of deeper integration in the sense of some coordination on subsidy levels. The widespread use of investment incentives to influence MNC location is a well documented fact. In a survey covering 83 countries, UNCTAD (1996) reports that 55 countries commonly use fiscal and indirect (infrastructure) incentives, while almost all resort to subsidies lowering the cost of capital for foreign investors. Subsidy provision has particularly increased within regional unions, as a result of competition between rival locations (see a survey by Oman 2000 providing numerous examples).

This surge in subsidy competition has coincided with waves of FDI flows following the creation of trade blocs, most notably in the EU, in NAFTA, and in Mercosur. Indeed, there is considerable evidence that regional integration affects FDI flows, in particular by redefining the location of horizontal FDI (see Barba Navaretti and Venables, 2004 for a detailed and up-to-date survey and discussion).

Ethier (1998) argues that attraction of FDI, rather than traditional gains from trade, has been a key motivation for membership in regional unions, consistent with the modest actual extent of trade concessions agreed upon. If this view is correct, investment incentives may well have been another way to attract foreign investors, once neighbor countries had become members.

A prominent example of the coincidence of regional integration, changes in location patterns and intense subsidy competition is given by Mercosur. Before integration, MNCs created subsidiaries in Brazil and Argentina in order to 'escape' from trade protection. More often than not, those subsidiaries had similar operations, used similar technologies, and sold similar products (Gatto et al., 1984) on each national market. 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). This coincided with a rise in the provision of investment incentives from all member governments, most notably in Argentina and Brazil[1]. Indeed, the implementation of some sort of coordination on subsidies belongs to the current agenda of talks on Mercosur's future[2].

The above cited evidence suggests that regional integration processes increase MNCs' "footlooseness" : offering even more favorable conditions logically appears to be in member governments' interest. Our contribution is to provide a formal analysis of this phenomenon in an imperfect competition framework, where subsidies should theoretically improve allocative efficiency. We show that, even in this optimistic view of subsidization, subsidy competition leads to welfare losses, when compared to several forms of policy coordination. Our model also helps explain the observed rise in incentives provision, seemingly exceeding pre-competition levels. In addition, we investigate conditions under which realizing the gains from integration requires regional coordination on investment incentives.

[1] 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 and 2002).

[2] As reported by Página 12, Argentinean newspaper, in June 28^{th}, 2005. See also Polínia Rios (2003).

We find the following results :

1. The combination of regional integration and subsidy competition leads to an excess of subsidization, even in an imperfect competition framework where subsidies should improve allocative efficiency.

2. Conflicts of interest between integrating countries create a potential gain from regional policy coordination.

3. The need for coordination depends on intra-regional trade barriers when subsidies are granted to an MNC owned by extra-regional residents.

4. Under certain circumstances, harmonizing production subsidies within the region by outright prohibition is enough to improve welfare compared to subsidy competition.

5. Results (1), (2), (3) and (4) rely upon regional asymmetries, MNC ownership and profit repatriation rates. Hence policy implications of our analysis need not be the same regional unions that differ along these dimensions.

Our formal analysis of these issues relies upon a theoretical model of subsidy competition that is sensitive to the level of regional integration. In section 2, we review the relevant literature and detail our contribution to it. In section 3, we set up the model and prove the existence of 4 qualitatively different types of equilibria. In section 4, we determine the prevailing equilibrium under full integration (4.1), assess the welfare effects of subsidy competition (4.2) and the corresponding net gains from trade (4.3.1), and investigate the benefits of regional coordination (4.3.2). Section 5 concludes.

2 Related Literature

There has been a great deal of interest in the effects of competition among countries for MNC activities location. Empirical studies addressing the effect of competition for MNC location converge in indicating that tax attenuation or production subsidies have had a clear impact on MNC investment (for a review, see Devereux and Griffith 2002). For instance, Hines (1996) offers evidence of the structure of U.S. inward FDI being significantly affected by tax incentives[3]. Similar results are obtained by Devereux and Pearson (1995), Devereux and Griffith (1998) for Europe, and Devereux and Griffith (2003) for both Europe and the U.S.

Governments may have various motives to offer fiscal or investment incentives to MNCs, which allows for different theoretical approaches. The tax competition literature, as reviewed by Wilson (1999), seeks to explain the effects of intergovernmental competition for mobile capital on the provision of public goods and overall efficiency. The Basic Tax Competition Model predicts sub-optimally low tax rates and under-provision of public goods[4]. The New Economic Geography literature emphasizes the role of agglomeration effects to explain governments' willingness to reduce taxes on mobile capital in an integrated region[5].

[3]He finds that percentage differences in the corporate tax rate are associated with differences up to 9-11% in the fraction of foreign investors (eligible to incentive provision) among all investors.

[4]This reasoning has been applied to competition for investment by Black and Hoyt (1989), Haaparanta (1996), and in an imperfect competition setup by Janeba (1998).

[5]See *inter alia* the core-periphery model of Baldwin and Krugman (2002), or footloose capital models by Dupont and Martin (2003), and Ottaviano and van Ypersele (2002).

Two useful insights from this literature are worth mentioning. First, further integration makes firms even more responsive to profit differentials resulting from incentive provision. Second, a core country may be able to set a limit tax deterring investment in the periphery. These two features will be present in our model. However, our focus will be on MNCs potentially operating several subsidiaries in potentially several countries, as opposed to single-plant firms as in the above mentioned papers. From another perspective, Haaland and Wooton (1999) find that providing investment subsidies to foreign-owned multinationals may be in the national interest due to vertical linkages with local suppliers and agglomeration effects[6].

With a limited number of potential foreign investors, countries may compete to attract them. The welfare analysis of subsidy competition relies upon the assumed attributes of FDI. For instance, Barros and Cabral (2000) focus on the reduction of unemployment allowed by the presence of FDI[7]. Fumagalli (2003) develops a technological argument and obtains a similar result[8], assuming positive externalities emanating from MNC activities[9]. Both papers find FDI incentives may be welfare enhancing even in the presence of subsidy competition between potential and mutually exclusive host countries.

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

Location choices are not exclusively influenced either by FDI incentives or by economic integration alone, but also by the interplay between both. The possibility for a MNC to relocate and the impact of integration on its location motives necessarily has an influence on governments' willingness to offer tax or production incentives. Consequently, there has been an increasing interest in the interaction between regional integration and fiscal competition recently. Haufler and Wooton (1999) analyze two-country 'auctions' for foreign investment and point at the role of country size : due to a home market effect, the largest country wins the auction[10].

Closer to our approach, Raff (2004) investigates the exports vs FDI decision of an extra-

[6]They assume that MNCs provide employment opportunities and generate demand for domestic intermediate inputs, produced by domestic workers with increasing returns to scale. This explains how MNC investment raises the net value of domestic production. The desirability of FDI is reinforced in the presence of agglomeration forces: a first comer, attracted by a subsidy, may induce several to enter, establishing a complete modern sector.

[7]An assumption justifiable in a partial equilibrium setting. In such a case the effect of competition will be positive since the country suffering the most from unemployment will have a higher willingness to pay for the location of the MNC, and therefore will win the bidding contest: the gain in employment will outweigh the expense in subsidies and competition will have a positive effect on allocative efficiency.

[8]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.

[9]Assuming positive technological externalities arising from FDI, especially within a sector, is not exempt of controversy (see Devereux and Griffith 2002), all the more in developing countries (Aitken and Harrison, 1999, Kugler, forthcoming and Chudnovsky and Lopez, 2004.)

[10]In their model with exogenous and identical transport costs, two countries competing to attract a foreign-owned monopolist offer positive lump-sum profit tax. When governments may count on an additional instrument, such as a tariff, the profit tax paid in equilibrium rises.

regional MNC in a two-country region, after the formation of a Free Trade Agreement or a Customs Union. He shows that trade integration never leads to a reduction in FDI when governments use bilateral tariffs in conjunction with proportional profit taxes. He also finds that a regional FTA may lead to lower external tariffs and a reduction in the tax rates levied by member countries on the profits of multinational firms.

Our approach is complementary to his in the sense that the fiscal instrument we study, production subsidies, affects output and hence allocative efficiency, creating a role for strategic subsidization by governments. Besides we relax the implicit assumption of costless profit repatriation. All this leads to different conclusions. In particular, we obtain a wider array of location possibilities, including duplication of plants under perfect integration, and find a determining role for ownership in shaping nationally optimal policies towards FDI. We also incorporate the possibility of regional coordination.

Indeed, the discussion on fiscal competition suggests that the case for regional coordination may straightforwardly be made, due to the existence of a prisoner's dilemma in setting national taxes. Haufler and Wooton (2001) 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[11]. 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:

- By incorporating the possibility of relocation we identify a channel through which regional integration interplays with regional competition for firms.

  In a non-integrated region, provided that the MNC prefers FDI to extra-regional exports, all countries will receive the investment. Regional integration enables the firm to create a regional export platform in one of the countries.

  This potential change in location would translate into a welfare loss or gain for the countries, which fosters competition for investment. In our framework, investments are sunk, and the firm may choose to keep both plants or to shut one down and produce for exports from the other. This complements the literature discussed above, which mainly analyses pure auctions for new investments.

