IDPM - UA discussion paper

Regional Integration and its Spatial Effects within a Member Country

María Florencia Granato

2005-02

UNIVERSITY OF ANTWERP

INSTITUTE OF DEVELOPMENT POLICY AND MANAGEMENT

Comments on this Working Paper are invited.
Please contact the author at **maria.granato@ua.ac.be**

Instituut voor Ontwikkelingsbeleid en -Beheer
Institute of Development Policy and Management
Institut de Politique et de Gestion du Développement
Instituto de Política y Gestión del Desarrollo

Venusstraat 35, B-2000 Antwerpen
België - Belgium - Belgique - Bélgica

Tel: +32 (0)3 220 49 98
Fax: +32 (0)3 220 44 81
e-mail: dev@ua.ac.be

http://www.ua.ac.be/dev

Regional Integration and its Spatial Effects within a Member Country

María Florencia Granato*

Institute of Development Policy and Management
University of Antwerp

June 2005

* Universiteit Antwerpen (België), Universidad Nacional de Río Cuarto and Universidad Nacional de Villa María (Argentina). Mailing address: Facultad de Ciencia Económicas, Universidad Nacional de Río Cuarto, Ruta Nacional 36 km. 601, (5800) Río Cuarto, Argentina. Tel. +54-358-4676441. E-mail: maria.granato@ua.ac.be or fgranato@eco.unrc.edu.ar.

Abstract

This paper studies the impact of regional integration on the economic geography of an interior region, for instance a member country. It extends a simple new economic geography model in which differentiated goods can be exchanged both nationally and internationally but at different positive costs. Both types of costs affect agglomeration and dispersion forces; as a consequence, regional integration modifies the incentive for firms to spatially concentrate. The results obtained suggest that heterogeneity between domestic locations, in terms of access to the preferential partner and in terms of market size play a major role in shaping industrial location inside the member country. If two domestic locations are equidistant from the preferential partner, regional integration tends to foster spatial concentration in the biggest location. When one of the regions has an advantage in terms of access to the partner's market, preferential trade liberalisation generally favours it, unless competition from abroad is too high.

JEL Classifications: F12, F15, R12

Key Words: Economic Integration, Industrial Location, Regional Inequalities, Economic Geography

I would like to thank G.I.P. Ottaviano and F. Robert-Nicoud for very valuable comments and suggestions. Financial support from the European Union –ALFA Programme, through project AML/B7-311-97/0666/II-0058-FA (Eulalia)– is gratefully acknowledged. The usual disclaimer applies.

1. Introduction

Regional integration agreements (RIAs), as it is well-known, tend to affect the location of economic activities and the spatial distribution of factors of production, demand, and thus the level of welfare both within and outside the integrated bloc. Policy-makers, who might intend to ease those relocation effects, and those agents whose interests can be significantly affected by the agreement may be very much concerned about how the economic landscape of the bloc is going to change. Nevertheless, to determine this last issue seems to be a very puzzling task since there are neither unanimous nor general answers. Particularly, and as it was suggested by Henderson (1996, p.33), the final spatial outcome is 'situation-specific'; it may crucially depend on the 'pre-integration' or distribution of economic activities, agents and factors within the bloc.

To be more illustrative and clear, we can consider the case of MERCOSUR, the Common Market of the South which was established by Argentina, Brazil, Paraguay and Uruguay in 1991. In terms of spatial impacts within the bloc, it seems very likely that some regions inside the members, such as Argentinean eastern or north-eastern regions might have been particularly affected by industry relocation due to their proximity to other members' markets. On the other hand, it is also plausible that in some regions, which before the agreement were more industrialised or developed –namely, Argentinean central-eastern and north-western regions– new firms might have entered since the market was attractive enough to counterbalance fiercer intra-bloc competition[1].