  We obtain a wealth of different types of equilibria that help rationalize excessive subsidization, as governments will want to deter potential competition by means of limit-subsidization. This allow us to identify under which circumstances subsidy competition between integrating economies may lead to an excess of subsidization.

- We also investigate whether there are gains to regional integration once the effect of fiercer subsidy competition is taken into account.

- We include the geography of capital in the analysis by allowing for two different types of ownership (intra- or extra-regional) and national absorption of MNC profits. This

[11] 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.

absorption capacity may be interpreted as a profit repatriation tax or as a particular measure of the social value of MNC investments.

- We put the normative discussion on subsidy competition into perspective by measuring regional welfare in alternative policy settings, such as mutual interdiction (harmonization) of subsidies and perfect regional 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 Preliminaries

In our model, trade integration allows the MNC to relocate its operations, building an export platform in the most technologically advanced country. Governments may react by strategically using production subsidies to prevent or enhance relocation, causing inefficiency in the location of production. 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.

Regional welfare losses suggest a case for regional regulation. We will consider three policy options: decentralized, harmonized (zero subsidy regime) and regionally optimal subsidies. By definition, the latter possibility maximizes regional welfare, but we show that its benefits increase with regional integration. Indeed, as integration proceeds, more efficient relocation opportunities are distorted away. We also show that harmonization dominates a decentralized framework when the MNC is from outside the region.
Formally, the region consists of 2 countries, A and B, whose markets are assumed to be segmented with a linear inverse demand function. Each market is served by a monopolist. We allow for 2 different types of ownerships, either a 'regional' firm belonging to country A or an extra-regional ('foreign') firm.

Consistent with our discussion of location decisions, the firm faces two location alternatives, 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.

The location choice of the MNC depends on host countries' characteristics: market size, as in Haufler and Wooton (1999), but also institutional settings, and technological characteristics. Although our framework is tractable enough to incorporate any of the mentioned sources of country heterogeneity, we focus on the last one. In particular, we assume that the production function exhibits constant returns to scale. Hence the costs for the MNC of serving the home market j, and the export market k, respectively, equal

$$C_{jj} = (\alpha_j - s_j)\, q_{jj}$$
$$C_{jk} = (\alpha_j - s_j + t)\, q_{jk}$$

The constant marginal cost is country-specific and may be decomposed between an exogenous component, α_j, and an endogenous subsidy s_j chosen by government j[12]. As for t, it is the Union's common internal tariff, with regional integration modelled as a reduction in t.

Monopoly profits in each market j are $\pi^j = (q_{jj})^2 = \frac{1}{4}(A - \alpha_j + s_j)^2$ if the market is served by regional production and $\pi^j = (q_{jk})^2 = \frac{1}{4}(A - \alpha_j + s_j - t)^2$ when market k is served by means of exports from j. As markets are segmented, regional profits (Π) are simply the sum of profits made in each market. Regional MNC profits are reported in Table 1.

Table 1: Regional MNC profits by location and ownership

U, regional MNC	$\Pi_{U,R}(s_A, s_B)$	$\frac{1}{4}[(A - \alpha_A + s_A)^2 + (1-\phi)(A - \alpha_B + s_B)^2]$
C, regional MNC	$\Pi_{C,R}(s_A, s_B)$	$\frac{1}{4}[(A - \alpha_A + s_A)^2 + (A - \alpha_A + s_A - t)^2]$
U, extra-regional MNC	$\Pi_{U,ER}(s_A, s_B)$	$\frac{(1-\phi)}{4}[(A - \alpha_A + s_A)^2 + (A - \alpha_B + s_B)^2]$
C, extra-regional MNC	$\Pi_{C,ER}(s_A, s_B)$	$\frac{(1-\phi)}{4}[(A - \alpha_A + s_A)^2 + (A - \alpha_A + s_A - t)^2]$

Note that the relative advantage of a location over the other depends on the internal tariff (t), technological differences (α's) and subsidies (s_j). ϕ stands for the ability of each nation to appropriate some part of the MNC's profit as national welfare, through a profit tax or the distribution of the affiliate's profits to local residents. From the MNC headquarters' viewpoint, $(1 - \phi)$ measures the profit repatriation rate. With little effort, we can also consider ϕ as 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. Henceforth, we refer to ϕ as local absorption. In order to focus on differences in production characteristics, we assume ϕ to be identical between countries[13].

As countries' decisions depend crucially on the form of the objective function, we assume it to be as general as possible: national welfare will amount to the sum of consumer surplus, some part of the MNC's producer surplus, and government surplus, i.e. tariff revenue minus the cost of subsidies. Table 2 displays welfare functions for each type of location and ownership.

Notice that firm ownership matters for the producer surplus except for the special case of $\phi = 1$. When the MNC is regional, country A is relatively more willing to offer subsidies. This will affect the subsidy game and, compared with the case of an extra-regional MNC, lead to different equilibria.

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 location choice exists.

We model the interaction between governments and the MNC as a two-stage non-cooperative game.

[12]In our partial equilibrium setting a marginal cost-reducing subsidy acts as a reduction of the cost of capital (with a linear homogenous production function), or any fiscal or indirect subsidy related to output. It should be noted that subsidy competition resulting in negative optimal subsidies (taxes), is not equivalent to fiscal competition, since this typically involves corporate profit taxes. This will be captured by our variable ϕ, as explained below.

[13]How heroic this assumption is depends on the way ϕ is interpreted. For instance, in the fiscal interpretation, evidence suggests convergence in corporate tax rates in the EU. See Devereux, Lockwood and Redoano (2004).

Table 2: Welfare functions by location and ownership

Regional MNC			
$W^j = CS^j + PS^j + GS^j$	CS	PS	GS
Ubiquity, Country A	$\frac{1}{2}(\frac{A-\alpha_A+s_A}{2})^2$	$(\frac{A-\alpha_A+s_A}{2})^2 + [1-\phi](\frac{A-\alpha_B+s_B}{2})^2$	$-s_A(\frac{A-\alpha_A+s_A}{2})$
Concentration, Country A	$\frac{1}{2}(\frac{A-\alpha_A+s_A}{2})^2$	$(\frac{A-\alpha_A+s_A}{2})^2 + (\frac{A-\alpha_A+s_A-t}{2})^2$	$-s_A(\frac{2A-2\alpha_A+2s_A-t}{2})$
Ubiquity, Country B	$\frac{1}{2}(\frac{A-\alpha_B+s_B}{2})^2$	$\phi(\frac{A-\alpha_B+s_B}{2})^2$	$-s_B(\frac{A-\alpha_B+s_B}{2})$
Concentration, Country B	$\frac{1}{2}(\frac{A-\alpha_A+s_A-t}{2})^2$	0	$t(\frac{A-\alpha_A+s_A-t}{2})$
Extra-regional MNC			
Ubiquity, Country A	$\frac{1}{2}(\frac{A-\alpha_A+s_A}{2})^2$	$\phi(\frac{A-\alpha_A+s_A}{2})^2$	$-s_A(\frac{A-\alpha_A+s_A}{2})$
Concentration, Country A	$\frac{1}{2}(\frac{A-\alpha_A+s_A}{2})^2$	$\phi[(\frac{A-\alpha_A+s_A}{2})^2 + (\frac{A-\alpha_A+s_A-t}{2})^2]$	$-s_A(\frac{2A-2\alpha_A+2s_A-t}{2})$
Ubiquity, Country B	$\frac{1}{2}(\frac{A-\alpha_B+s_B}{2})^2$	$\phi(\frac{A-\alpha_B+s_B}{2})^2$	$-s_B(\frac{A-\alpha_B+s_B}{2})$
Concentration, Country B	$\frac{1}{2}(\frac{A-\alpha_A+s_A-t}{2})^2$	0	$t(\frac{A-\alpha_A+s_A-t}{2})$

- 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 R between alternatives U and C.

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

The solution to that 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 $\{R, s_A, s_B\}$. 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. The solution is essentially the same in the 'regional MNC' and 'extra-regional MNC' cases.

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 $\{U, C\}$.

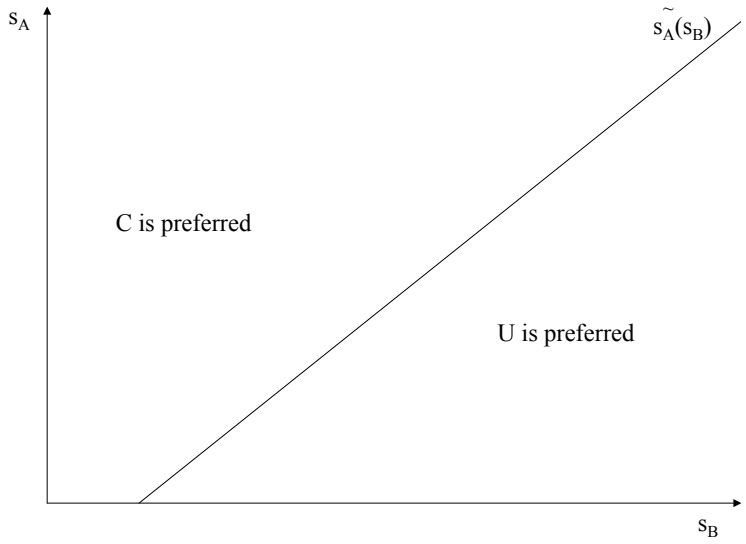
In both 'regional MNC' and 'extra-regional MNC' frameworks this best-reply function may be illustrated by a straight line in $\{s_A, s_B\}$ space. In general, the profit differential between ubiquity and concentration, conditional on subsidies s_A and s_B, is given by

$$\Delta\Pi(s_A, s_B) = (1-\phi)\frac{1}{4}(A - \alpha_B + s_B)^2 - \frac{1}{4}(A - \alpha_A + s_A - t)^2$$

in the regional MNC scenario and

[14]Credibility is an important assumption, as in one case government A would gain from reneging 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.