Moreover, prospective enlargements of MERCOSUR or deeper trade agreements with the EU or NAFTA open new queries about those spatial effects. How could MERCOSUR's industry structure be modified? How might factor owners react to those changes? How may certain regions, for instance the Patagonia in Argentina, be affected in terms of industry location and welfare? These are the type of questions that policy-makers and involved agents may be willing to answer; and they are indeed the type of issues our paper aims to address.

More specifically, from the perspective of new economic geography (NEG) the paper proposes a theoretical discussion about the impacts of RI on industry location within the bloc and inside any member country or interior region. The objective is to present a simple but illustrative framework that can deal with different 'pre-integration' scenarios in order to address various benchmark cases; our final aim is to obtain a broader picture of the spatial effects of preferential trade liberalisation in terms of both location and welfare.

[1] Those 'predictions' are indeed in line with the results Terra and Vaillant (1997) obtain from their simulation exercise for MERCOSUR.

Within theoretical literature, the link between trade liberalisation and industrial location inside countries has already been studied by different authors from the NEG perspective[2]. More specifically, those papers aimed to study, within a *particular* geographical scenario, how industrial location across two domestic regions may be modified when the country *unilaterally* opens to trade. Therefore, it seems there is room for some appealing extensions to those models that can take account of *different* 'pre-integration' geographical scenarios and which allow evaluating the distinctive effects of *preferential* or *discriminatory* trade liberalisation.

The specific framework adopted is an extended version of the very tractable NEG model due to Martin and Rogers (1995), which is simple and thus permits us to more easily extend the model towards those issues we aim to address[3]. Specifically, we model a world economy with three countries or larger regions: two preferential partners, which may differ in terms of size, and the Rest of the World (RoW) or the 'trade-policy-discriminated' outside[4]. In addition, one member country is assumed to comprise two domestic locations that can differ in terms of both access to the preferential partner and size[5].

The remainder of the paper is organised as follows. The next section sets up the formal model, and section 3 illustrates how dispersion and agglomeration forces can support a long-run equilibrium. Section 4 shows, through numerical simulations, how RI can modify the geographical landscape of a member country. More specifically, this section provides a set of examples for specific asymmetries among regions, which are therefore just indicative of general conclusions about the relocation process that RI provokes. Our results suggest that preferential liberalisation tends to foster industrial concentration within the member country and generally favours its border location, unless competition from abroad is too high. In section 5, main welfare implications of RI are analysed. Finally, section 6 presents some concluding remarks and draws some lines for future research.

[2] The referred studies are: Krugman and Livas Elizondo (1996), Krugman (1996), Fujita et al. (1999, Ch.18), Monfort and Nicolini (2000), Alonso-Villar (2001), Paluzie (2001), Crozet and Koening-Soubeyran (2002), Behrens et al. (2003) and Moncarz (2004).

[3] More precisely, our framework is based on posterior versions of Martin and Rogers' (1995) model, which were put forth by Baldwin et al. (2003) and Ottaviano and Thisse (2004).

[4] The incorporation of a third country for studying preferential trade liberalisation is the approach already followed by Puga and Venables (1997) and Baldwin et al. (2003, Ch.14).

[5] In order to make the exposition clearer, we will talk about *countries* and *domestic locations*; however, the reader must bear in mind that a member country can be thought instead as any *region* within the bloc, and that domestic locations can be regarded as *locations within a region*.

2. The model

2.A. Assumptions

Four regions $r,s=\{A1,A2,B,C\}$. More specifically, there are three countries: the domestic country divided in two locations ($A1$ and $A2$), and two foreign countries B and C –the prospective bloc partner and the RoW, respectively– represented by a single location each.

Two productive sectors: the 'traditional' sector (or agriculture) Z, and the 'modern' sector (or manufacturing) X.

Two production factors: 'physical' capital H and labour L.

Regions:

Regions are symmetric in terms of tastes and technology. With respect to endowments, the model allows to analyse different cases as explained later on.