Figure 1: The MNC's location choice according to first-stage subsidies



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

in the extra-regional MNC scenario (see Table 1). We may express this basic comparison between profits from home-based exports and local operations by computing subsidy pairs that leave the MNC 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

$$\widetilde{s_A}(s_B) = \left(\sqrt{1-\phi}\right) s_B - (A-\alpha_A) + (\sqrt{1-\phi})\,(A-\alpha_B) + t \tag{1}$$

in the regional MNC scenario and

$$\widetilde{s_A}(s_B) = s_B + \alpha_A - \alpha_B + t \tag{2}$$

in the extra-regional MNC scenario. Figure 1 represents the graph of this function[15].

3.2.2 In the first stage

Governments choose subsidy levels simultaneously. At a sub-game perfect equilibrium, the subsidy of one government should maximize its continuation payoff given the other government's subsidy. Note that in the case when subsidies posted by governments make the MNC indifferent, we consider ubiquity as the *status quo*.

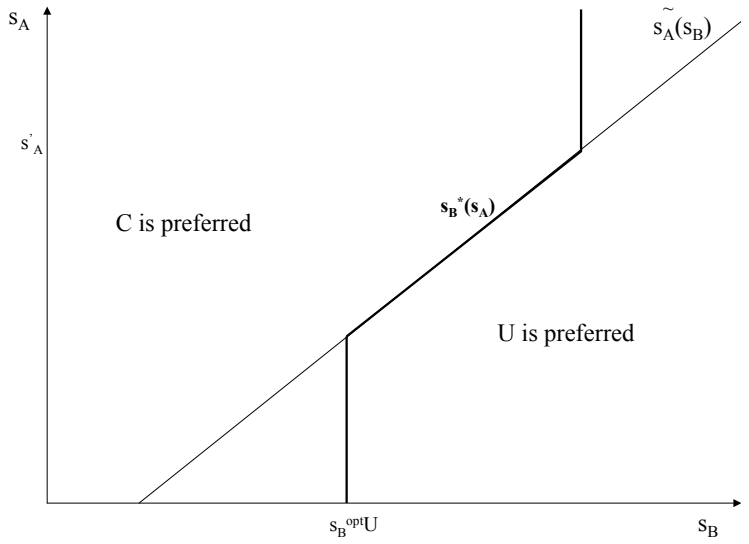
Government B's best reply

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

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

[15]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.

Figure 2: Government B's best-reply schedule



This is government B's best-reply to all s_A lower than $\widetilde{s_A}(s_B^{opt}(U))$ in both 'regional' and 'extra-regional' scenarios, 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 $s_A < \widetilde{s_A}(s_B^{opt}(U))$, 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

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

Any subsidy higher than s'_A makes concentration more desirable than ubiquity for government B. Note that this threshold subsidy is the same in both foreign and regional MNC scenarios.

Summarizing, we have the following best-reply schedule for government B, pictured in Figure 2 :

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

Government A's best reply

We proceed in a similar manner by defining

$$s_A^{opt}(U) = \arg\max_{s_A}\{W_A(s_A, s_B, U)\} = A - \alpha_A$$

$$s_A^{opt}(C) = \arg\max_{s_A}\{W_A(s_A, s_B, C)\} = \frac{A - \alpha_A}{3}$$

in the case of a regional MNC and

$$\begin{aligned} s_A^{opt}(U) &= \frac{2\phi - 1}{3 - 2\phi}(A - \alpha_A) \\ s_A^{opt}(C) &= \frac{4\phi - 3}{7 - 4\phi}(A - \alpha_A) + 2t\frac{1 - \phi}{7 - 4\phi} \end{aligned}$$

in the case of an 'extra-regional' MNC. Let us first see why government A's best-reply schedule has a three-part structure[16].

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 case where $W_A(s_A^{opt}(C), C) > W_A(s_A^{opt}(U), s_B^{opt}(U), U)$. Noting that $W_A(s_A, C)$ has an inverted U shape, and decreases with s_A for values higher than $s_A^{opt}(C)$, there must be a threshold $\underline{s_A} > s_A^{opt}(C)$ above which ubiquity is preferred, i.e. $W_A(\underline{s_A}, C) = \max_{s_A}\left\{W_A(s_A, s_B^{opt}(U), U)\right\}$. Similarly, in the opposite case where $W_A(s_A^{opt}(C), C) \leq W_A(s_A^{opt}(U), s_B^{opt}(U), U)$ there exists a $\overline{s_A} > s_A^{opt}(C)$ such that $W_A(\overline{s_A}, \widetilde{s_B}(\overline{s_A}), U) = \max_{s_A}\{W_A(s_A, C)\}$. The existence of these threshold subsidies implies a switch in preferred locations by governments in this 'second' part of their best-reply schedule.

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

Intuitively, the overall shape of government A's best-reply schedule ultimately depends on the comparison between welfare under ubiquity and concentration. Provided no regime unambiguously welfare-dominates the other for all possible subsidy levels, we obtain this three-part structure. 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.

Before we turn to these conditions, let us construct an illustrative example. Suppose that $W_A(s_A^{opt}(C), C) > W_A(s_A^{opt}(U), s_B^{opt}(U), U)$. This may in particular be the case for low trade barriers, or substantial technological backwardness of country B.

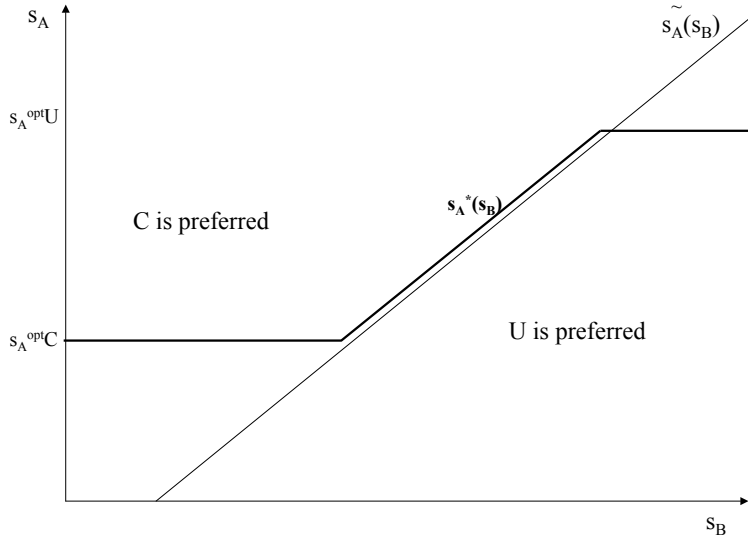
Against that interval of s_B where $s_A^{opt}(C)$ yields concentration, that subsidy is clearly a best-reply to s_B. The threshold subsidy $\overline{s_A}$ such that ubiquity is preferred is given by $W_A(\overline{s_A}, C) = \frac{(A-\alpha_A)^2}{2(3-2\phi)}$ in the extra-regional MNC scenario and $W_A(\overline{s_A}, C) = \frac{(A-\alpha_A)^2}{2} + \frac{(1-\phi)(A-\alpha_B)^2}{(3-2\phi)^2}$ in the regional MNC scenario. At this point, there is a switch from the best-reply function to the profit indifference frontier. Finally, if the difference between maximal welfare under ubiquity and welfare under concentration with suboptimal subsidies is low enough, 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 ε may be arbitrarily small. Figure 3 shows government A's best-reply map.

[16]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 3: 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.
- 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.
- A $C2$ equilibrium yielding concentration, with both governments bidding higher subsidies than in the $C1$ equilibrium levels, where the part of A's best reply line closely parallel to the MNC indifference line ($\widetilde{s_A}(s_B)$) intersects B's reply curve in its vertical component.
- A $U2$ equilibrium yielding ubiquity, with government B bidding a higher subsidy than in the $U1$ equilibrium in order to prevent relocation in country A.

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

Proposition 1 *Consider the following set of conditions:*

1. $s_A^{opt}C \geq s'_A$
2. $W_A(s_A^{opt}U, s_B^{opt}U, U) \geq W_A(s_A^{opt}C, C)$
3. $W_A(s_A^{opt}U, s_B^{opt}U, U) \geq W_A(s'_A, C)$
4. $\Pi(s_A^{opt}U, s_B^{opt}U, U) > \Pi(s_A^{opt}U, s_B^{opt}U, C)$

5. $s_A^{opt} U \leq s'_A$

6. $W_A(s'_A, \widetilde{s_B}(s'_A), U) \geq W_A(s'_A + \epsilon, C)$

This set of conditions is logically sufficient to determine the existence of either type of equilibrium. The determination of equilibria is given by the following diagram.

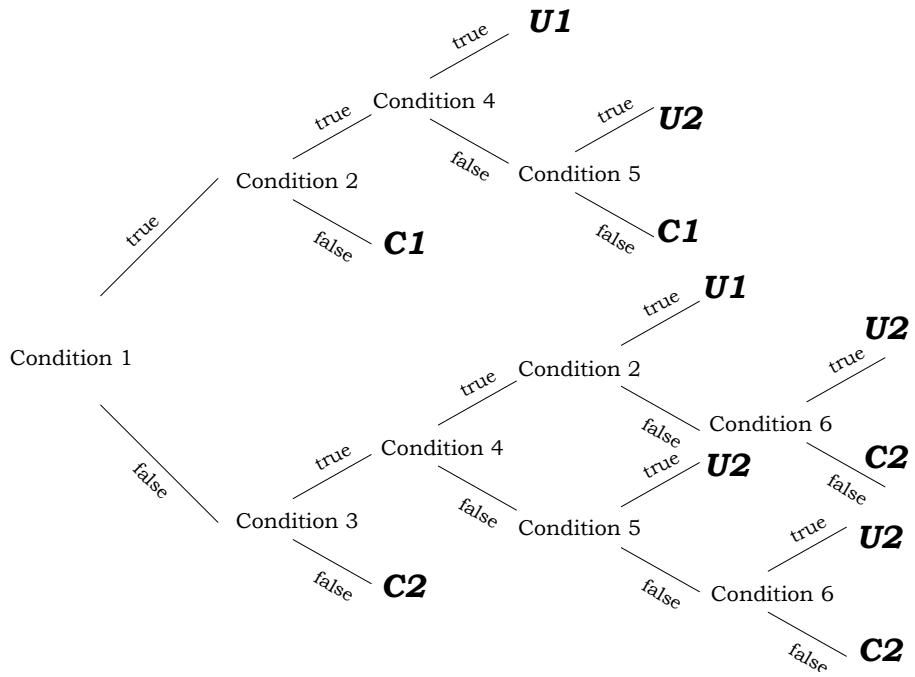


Figure 4: Conditions 1-6 and the existence of equilibrium

Proof. See Appendix *A*1. ■

We pause now to give some intuition on Proposition 1 and the determination of equilibria in the subsidy game.

The most important condition is Condition 1, that determines whether concentration/relocation with optimal subsidies for country A is acceptable to country B. In this model, governments will generally compete for investment, since the social benefit to the MNC's presence is higher consumer surplus plus a share of profits. However, concentration/relocation may be a good option for the 'losing' country if it implies large efficiency gains that are passed through to the consumers, and ultimately depends on the amount of subsidy spent by the 'winning' government. Hence the role of s'_A. In graphical terms, this means that government B's best-reply schedule will always have a vertical component. To summarize, Condition 1 tells us where governments' best-reply curves intersect in the subspace where concentration obtains.

When Condition 1 holds, then either government A may not increase welfare under concentration (Condition 2 does not hold and we have the simple C1 equilibrium), or government A may reach a higher welfare level under ubiquity, despite higher subsidies from the rival government (U2 equilibrium). When Condition 1 does not hold, then a C1 equilibrium is not possible, but all other types of equilibria exist, depending on government A's comparison between welfare under concentration with suboptimal subsidization, and welfare under ubiquity. Table 3 displays Conditions $1-6$ expressed in parameter values.

Table 3: Conditions for existence of different equilibria in the Subsidy Game expressed in parameter values

	Extra-regional MNC
1	$t \geq \frac{2}{3-2\phi}(\alpha_B - \alpha_A)$
2	$t \geq \frac{2\sqrt{\frac{(A-\alpha_A)^2(1-2\phi)^2(7-4\phi)}{12-8\phi}} - 3(A-\alpha_A)}{2\phi^2-3\phi-2}$
3	$\frac{1}{2}\frac{(A-\alpha_A)^2}{3-2\phi} \geq (\frac{1}{2}+\phi)(\Omega(t)-\frac{t}{2})^2 - (\Omega(t)-\frac{t}{2})(2\Omega(t)-(A-\alpha_A)-t)$ where $\Omega(t) = \sqrt{\frac{(A-\alpha_B)^2}{3-2\phi}+t^2}$
4	$A - \alpha_A \leq \sqrt{3-2\phi}(A-\alpha_B)$
5	$t \geq \frac{\frac{(A-\alpha_B)(7-4\phi)}{\sqrt{3-2\phi}} - 2(A-\alpha_A)}{1-\phi}$
6	$t \geq \frac{2(A-\alpha_A)(3-2\phi) - \sqrt{4-(A-\alpha_A)^2(3-2\phi)^2 - 16(A-\alpha_a)^2(3-s\phi)^2(1-\phi)\phi}}{2(3-2\phi)^2\phi}$ $t \leq \frac{2(A-\alpha_A)(3-2\phi) + \sqrt{4-(A-\alpha_A)^2(3-2\phi)^2 - 16(A-\alpha_a)^2(3-s\phi)^2(1-\phi)\phi}}{2(3-2\phi)^2\phi}$
	Regional MNC
1	$t \geq 2(A-\alpha_A) - \frac{2\sqrt{1-\phi}}{3-2\phi}(A-\alpha_B)$
2	$t \leq A - \alpha_A - \sqrt{\frac{1}{3}(A-\alpha_A)^2 + 4\frac{(A-\alpha_B)^2(1-\phi)}{(3-2\phi)^2}}$
3	$\frac{1}{2}(A-\alpha_A)^2 + (1-\phi)(\frac{A-\alpha_B}{3-2\phi})^2 \geq \frac{3}{2}(\Omega(t)-\frac{t}{2})^2 - (\Omega(t)-\frac{t}{2})(2\Omega(t)-(A-\alpha_A)-t)$ where $\Omega(t) = \sqrt{\frac{(A-\alpha_B)^2}{3-2\phi}+t^2}$
4	$A - \alpha_A \leq \frac{A-\alpha_B}{\sqrt{3-2\phi}}$
5	$\frac{2}{3}(A-\alpha_A) \leq \frac{A-\alpha_B}{\sqrt{3-2\phi}}$
6	$t \leq \frac{(2A-\alpha_A-\sqrt{1-\phi}(\alpha_B-1))^2}{2A-\alpha_A-2\sqrt{1-\phi}(\alpha_B-1)}$

3.3 Discussion

We have now fully characterized the equilibria of this game. Conditions $1-6$ and the tree diagram enable us to easily determine the prevailing equilibrium for different levels of regional integration, ownership, local absorption and regional technological differences.

Despite a simple formalization, with the property that for a given location regime welfare-maximizing subsidies do not depend on the other government's subsidy, we have ended up with a wealth of equilibria. This results from the sequential game setup. In a simultaneous game, only U1 and C1 equilibria would appear[17]. The $C2$ equilibrium, that exhibits subsidies in excess of the $C1$ simultaneous-game outcome, would only occur in a sequential game, where governments are able to credibly commit to announced subsidy levels. $C2$ helps us rationalize the observed tendency to excess subsidization from governmental agencies, mentioned in the introduction. A similar remark applies to $U2$ and $U1$.

As appears clearly from the above conditions, which equilibrium eventually obtains depends on MNC ownership and on three features of the regional union: technological asymmetries between countries (α_i), the extent of local absorption (ϕ), and internal trade barriers (t). For instance, an equilibrium with concentration is more likely to occur whenever asymmetries are substantial, absorption is 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). We defer to Appendix $A1$ a

[17] In fact, the same subsidies would have been offered in a simultaneous game between a single government and the MNC

discussion on how the threshold tariffs depends on the parameters and the type of subsidy competition. What is interesting to bear in mind is that deepening regional integration is likely to make the region switch to another equilibrium.

We are now in a position to adapt our general framework to special cases of regional unions.

4 Applications

Public policy towards FDI may take various forms in an integrating region, according to the degree of regional coordination. To explore this, we define 3 alternative policy options for a regional union :

- Decentralized integration, under which countries compete in subsidies to influence the MNC's location choice.
- Harmonized integration, under which governments commit themselves to a weak form of coordination, namely zero subsidy. This situation amounts to the mutual interdiction of investment incentives.
- Coordinated integration, under which countries cooperatively set subsidy levels that maximize regional welfare, mimicking a benevolent supranational social planner. '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 $A2$).

At this point we can address the following key questions:

1. How does the integration process modify firm location in the presence of subsidy competition? (section 4.1)
2. How and when does subsidy competition improve on harmonization ? (section 4.2)
3. Does subsidy competition jeopardize the gains from trade integration ? (section 4.3.1)
4. Does regional integration increase the reward to subsidy coordination ? (section 4.3.2)

4.1 Location choice and integration

We explore here the prevailing location choice after regional integration. Intuitively, in the absence of trade, a MNC would set up an affiliate in each nation[18]: for a large enough tariff, the tariff-jumping motive dominates the export platform motive. But with heterogeneous country-specific production characteristics, lower tariffs allow the MNC to concentrate production in the most convenient country and serve both markets from there. Therefore, with different countries and costless relocation, full regional integration ($t = 0$) implies concentration in a harmonized as well as in a coordinated region. Conversely, in both cases, with identical countries in terms of production, integration will not be accompanied by relocation.