Regions r and s are distinguished from each other in terms of exchange costs, t_{rs}. While 'domestic' exchange of manufactured goods –i.e. between $A1$ and $A2$– has a cost related with transport infrastructure and distance, $d_{rs} \in [\varepsilon,\infty[$; 'external' exchange is costly due to both transport and trade costs – the latter being for instance tariff and non-tariff barriers, $\tau_{rs} \in [0,\infty[$ $\forall r,s \neq A1,A2$[6].

In addition, exchange costs from r to s are assumed to be identical to those from s to r; that is:

$$d_{rs} \equiv d_{sr} \qquad \forall r \neq s$$

All regions are assumed to be either: equidistant among them or 'partially' heterogeneous.

In the first case or 'No Border Effect' scenario, transport costs are assumed to be the same between any two regions, i.e.:

$$d_{rs} = d \qquad \forall r \neq s$$

On the other hand, the 'Border Effect' case implies that one domestic location; let's assume $A1$, has better access to B than the other, $A2$:

$$d_{A2B} = d_{A2A1} + d_{A1B} = 2d,$$

while all the other regions remain as before (equidistant). Thus, shipments from $A2$ arrive in B after passing through location $A1$.

[6] Unlike previous literature, the model does not make any additional distinction between countries and domestic locations in terms of factor mobility. More specifically, while those studies assume free labour ('embodied' factor) mobility within each country but complete labour immobility across countries, our model rules out any labour mobility and assumes free capital-services ('disembodied' factor) mobility. Consequently, this setting features neither circular causality nor endogenous catastrophic agglomeration.

Sectors:

The traditional sector is kept as simple as possible. It is assumed that it produces a homogeneous good under constant returns to scale (CRS) and perfect competition, and its output is inter-regionally exchanged without cost. The production of one unit of output requires one unit of *L*.

The modern sector produces a continuum of horizontally differentiated varieties under IRS and monopolistic competition, with free entry –the number (mass) of varieties is *N*, being n_r the sub-set produced in region *r*. The interregional exchange of its output is costly, as already explained, and regional markets are segmented.

The production of *x*(*i*) units of variety *i* requires a fixed amount *F* of capital and a variable amount *mx*(*i*) of labour. The total cost, then, of the firm producing variety *i* in region *r* is given by:

$$TC_r(i) = \pi_r F + w_r m x_r(i) \quad \forall r$$

where π_r is both the rental rate of capital in region *r* and firm's operating profit under free entry, and w_r is the nominal wage.

Market structure in the modern sector:

Monopolistic competition takes Dixit and Stiglitz's (1977) form. The representative consumer in each region has preferences given by a two-tier utility function: the upper tier determines consumer's division of expenditure between the homogeneous good and all differentiated industrial varieties; and the lower tier dictates his/her preferences over those varieties. More specifically, the utility function of the representative consumer living in region *r* is given by:

$$U_r = \frac{Q_r^{\mu} Z_r^{1-\mu}}{\mu^{\mu}(1-\mu)^{(1-\mu)}} \quad \forall r, \qquad (1)$$

where $Q_r = \left[\int_0^N q_r(i)^{\frac{\sigma-1}{\sigma}} di\right]^{\frac{\sigma}{\sigma-1}}$ is the consumption of good *X*, $q_r(i)$ the consumption of variety $i \in [0,N]$, and Z_r the consumption of the traditional good. $\mu \in]0,1[$ is the weight of good *X* in utility, and $\sigma \in]1,\infty]$ is the elasticity of substitution between any two varieties.

Transaction costs are modelled as iceberg costs à la Samuelson.

$$t_{rs} = 1 + d_{rs} + \tau_{rs} \quad \forall r \neq s$$

That is, for one unit of the differentiated good produced in region *r* to reach region *s*, $t_{rs} \in [1+\varepsilon,\infty[$ units must be shipped. Thus, t_{rs}-1 units of the good 'melt' in transit.