[18]Remember that we do not consider the possibility of exports from outside the region.

Under subsidy competition the location choice is a bit less straightforward to predict. Basically, we need to evaluate Conditions $1-6$ at $t=0$ and to find the prevailing equilibrium.

To introduce regional characteristics, we need to set some values for a few parameters. For technologically symmetric countries we normalize $\alpha_A = \alpha_B = 0$ and for asymmetric countries we set $\alpha_A = 0$ and $\alpha_B > 0$. As for the level of MNC profit appropriation, we consider low absorption through the extreme case of $\phi = 0$ and high absorption by setting $\phi = 1$. Careful analysis of the set of equilibria leads us to determine analytically the MNC location choice at full integration, as summarized in the following Proposition.

Proposition 2 *Under perfect trade integration, allowing for free subsidy competition between governments typically affects the location choice by the MNC, compared to its choice under subsidy harmonization or coordination. Specifically, Table 4 displays the different equilibria under perfect integration.*

Table 4: Prevailing equilibrium under perfect integration

			Agreement	
		Decentralized	Harmonized	Coordinated
Regional MNC				
Region	Repatriation		Equilibrium	
Symmetric	low	$C2$	$U1$	$U1$
	high	$C1$	$U1$	$U1$
Asymmetric	low	$C2$ if asymmetry is low ($\alpha_B \leq \frac{A}{3}$) $C1$ otherwise	$C1$	$C1$
	high	$C1$	$C1$	$C1$
Extra-regional MNC				
Symmetric	low	$U1$	$U1$	$U1$
	high	$U1$	$U1$	$U1$
Asymmetric	low	$U2$ if asymmetry is low ($\alpha_B \leq \frac{A}{3}$) $C1$ otherwise	$C1$	$C1$
	high	$U2$ if asymmetry is low ($\alpha_B \leq \frac{A}{2}$) $C1$ otherwise	$C1$	$C1$

Proof. Evaluation of conditions $1-6$ expressed in Table 3 at $t=0$ is a straightforward but tedious task, which we defer to Appendix $A2$. ■

What Table 4 tells us is that, under perfect regional integration, subsidy competition generally leads to equilibria that differ from those of harmonization and coordination.

Indeed, subsidy harmonization or even coordination makes $U1$ optimal for a symmetric region, and $C1$ for an asymmetric region : given negligible trade costs, relocation requires lower local production costs. In contrast, decentralized (competitive) subsidization enables the high-cost country's government to influence location decisions : we predict that an 'extra-regional' MNC will not relocate because of competition from the 'high-cost' government ($U2$ equilibrium) ; conversely, a 'regional' MNC will relocate, but benefit from sub-optimally high subsidies from the low-cost location's government ($C2$ equilibrium). The difference is due to profit appropriation by nation A in the 'regional' case, which allows for higher subsidies, which in turn benefit the other location's consumer and tempers competition between governments.

Discussion In various types of regions, the prevailing equilibrium under perfect integration is characterized by subsidization in excess of its level in the absence of competition: a $C2$ type of equilibrium when the MNC is regionally owned and $U2$ when it is extra-regional. Indeed, deepening integration favors the export-platform motive, increasing governments' willingness to subsidize beyond their optimal levels, resulting in an efficiency loss.

Excessive subsidization of an extra-regional MNC always obtains, except for the polar case of technologically similar countries. The slightest difference in technologies will lead to a $U2$ equilibrium. This result also suggests that subsidy competition may jeopardize the gains from trade associated with regional integration (see subsection 4.3.1). Integration in this case would only invigorate competition for MNC location.

Excessive subsidization of a regional MNC is unlikelier. whether the equilibrium is $C2$ or $C1$ depends on the level of repatriation, a low repatriation (high ϕ) implying a $C2$ equilibrium, and hence an excess of subsidization. For this reason it is interesting to identify the value of ϕ that is sufficient to make the region switch to a $C2$ equilibrium. As Conditions 3 and 2 are never satisfied, we simply have to find the value of ϕ that makes Condition 1 be satisfied[19]. Simple inspection of Condition 1 at $t = 0$ shows that this condition is satisfied whenever $\phi < \frac{3(A^2+6A\alpha_B-3\alpha_B^2)}{8A^2}$. Therefore a $C2$ equilibrium is likely to prevail when a sufficiently important part of MNC profits are appropriated by the host country.

How restrictive this condition might be clearly depends on the level of regional asymmetry. For instance, for a region made up of similar countries, Condition 1 is satisfied for $\phi > \frac{3}{8}$ which shows that a $C2$ is compatible with a high level of repatriation. As regional asymmetry increases, the existence of a $C2$ equilibrium relies on low levels of repatriation. Note that in the case of a regional MNC subsidy competition does not avoid relocation when the countries integrate. The main effect in this case is to generate excessive subsidization.

4.2 Subsidy Competition and Welfare

We have identified situations where subsidy competition makes governments exceed their preferred expenditure level. However, this does not imply that countries should necessarily avoid offering subsidies. To make this point, we compare subsidy competition and weak coordination (harmonization at a *zero* subsidy level) from a regional welfare point of view. Our review of the literature suggests we should expect subsidy competition to be welfare-improving with respect to no intervention. In our framework this is typically the case of a regionally-owned MNC. However, when the MNC is extra-regional we obtain an opposite result.

Proposition 3 *Unconstrained subsidy competition increases regional welfare compared to a zero subsidy commitment (harmonization) when the MNC belongs to the region. To the contrary, harmonization is welfare-improving over subsidy competition when the MNC belongs to an out-of-block country.*

Proof.

We defer the proof to Appendix $A3$. ■

The intuition is as follows. In the case of an extra-regional MNC, whether the decentralized outcome (equilibrium $U2$) welfare-dominates the harmonized outcome ($C1$) depends

[19]Remember from our previous discussion (see Figure 4) that should this happen, the prevailing equilibrium would be $C1$

on local production cost differences. A moderately high difference suffices for harmonization to improve on decentralized competition, since the latter prevents efficient relocation. When the difference is low, the result holds only for intermediate levels of profit repatriation. In the case of a 'regional' MNC, the location decision is not affected by competition. Subsidy expenditure from the host government rises too much, but harmonization may not lead to a global improvement. Indeed, the high-cost location's consumers benefit from highly subsidized imports from the other location. Hence no decisive intervention from their government.

This result is interesting for policy matters, as it shows that it is in the interest of the region to find coordination rules (even in a weak form) among partner countries in order to fully enjoy the benefits from trade integration.

4.3 The effects of integration

Let us move on now on to the second and third of our key questions.

4.3.1 Is integration under subsidy competition welfare reducing?

We have shown that subsidy competition may actually lead to welfare losses. This raises the question of whether there are any gains from trade to be expected from regional integration.

Proposition 4 *Decentralized regional integration increases regional welfare with respect to autarky when the MNC belongs to the region. To the contrary, it leads to welfare losses when the MNC belongs to a country outside the region.*

Proof. See Appendix *A*4. ■

Our framework allows us to focus on gains from trade due to efficient relocation. We predict that subsidy competition prevents such relocation in the case of an extra-regional MNC. Hence no gains from trade are to be expected. Conversely, subsidy competition does allow for relocation, and hence for gains from trade, in the case of a regional MNC. This rather straightforward result paves the way for a broader welfare assessment, which is the subject of the next section.

Before we turn to this, a comment is in order. Our welfare comparison involved perfect integration with subsidies and autarky with subsidies. We find this 'sophisticated' autarkic benchmark to be more relevant for governments considering regional integration while being aware of potential losses from subsidy competition. Integration in the 'extra-regional MNC' case creates a possibility of relocation off the equilibrium path, leading to higher subsidy levels, and welfare losses.

4.3.2 Does the gain from cooperation increase with regional integration?

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 subregional 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. As a first step, consider a move from autarky to freer trade.

Proposition 5 *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.*

Proof. See Appendix $A5$. ■

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, we know that a reduction of trade barriers starting from autarky raises the extent of welfare gains from coordination.

Turning now to the case of low trade barriers, we would like to understand how and when welfare gains from coordination increase with further trade integration. This comparative statics exercise involves the derivative of the regional welfare differential between coordination and subsidy competition with respect to t, the internal tariff.

Proposition 6 *Welfare gains from coordination, evaluated at perfect integration :*

1. *are maximal for an extra-regional MNC*
2. *may be at a maximum for a strictly positive tariff level, when the MNC belongs to the region.*

Proof. See Appendix $A6$ ■

For each part of the Proposition, we first discuss the intuition behind the result, and then the implications for economic policy.

This proposition first shows, in the case of an extra-regional MNC, that 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 government intervention under subsidy competition induces the MNC to choose ubiquity, so that regional welfare does not depend on trade openness. In that sense subsidy competition eliminates some 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.