Production factors:

The world economy is endowed with H capitalists and L workers, each supplying one unit of their corresponding factor inelastically. Generally speaking, endowments are distributed among regions as follows:

$$H_{r\in O} = \theta H \quad , \quad H_{A1} = \rho(1-2\theta)H \quad \text{and} \quad H_{A2} = (1-\rho)(1-2\theta)H$$
$$L_{r\in O} = \theta L \quad , \quad L_{A1} = \rho(1-2\theta)L \quad \text{and} \quad L_{A2} = (1-\rho)(1-2\theta)L$$

where $O=\{B,C\}$ is the set of '*O*ustide' or foreign countries which are assumed to be equally endowed. $\theta\in]0,1/2[$ is the share of world capital (labour) that resides in each foreign country, and $\rho\in]0,1[$ is the share of domestic capitalists (workers) who live in *A1*.

As it can be observed, relative endowments are the same across regions; thus there is no place for comparative advantage à la Heckscher-Ohlin[7].

Labour is inter-regionally immobile and capital-services are perfectly mobile, but capitalists stay put; in other words, they reside and expend money in their region of origin though they can offer their services in any region.

Both, labour and capital are fully employed.

$$L_r = \int_{i\in n_r} m x_r(i)di + L_r^Z \quad \forall r \quad \text{(regional full employment of labour)}$$
$$H = NF \quad \text{(global full usage of capital-services)}$$

where L_r^Z is the number of workers employed in the traditional sector.

Inter-regional distribution of capital-services is endogenously determined. λ_r is the fraction of H employed in region r, where $\sum_r \lambda_r = 1$.

Since $\pi_r(\Gamma)$ is the rental rate of capital-services in region r when their spatial distribution is $\Gamma=\{\lambda_{A1},\lambda_{A2},\lambda_B,\lambda_C\}$, a spatial equilibrium arises at $\lambda_r\in]0,1[$ $\forall r$ –i.e. an interior equilibrium– when:

$$\Delta\pi(\Gamma) \equiv \pi_r(\Gamma) - \pi_s(\Gamma) = 0 \quad \forall s \neq r$$

because perfect capital mobility equalises the equilibrium rewards to capitalists. A spatial equilibrium could also arise at $\lambda_r = 0$ for some $r \neq s$ when $\Delta\pi(\Gamma)\leq 0$[8]. However, from now on we assume that parameters allow for $\lambda_{r\in O} > 0$ and $\min\{\lambda_{A1},\lambda_{A2}\} > 0$; thus their values ensure that some firms are in fact operating in every region.

7 A more general framework could easily allow for asymmetric-sized foreign countries, international and intra-national H-O comparative advantage, etc.

8 For values of t_{rs} or Γ that would imply a share λ_r for some r below zero or above unity, it is assumed that all industry is clustered in the remaining regions or, conversely, it is agglomerated in those specific regions.

2.B. Equilibrium

2.B.a. Traditional Sector

In each region, the traditional sector maximises its profits. Since the homogeneous good is traded at zero cost, its price is the same everywhere.

$$Max_{Z_r \geq 0} Z_r p^Z - Z_r w_r$$

The traditional good is chosen as a numeraire. Therefore, under CRS and perfect competition, the first order conditions imply that $p^{Z^*} = 1 = w_r$. Furthermore, as long as the homogeneous good is produced in every region: $w_r = w_s = 1 \quad \forall r, s$; that is, there is inter-regional wage equalisation[9].

2.B.b. Consumers

The representative consumer in each region maximises its two-tier utility function. First, she/he decides the amounts of both the homogeneous and differentiated goods that he/she will optimally consume.

$$Max_{Q_r, Z_r \geq 0} U_r = \frac{Q_r^{\mu} Z_r^{1-\mu}}{\mu^{\mu}(1-\mu)^{(1-\mu)}}$$

$$s.t. \quad Y_r = Z_r + P_r Q_r$$

where Y_r is income (expenditure) in region r[10].