Second, in the case of a regional MNC, the effect of trade integration on the gains to coordination is non-monotonic. In particular, a move towards full integration reduces these gains. To gain some intuition about this result, recall that both cooperative ($C1$) and non-cooperative ($C1$ or $C2$) equilibrium subsidies make the concentration regime more advantageous for the MNC at full integration. In other words, subsidy competition does not prevent the MNC from exploiting the new location possibility made available by regional integration. Compared to the 'extra-regional MNC case', this result is now

due to the fundamental asymmetry between the origin country of the MNC and the other country, the former having an additional motive for subsidization.

In particular, when integration is less than perfect, we may distinguish between $C1$ 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 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.

5 Conclusion

We have investigated the effects of subsidy competition in situations where regional integration modifies the location motives of a MNC.

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. We show how sufficiently high integration levels entail equilibria characterized by an excess of subsidization with respect to the autarkic case.

MNC location under free trade within the region depends on ownership. In equilibrium, an extra-regional MNC will serve the region from existing subsidiaries in each country. A regionally-owned MNC will relocate its operations and serve the region from an export platform, except in the limit case where production costs are identical in both countries.

An excess of subsidization does not necessarily mean that countries are not to gain from regional integration. Only in the case of an extra-regional MNC does intense subsidy competition prevent the region from specialization. In that case, reducing trade barriers intensifies subsidy competition, leading to excessively high subsidies, but this does not lead the MNC to concentrate its operations. In contrast, when the MNC is regional and for a relatively low level of technological asymmetry, excessive subsidization also occurs and involves relocation, which is efficient for the region.

We find mixed results for the welfare gains from subsidy harmonization in an integrated region, depending on MNC ownership and regional characteristics. We show that for the case of an extra-regional MNC, harmonization generally dominates subsidy competition in terms of regional welfare. This result is conditional on the level of regional asymmetry and profit repatriation. Harmonization is likelier to make the region better off when regional asymmetry is high ($\alpha_B > \frac{1}{4}A$). 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.

While we do not discuss the political feasibility of coordination, we still show that building the appropriate regional institutions may be crucial for the region to enjoy gains from regional integration. Moreover, we show how a reduction of trade barriers, starting from autarky, raises the extent of welfare gains from coordination. This is so since integra-

tion causes a divergence between national governments' and a supranational authority's welfare objectives, or even a change in location choices that results in regionally suboptimal outcomes. 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 regional coordination as integration proceeds is interesting from the point of view of integrating processes among developing countries, highly characterized by the presence of extraregional MNCs. Our result suggests that in a gradual integration process, the cost of building institutions may later be recouped by gains from further integration.

Our theoretical framework is sufficiently general to adapt to be applied to the specificities of various regions and economic unions, such as Mercosur (which resembles our extra-regional MNC case in a heterogenous region with incipient efforts of harmonization), the former 15-country European Union (a relatively homogenous region, with both regional and extraregional MNCs, and some coordination between partner countries), the 25-country EU (relatively more asymmetric), and the NAFTA (an asymmetric region with no explicit regional coordination).

Our findings are sensitive to firm ownership, regional technological heterogeneity, absorption capability of governments, and, furthermore, to the kind of agreement between countries. No analysis of the role played by country size has been carried out. Nor have we analyzed the case in which repatriation levels are endogenously determined by governments or extended our framework to the case of multiple firms (as we do in Albornoz and Corcos, 2004). We leave these complementary tasks to future research.

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Appendix $A1$: Proof of Proposition 1

The above mentioned seven conditions fully characterize best-reply functions and their intersections in $\{s_A,\ s_B\}$ space. The tree diagram follows from careful inspection of all possible intersections. In this proof, we will go through some steps to characterize necessary conditions for the existence of qualitatively different types of equilibria.

U1 equilibrium $(s_A^{opt}U, s_B^{opt}U, U)$

- **MNC**

By backward induction, it must be optimal for the MNC to choose U in the second stage, i.e. given these subsidies, Ubiquity profits must be higher than concentration profits. Hence Condition 4 :

$$\Pi(s_A^{opt}U, s_B^{opt}U, U) > \Pi(s_A^{opt}U, s_B^{opt}U, C) \qquad \text{(Condition 4)}$$

Under this condition, choosing ubiquity indeed maximizes the MNC's second-stage payoff. But when does our candidate equilibrium belong to governments' best replies ?

- **Government A**

Let us start with government A, facing $s_B^{opt}U$. By construction, no subsidy conducive to ubiquity could dominate this candidate equilibrium subsidy. Recall now that s'_A is the exact subsidy from A that makes government B indifferent between concentration and $U1$ ubiquity. In order to induce concentration, Government A could thus offer a subsidy equal to $\max\{s'_A, s_A^{opt}C\}$, knowing that it will be unmatched by the rival government. We should now check whether this strategy pays off more for A than the candidate equilibrium strategy. If not, then against $s_B^{opt}U$ no other subsidy may dominate the candidate equilibrium subsidy. To achieve this, we first need to examine Condition 1:

$$s_A^{opt}C \geq s'_A \qquad \text{(Condition 1)}$$

If Condition 1 is met, then for $U1$ to be an equilibrium it is necessary that the following condition, Condition 2, hold :

$$W_A(s_A^{opt}U, s_B^{opt}U, U) \geq W_A(s_A^{opt}C, C) \qquad \text{(Condition 2)}$$

If, to the contrary, Condition 1 is not met, then for $U1$ to be an equilibrium it is still necessary that Condition 2 be met, and also that the following condition, Condition 3, hold

$$W_A(s_A^{opt}U, s_B^{opt}U, U) \geq W_A(s'_A, C) \qquad \text{(Condition 3)}$$

Conditions 2 and 3 ensure that against $s_B^{opt}U$, no subsidy conducive to concentration (even outside the equilibrium set) may be preferred by government A. Hence under these conditions the candidate equilibrium subsidy is government A's best-reply to $s_B^{opt}U$.

- **Government B**

To complete the proof of existence of equilibrium $U1$, we need to examine government B's best-reply to $s_A^{opt}U$. Again, by construction, $s_B^{opt}U$ dominates any other subsidy conducive to ubiquity. It must therefore be checked that setting an s_B conducive to concentration, against $s_A^{opt}U$, does not yield a higher payoff.

This simply amounts to Condition 5 (recall that it is implied by Condition 4):

$$s_A^{opt}U \leq s'_A \qquad \text{(Condition 5)}$$

Hence, if either Conditions 4, 2 and 1 are met, or Conditions 4, 2 and 3 are met and 1 is not met, then a $U1$ equilibrium also exists.

$C1$ equilibrium $(s_A^{opt}C, \emptyset, C)$

- **MNC**

The MNC will choose concentration with subsidy $s_A^{opt}C$ if country B's subsidy is below the profit indifference level. This obviously depends on government B deciding to post a subsidy consistent with this location choice.

- **Government B**

Since the sub-game between governments is simultaneous, a $C1$ equilibrium only obtains whenever government B is better off with concentration at government A's equilibrium subsidy level, i.e. $s_A^{opt}C$ is sufficient for government B to prefer concentration. Hence the necessity of Condition 1:

$$s_A^{opt}C \geq s'_A \qquad \text{(Condition 1)}$$

- **Government A**

For $C1$ to be an equilibrium it is sufficient that Condition 2 does not hold, since then the candidate equilibrium subsidy payoff-dominates all other subsidies conducive to either concentration (by construction) or ubiquity (by the Condition). However, this condition is not necessary. Whenever Condition 2 holds, it is sufficient that Condition 5 fails to hold for a $C1$ equilibrium to occur. Indeed, the invalidity of Condition 5 implies that against $s_A^{opt}U$ government B will always choose s_B so as to induce concentration. Given that concentration with $s_A^{opt}C$ is feasible, it must be government A's best reply.

$C2$ equilibrium[20] $(s'_A, \emptyset, C)$

A $C2$ equilibrium obtains when a subsidy higher than $s_A^{opt}C$ is necessary to make government B accept concentration. Obviously, A would prefer it to be the smallest amount required by B not to 'compete', hence we may talk about a limit-subsidy equilibrium. Given our assumption that ubiquity should be the status quo location in case of equal profits, it is sufficient for government A to offer an infinitesimal quantity over the limit subsidy to secure location of the MNC. [21]

For the MNC, as in the previous subsection, s_B must be sufficiently low for the MNC to choose concentration. Rather straightforwardly, for government B, Condition 1 must be invalid for a $C2$ equilibrium to exist else the $C1$ subsidy would be available for and preferred by A. Examining government A's best-reply strategy, we find that the invalidity of Condition 3 rules out any subsidy leading to ubiquity, as the candidate subsidy must payoff-dominate it. Alternatively, when Condition 3 is met, the invalidity of Condition 6 guarantees that the limit-subsidy strategy be payoff-dominant. Hence, a $C2$ (limit-subsidy) equilibrium exists whenever Conditions 1 and 3 are not met, or whenever Conditions 1 and 6 are not met but Condition 3 is met, excluding the above-mentioned $U1$ equilibrium.

$U2$ equilibrium $(s_A^{opt}U, \widetilde{s_B}(s_A^{opt}U), U)$

Loosely speaking, a $U2$ equilibrium obtains when government A reaches a high level of welfare with ubiquity and government B is able to 'compete' for high enough amounts of subsidies. This results in government B offering the exact amount of subsidy that leads to the status quo (ubiquity, by assumption).