The optimal quantities are: $Z_r^* = (1-\mu) Y_r$ and $P_r Q_r^* = \mu Y_r$, where P_r is the local CES price index in region r. Explicitly,

$$P_r = \left[\int_{i \in n_r} p_{rr}(i)^{1-\sigma} di + \sum_{s \neq r} \int_{i \in n_s} p_{sr(i)}{}^{1-\sigma} di \right]^{\frac{1}{1-\sigma}} \qquad (2)$$

being $p_{sr}(i)$ the price of variety i produced in region s and consumed in region r.

After that first stage, the representative consumer determines her/his demands for each variety of the industrial good by solving the following problem

---

9 The homogeneous good is produced in every region when any three regions together (or less) have not enough labour to satisfy world demand for this good. The exact condition is that total world spending on Z, $(1-\mu)Y$, is greater than the maximum value of Z's production attainable by any three regions together. After operating, the condition can be written as: $\mu < 1 + \left(\frac{\mu}{\sigma} - 1\right)\left(\max\{[2\theta + \rho(1-2\theta)], [2\theta + (1-\rho)(1-2\theta)], (1-\theta)\} L\right)$. This condition, which is assumed to hold from now on, applies when the differentiated good has a small weight in utility and product variety is so highly valued by consumers –i.e. σ is small– that a large amount of labour is employed in the modern sector.

10 By assuming the equivalence between income and expenditure, the model rules out investment and in turn growth; thus it precludes *real* dynamics.

$$Max_{q_{sr}(i),q_{rr}(i)\geq 0} Q_r = \left[\int_{i\in n_r} q_{rr}(i)^{\frac{\sigma-1}{\sigma}} di + \sum_{s\neq r} \int_{i\in n_s} q_{sr}(i)^{\frac{\sigma-1}{\sigma}} di \right]^{\frac{\sigma}{\sigma-1}}$$

$$s.t. \quad \int_{i\in n_r} p_{rr}(i) q_{rr}(i) di + \sum_{s\neq r} \int_{i\in n_s} p_{sr}(i) q_{sr}(i) di = \mu Y_r$$

where $q_{sr}(i)$ is the consumption of variety i, produced in region s, by a consumer who resides in region r.

The optimal direct demands are:

$$q^*_{sr}(i) = \frac{p_{sr}(i)^{-\sigma}}{P_r^{1-\sigma}} \mu Y_r \qquad (3)$$

And finally, the indirect utility function in region r can be written as[11]:

$$V_r = \frac{Y_r}{P_r^{\mu}} \qquad (4)$$

2.B.c. Modern Sector

A typical firm located in region r and producing variety i maximises its profits, which are given by:

$$\Pi_r(i) = p_{rr}(i) q_{rr}(i) + \sum_{s\neq r} p_{rs}(i) q_{rs}(i) - m\left[q_{rr}(i) + \sum_{s\neq r} t_{rs} q_{rs}(i)\right] - \pi_r F$$

The resulting optimal prices for that firm producing in region r are:

$$p^*_{rr}(i) = m\frac{\sigma}{\sigma-1} \qquad \text{for sales in region } r\text{, and}$$

$$p^*_{rs}(i) = m t_{rs}\frac{\sigma}{\sigma-1} \qquad \text{for sales in region } s.$$

Introducing these optimal prices in the formula for the CES price index (2), the latter simplifies to the following expression:

$$P_r = \frac{m\sigma}{\sigma-1}\left(n_r + \sum_{s\neq r} t_{sr}^{1-\sigma} n_s\right)^{\frac{1}{1-\sigma}} \qquad (5)$$

We define ϕ_{sr}:

$$\phi_{sr} \equiv t_{sr}^{1-\sigma} \quad \in]0,1[$$

as a measure of the freeness of exchange, which approximates the value of one as τ_{sr} approximates to zero. Then, expression (5) can be re-written as follows:

---

11 To find this short expression, we first plug the optimal direct demands for the homogeneous and modern goods (3) into the utility function (1), getting:

$$V_r = \left\{ \int_{i\in n_r} \left[\frac{p_{rr}(i)^{-\sigma}}{P_r^{1-\sigma}} \mu Y_r\right]^{\frac{\sigma-1}{\sigma}} di + \sum_{s\neq r} \int_{i\in n_s} \left[\frac{p_{sr}(i)^{-\sigma}}{P_r^{1-\sigma}} \mu Y_r\right]^{\frac{\sigma-1}{\sigma}} di \right\}^{\mu\left(\frac{\sigma}{\sigma-1}\right)} \left[(1-\mu) Y_r\right]^{1-\mu}.$$

$$P_r = \frac{m\sigma}{\sigma - 1}\left(n_r + \sum_{s\neq r}\phi_{sr} n_s\right)^{\frac{1}{1-\sigma}}$$

2.B.d. Market Clearing in the Modern Sector

The market clearing conditions say that total production by a typical firm in region *r* must equal, in equilibrium, world consumption of the variety produced by that firm, plus the real exchange costs paid to ship goods from *r* to other regions:

$$x_r(i) = q_{rr}(i) + \sum_{s\neq r}\phi_{rs}^{\frac{1}{1-\sigma}} q_{rs}(i)$$

Replacing optimal direct demands into the last expression, we find that market clearing conditions imply:

$$x_r^*(i) = \frac{\sigma - 1}{m\sigma}\left[\frac{\mu Y_r}{n_r + \sum_{s\neq r}\phi_{sr} n_s} + \sum_{s\neq r}\frac{\phi_{rs}\mu Y_r}{n_s + \sum_{r\neq s}\phi_{rs} n_r}\right] \quad (6)$$

2.B.e. Free Entry in the Modern Sector

Due to the 'free entry' assumption, a firm's scale of production is such that pure profits, $\Pi_r(i)$, are zero. In other words, the fixed cost paid in terms of capital is determined by a bidding process for *H*, which ends when no firm can earn a positive profit at the equilibrium market prices[12]. By the market clearing condition, the free-entry assumption, and given that $p_{rs}^*(i) = \phi_{rs}^{\frac{1}{1-\sigma}} p_{rr}^*(i)$, the equilibrium operating profits for every firm are:

$$\pi_r^* = \frac{m x_r(i)}{F(\sigma - 1)}$$

Replacing $x_r(i)$ by its equilibrium value (6), we find that the final expression for the equilibrium reward to capital in region *r* is:

$$\pi_r^* = \frac{\mu}{\sigma F}\left[\frac{Y_r}{n_r + \sum_{s\neq r}\phi_{sr} n_s} + \sum_{s\neq r}\frac{\phi_{rs} Y_r}{n_s + \sum_{r\neq s}\phi_{rs} n_r}\right] \quad (7)$$

[12] For simplicity, we choose *F*=1; thus the fixed cost equals the equilibrium rental rate.

3. Agglomeration and dispersion forces: the spatial equilibrium

The model presented is a 4x2x2 'Footloose Capital'[13] setting, which allows for: uneven levels of exchange freeness across regions, size asymmetries, and external market-access heterogeneity between domestic locations. In order to simplify it a bit, the following assumptions are taken to hold from now on:

$$\phi_{A1A2} = \phi_{A2A1} = \phi_A \equiv (1+d)^{1-\sigma}$$
$$\phi_{CA1} = \phi_{CA2} = \phi_{CA} \equiv (1+d+\tau_{CA})^{1-\sigma}$$
$$\phi_{A1C} = \phi_{A2C} = \phi_{BC} = \phi_C \equiv (1+d+\tau_C)^{1-\sigma}$$

where the first equalities express that transport costs for national shipments are equal independently of their direction. The second line implies that there is no 'border' effect or market-access advantage between any domestic location and the RoW. Finally, the third equalities state that exchange costs for goods shipped from any region to the RoW are equal.