Formally, a $U2$ equilibrium occurs whenever it is in both governments' interest to offer subsidy levels that exactly induce the MNC to keep the status quo, i.e. on the profit indifference line. First consider the case where Condition 1 is met. Condition 5 being true implies a ranking of the three reference subsidy levels. If Condition 4 is false, then the $U1$ equilibrium is not feasible, but if Condition 2 holds, then by continuity government A's best-reply curve should intersect with

[20] To save space, we will refer to Conditions $1-6$ as presented in Table 3.

[21] In the next section, we will consider that this infinitesimal amount tends to zero in our calculations.

government B's on the profit indifference line. This result derives from the shape of government B's best-reply function, as explained in the main text. Now consider the case when Condition 1 is not met. As explained before, Condition 3 rules out one instance of the $C2$ equilibrium. Suppose first that Condition 4 does not hold, implying that neither $U1$ nor $C1$ is feasible. Then by a continuity argument again, government A's best-reply must have a 'knife-edge' shape, lying on the profit indifference curve or away by an infinitesimal amount (inducing concentration). Condition 6 then ensures that a $U2$ equilibrium is reached.

Lastly, suppose that Condition 4 holds, namely that a $U1$ equilibrium would be feasible for the firm but does not exist. Notice that Condition 4 implies Condition 5 (the reciprocal is not true). If Condition 2 fails to hold, government A will not be satisfied with $U1$, hence playing again along the profit indifference line, therefore Condition 6 will again determine which equilibrium will occur.

To summarize, a $U2$ equilibrium occurs when Conditions 1, 2 and 5, but not 4, are met ; or, when Conditions 1 and 2 are not met, but 4, 3 and 6 are met ; or when Conditions 1, 4 and 5 are not met, but 3 and 6 are met ; or else when Conditions 1 and 4 are not met, but 3 and 5 are met. All these cases exhibit rivalry between the two governments, as government B is not willing to settle for concentration, and government A has to offer more than it would without competition.

Appendix $A2$: MNC location under perfect integration

In this appendix, we establish the MNC location choice for the 3 types of regional integration.

From table 1, we know the MNC regional profits. The location decision of the MNC amounts to choosing R such that $\Pi = Max(\Pi_U, \Pi_C)$

Harmonization

Let's begin by considering the case of harmonization ($s_A = s_B = 0$). What we need to show is that regional integration involves a new location by the MNC, depending on regional characteristics. In particular, we find that, in a technologically homogenous region, the MNC will keep operating two subsidiaries (location U) but, when then region exhibits technological asymmetries, the MNC will choose to relocate production so as to run a single subsidiary (location C). To see this, define, for simplicity, $a = A - \alpha_A$ and $b = A - \alpha_B$. So $\Pi_{U,R} = \frac{1}{4}[a^2 + (1-\phi)b^2]$, $\Pi_{C,R} = \frac{1}{4}[a^2 + (a-t)^2$, $\Pi_{U,ER} = \frac{1-\phi}{4}[a^2+b^2]$, and $\Pi_{C,ER} = \frac{1-\phi}{4}[a^2, (a+t)^2]$. Let us call χ the profit differential $(\Pi_U - \Pi_C)$. Then $\chi_R = (1-\phi)b^2 - (a-t)^2$ for the case of a regional MNC and $\chi_{ER} = b^2 - a^2$ for the case of an extra-regional MNC. Observe that χ increases with t so that, for sufficiently high values of t, χ is positive (U is preferred by the MNC). When t decreases, the chances for a MNC to choose concentration increase. Consider now the extreme case of full integration. In such a case, $\chi_R = (1-\phi)b^2 - a^2$ and $\chi_{ER} = b^2 - a^2$ which equals 0 when technologies in each country are the same ($\alpha_A = \alpha_B$). Thus, the MNC is indifferent between both location and, by convention, ubiquity remains the prevailing equilibrium. In the case of an asymmetric region, $a > b$ and therefore χ is negative which implies that the preferred location will be concentration.

Regional subsidies

Let's proceed now with the limit case of governments coordinating on subsidy levels that maximize regional welfare, replicating the decision of a fictitious regional social planner. Consistent with our framework, the timing of the game is now the following:

- first, the fictitious regional planner sets s_A and s_B
- second, the MNC chooses a location

Notice that the social planner may always set $s_B^{reg}(C)$ so as to induce the MNC to choose concentration with the desired $s_A^{reg}(C)$. Hence any candidate equilibrium subsidy pair should be compared to the one leading to a welfare maximum under concentration. For a start, let us determine 'regionally optimal subsidies', i.e. subsidies that maximize the *sum* of both national

welfare functions conditional on the MNC choosing a given location. For the case of a regional MNC we obtain,

$$\begin{aligned} s_A^{reg}(U,R) &= A-\alpha_A \\ s_B^{reg}(U,R) &= A-\alpha_B \\ s_A^{reg}(C,R) &= A-\alpha_A+\frac{t}{2} \end{aligned}$$

whereas for an extra-regional MNC,

$$\begin{aligned} s_A^{reg}(U,ER) &= \frac{2\phi-1}{3-2\phi}(A-\alpha_A) \\ s_B^{reg}(U,ER) &= \frac{2\phi-1}{3-2\phi}(A-\alpha_B) \\ s_A^{reg}(U,ER) &= \frac{2\phi-1}{3-2\phi}(A-\alpha_A)+\frac{t}{2} \end{aligned}$$

with obvious notations[22]. It is easy to check that such subsidies bring prices down to marginal cost, totally removing the market power inefficiency. For $\{s_A^{reg}(C),0,C\}$ to be the equilibrium triplet, it must hold that it welfare-dominates $\{s_A^{reg}(U),s_B^{reg}(U),U\}$, let alone any other subsidy pair under ubiquity. This is true in the extra-regional MNC case whenever

$$\widetilde{t}_{ER}<\frac{2\sqrt{2}\sqrt{(\alpha_A^2-\alpha_B^2)+A(\alpha_B-\alpha_A)}}{3-2\phi}$$

and for a regional MNC

$$\widetilde{t}_R<2\sqrt{2}\sqrt{(\alpha_A^2-\alpha_B^2)+A(\alpha_B-\alpha_A)}$$

It is easy to see that for a homogenous region $\widetilde{t}$ equals 0 indicating that concentration is not possible even under full integration. For a region made of different countries, for any $t\leq\widetilde{t}$ concentration will be the prevailing equilibrium. To check that Ubiquity is indeed an equilibrium we need to verify that the MNC will choose Ubiquity when receiving $s_A^{reg}(U),s_B^{reg}(U)$. Put another way, we need to show that $\Pi_U(s_A^{reg}(U),s_B^{reg}(U))-\Pi_C(s_A^{reg}(U),t)$ for $t>\widetilde{t}$ which is clear after simple inspection. Summarizing, in the absence of trade within the region, the prevailing equilibrium is $U1$. Under perfect integration, $U1$ prevails when the region is homogenous, $C1$ otherwise.

Subsidy competition

For establishing location in the case of subsidy competition in an integrated region, we need to evaluate Conditions $1-6$ for $t=0$ for every type of region. Normalizing for commodity matter $\phi=0$ when repatriation is high, $\phi=1$ when repatriation is low, and using Tables 2 and 1, and Figure 4, straightforward calculations show that:

- For a symmetric region ($\alpha_A=\alpha_B$) in the case of a regional MNC, Conditions 4, 2, 3 and 1 are never satisfied, Condition 6 always hold. Condition 1 is satisfied for high values of ϕ and therefore $C1$ is the prevailing equilibrium. For low values of ϕ Condition 1 is not satisfied and therefore the equilibrium is $C2$.
- For an asymmetric region ($\alpha_A=0$, $\alpha_B>0$) in the case of a regional MNC, only Conditions 1 and 6 are satisfied repatriation is high and therefore the equilibrium is $C1$. When repatriation is low, satisfying Condition 1 depends on regional asymmetry. If $\alpha_B<\frac{A}{3}$ Condition 1 is not satisfied and therefore the equilibrium is $C2$. The prevailing equilibrium is $C1$ otherwise.

[22]Note that regional subsidies for a regional MNC do not depend on ϕ, the part of profits that is appropriated by country B.

- For a symmetric region ($\alpha_A = \alpha_B$) in the case of an extra-regional MNC, Conditions 1 and 2 are not satisfied whereas Conditions 3, 4, and 5 are satisfied. Therefore the equilibrium is U1.
- For an asymmetric region ($\alpha_A = 0$, $\alpha_B > 0$) in the case of an extra-regional MNC, Condition 1 is satisfied for $\alpha_B > \frac{A}{3}$ when repatriation is low and for $\alpha_B > \frac{A}{2}$ when repatriation is high. As Condition 2 is never satisfied independently of the repatriation, the prevailing equilibrium in those cases is $C1$. Otherwise, Condition 1 does not hold. For all values of ϕ, Condition 3 holds and Condition 4 is never satisfied. When repatriation is high, Condition 5 holds. When repatriation is low, Condition 5 is not satisfied while Condition 6 is satisfied. Both situations correspond to U2 as the prevailing equilibrium.

Appendix $A3$: Harmonization as a welfare-improving policy option

From our study of an extra-regional MNC we know that when technologically different countries compete for location, the prevailing equilibrium under full integration is $U2$. In this case, country A offers $s_A^{opt}(U)$ and country B offers $\widetilde{s_B}(s_A^{opt}(U))$. Conversely, the equilibrium associated with harmonization is $C1$. Define $\Delta = W^{reg}(C, 0, t) - W^{reg}(U, s_A^{opt}(U), \widetilde{s_B}(s_A^{opt}(U)))$ as the difference in regional welfare with harmonization and subsidy competition. Using Table 4 and recalling that $\alpha_A = 0$ and $\alpha_B \geq 0$, we obtain

$$\Delta = \frac{A(4\alpha_B - A(1-2\phi)^2)}{12 - 8\phi}$$

Observe that Δ is positive for $\alpha_B > \frac{1}{4}A(1-2\phi)^2$. This means that for sufficiently high levels of regional asymmetry, harmonization dominates subsidy competition. How high ϕ must be, depends on the level of repatriation. For intermediate levels of ϕ (i.e. $\phi = \frac{1}{2}$) this result holds even for tiny differences between the countries. For extreme values of ϕ, harmonization dominates subsidy competition for intermediate levels of regional asymmetry.

As for the regional MNC, we know by construction that subsidy competition dominates harmonization when both regimes lead to the same type of equilibrium. Therefore to see whether harmonization dominates subsidy competition in the case of a regionally owned MNC, we need to look at the following situations and at their corresponding welfare comparison between subsidy competition and harmonization:

1. Low repatriation and similar countries, $W^{reg}(U, 0, 0)$ with $W^{reg}(C, s'_A, 0)$
2. Low repatriation and different countries, $W^{reg}(C, 0, t)$ with $W^{reg}(C, s'_A, 0)$
3. High repatriation and similar countries, $W^{reg}(U, 0, 0)$ with $W^{reg}(C, s_A^{opt}(C), 0)$;

Let $\Delta_1 = (\frac{7}{4} - 2)A^2$, $\Delta_2 = \frac{7A^2 + 4\alpha_B^2 - 8A(\sqrt{(A-\alpha_B)^2} + \alpha_B)}{4}$ and $\Delta_3 = \frac{27\alpha_B^2 - 10A^2 - 54A\alpha_B}{72}$ be the expressions of such comparisons and observe that they are negative for the pertinent parameters values.

Appendix $A4$: Net gains from trade

We know so far that the reduction of regional tariffs may lead to an excess of subsidization.

In the case of an extra-regional MNC subsidy competition prevents the region from enjoying gains from trade. The effect of integration consists is to switch from a $U1$ to a $U2$ equilibrium. Simple investigation of regional welfare under both equilibria shows that reducing trade barriers within the region reduces welfare ($W^{reg}(U, s_A^{opt}(U), s_B^{opt}(U)) - W^{reg}(U, s_A^{opt}(U), \widetilde{s_B}(s_A^{opt}(U))) = \frac{\alpha_B^2}{6-4\phi}$, which is always positive).

Once again, the effect of ownership reverses the results. When the MNC is regionally-owned, regional integration implies relocation towards the more advanced country. Conditional on ϕ the

equilibrium will be either $C1$ or $C2$. To confirm that regional integration is welfare enhancing, we need to show that:

$$W^{reg}(C, s_A^{opt}(C), 0) \geq W^{reg}(U, s_A^{opt}(U), s_B^{opt}(U)) \textbf{ for high repatriation} \quad (4)$$

$$W^{reg}(C, s'_A, 0) \geq W^{reg}(U, s_A^{opt}(U), s_B^{opt}(U)) \textbf{ for low repatriation} \quad (5)$$

We are now left with proving that these conditions are always satisfied. To that purpose, we have to compare $W^{reg}(U, s_A^{opt}, s_B^{opt})$ with the regional welfare at the prevailing equilibrium under perfect integration. As this depends on the level of repatriation and on regional asymmetry, the correspondent comparisons are:

- $\Delta_4 = W^{reg}(U, s_A^{opt}(U), s_B^{opt}(U))$-$W^{reg}(C, s'_A, 0)$ for low repatriation and $\alpha_B \leq \frac{A}{3}$
- $\Delta_5 = W^{reg}(U, s_A^{opt}(U), s_B^{opt}(U))$-$W^{reg}(C, s_A^{opt}(C), 0)$ otherwise

Note that s'_A is evaluated at a zero tariff. Simple calculation yields:

- $\Delta_4 = \frac{1}{2}(4A^2 - 4A\sqrt{(A-\alpha_B)^2} - 6A\alpha_B + 3\alpha_B^2)$
- $\Delta_{5a} = \frac{5\alpha_B^2 - 10\alpha_B A - 2A^2}{18}$ for a high repatriation rate and
- $\Delta_{5b} = \frac{A^2}{9} - A\alpha_B + \frac{\alpha_B^2}{2}$ for the special case of low repatriation and $\alpha_B > \frac{A}{3}$

which are always negative.

Appendix $A5$: Gains from trade and coordination

We prove here Proposition 5

First, a brief inspection of nationally and regionally optimal subsidies (Appendix $A2$) shows that they coincide only at a U1 equilibrium. Second, as explained in Appendix $A2$, U1 subsidies must induce the MNC to choose ubiquity for U1 to be a subgame-perfect equilibrium, implying that an analog of Condition 4 with regional subsidies is met. This analog condition is given by

$$\Pi(s_A^{reg}U, s_B^{reg}U, U) \geq \Pi(s_A^{reg}U, s_B^{reg}U, C)$$

Define t_1 as the threshold tariff such that the inequality in Condition 4 just holds, and similarly t_2 for the analog condition. Then $t \geq \min\{t_1, t_2\}$ is a sufficient condition to obtain different equilibria under subsidy competition and coordination. Note that it is straightforward to compute these threshold tariffs using Table 3 and show that they exceed prohibitively high tariffs.

Since regional coordination achieves a regional welfare maximum by assumption, a gain from coordination always occurs for a low enough tariff.

Appendix $A6$: Gains from coordination and trade integration

We prove here Proposition 6.

1. Recall from Table 4 that at a full-integration subgame-perfect equilibrium, the extra-regional MNC chooses ubiquity: either with U1 subsidies when countries are technologically symmetric, or with U2 subsidies in the case of a technological asymmetry. On the contrary, a social planner would prefer concentration with C1 subsidies (weakly in the symmetric case). The welfare differential between coordination and competition is given by:

$$W^{reg}(s_A^{reg}C, t, C) - W^{reg}(s_A^{opt}U, s_B^{opt}U, U) = \frac{(A-\alpha_A)^2}{3-2\phi} - \frac{3-2\phi}{16}t^2 - \frac{(A-\alpha_A)^2 + (A-\alpha_B)^2}{2(3-2\phi)}$$

in the cases of symmetry and by

$$W^{reg}(s_A^{reg}C,t,C)-W^{reg}(s_A^{opt}U,s_B^{opt}U,U)=\frac{(A-\alpha_A)^2}{3-2\phi}-\frac{3-2\phi}{16}t^2-\frac{(A-\alpha_A)^2+(A-\alpha_B)^2}{2(3-2\phi)}$$

in the case of asymmetry. Taking the derivatives of these welfare differentials with respect to t yields:

$$\frac{\partial\left[W^{reg}(s_A^{reg}C,t,C)-W^{reg}(s_A^{opt}U,s_B^{opt}U,U)\right]}{\partial t}=-\frac{3-2\phi}{8}t^2$$

in the symmetric case and

$$\frac{\partial\left[W^{reg}(s_A^{reg}C,t,C)-W^{reg}(s_A^{opt}U,s_B^{opt}U,U)\right]}{\partial t}=-\frac{3-2\phi}{8}t^2-\frac{\alpha_B-\alpha_A}{2}$$

in the asymmetric case. It is straightforward to see, that evaluated in the neighborhood of a zero tariff, these derivatives are negative, proving the first part of this Proposition.

2. Similarly, we may evaluate the derivative of the gain from coordination with respect to t in the neighborhood of zero. We know from 4 that either C1 or C2 may obtain as an equilibrium.

   In the former case, the gain from coordination is given by

$$\frac{\partial\left[W^{reg}(s_A^{reg}C,t,C)-W^{reg}(s_A^{opt}C,t,C)\right]}{\partial t}=\frac{A-\alpha_A}{6}+\frac{t}{4}$$

   which is positive at any relevant value of t, and in particular at $t=0$.

   In the latter case, the gain from coordination is given by a similar though substantially more cumbersome calculation. We display here the value of this derivative at the neighborhood of a zero tariff.

$$\frac{\partial\left[W^{reg}(s_A^{reg}C,t,C)-W^{reg}(s_A^{opt}C,t,C)\right]}{\partial t}=\frac{3\left((A-\alpha_A)\sqrt{3-2\phi}-(A-\alpha_B)\right)}{2\sqrt{3-2\phi}}$$

   which is also positive, and strictly so in the asymmetric case.

   Hence potential tariff increases from full integration may cause higher gains from coordination, suggesting that the maximum gain occurs at a positive tariff level.