Expression (7), together with both the above assumptions on 'freeness' parameters and the fact that λ_r is given by n_rF/H, allows us to write down the following system of equations.

$$\begin{aligned}
\pi^*_{A1} &= \frac{\mu}{\sigma H}\left[\frac{Y_{A1}}{DA1} + \frac{\phi_A Y_{A2}}{DA2} + \frac{\phi_{A1B} Y_B}{DB} + \frac{\phi_{AC} Y_C}{DC}\right] \\
\pi^*_{A2} &= \frac{\mu}{\sigma H}\left[\frac{\phi_A Y_{A1}}{DA1} + \frac{Y_{A2}}{DA2} + \frac{\phi_{A2B} Y_B}{DB} + \frac{\phi_{AC} Y_C}{DC}\right] \\
\pi^*_{B} &= \frac{\mu}{\sigma H}\left[\frac{\phi_{BA1} Y_{A1}}{DA1} + \frac{\phi_{BA2} Y_{A2}}{DA2} + \frac{Y_B}{DB} + \frac{\phi_{BC} Y_C}{DC}\right] \\
\pi^*_{C} &= \frac{\mu}{\sigma H}\left[\frac{\phi_C Y_{A1}}{DA1} + \frac{\phi_C Y_{A2}}{DA2} + \frac{\phi_C Y_B}{DB} + \frac{Y_C}{DC}\right]
\end{aligned} \qquad (8)$$

where $DA1 \equiv \lambda_{A1} + \phi_A\lambda_{A2} + \phi_{BA1}\lambda_B + \phi_C\lambda_C$, $DA2 \equiv \phi_A\lambda_{A1} + \lambda_{A2} + \phi_{BA2}\lambda_B + \phi_C\lambda_C$, $DB \equiv \phi_{A1B}\lambda_{A1} + \phi_{A2B}\lambda_{A2} + \lambda_B + \phi_C\lambda_C$, and $DC \equiv \phi_{AC}(\lambda_{A1} + \lambda_{A2}) + \phi_{BC}\lambda_B + \lambda_C$ [14].

For $\lambda_r \in]0,1[\ \forall r$, the equilibrium distribution of firms solves: $\pi^*_{A1} = \pi^*_{A2} = \pi^*_B = \pi^*_C = \pi$. This equalisation of rental rates across regions implies that:

$$Y_{A1} = \rho(1-2\theta)(\pi H + L)$$
$$Y_{A2} = (1-\rho)(1-2\theta)(\pi H + L)$$
$$Y_B = Y_C = \theta(\pi H + L)$$

where $Y \equiv \pi H + L$ is world income.

Plugging these expressions into (8), we can re-write the system of equations as follows:

---

[13] This is the name given by Baldwin et al. (2003, Ch.3) to their 2x2x2 version of Martin and Rogers' (1995) model.

[14] Being the fifth equation: $\lambda_r = 1 - \sum_{s \neq r} \lambda_s$ for any $r \neq s$.

$$\Omega^*_{A1} = (1-2\theta)\left[\frac{\rho}{DA1} + \frac{\phi_A(1-\rho)}{DA2}\right] + \theta\left[\frac{\phi_{A1B}}{DB} + \frac{\phi_{AC}}{DC}\right]$$
$$\Omega^*_{A2} = (1-2\theta)\left[\frac{\phi_A\rho}{DA1} + \frac{(1-\rho)}{DA2}\right] + \theta\left[\frac{\phi_{A2B}}{DB} + \frac{\phi_{AC}}{DC}\right] \quad (9)$$
$$\Omega^*_{B} = (1-2\theta)\left[\frac{\phi_{BA1}\rho}{DA1} + \frac{\phi_{BA2}(1-\rho)}{DA2}\right] + \theta\left[\frac{1}{DB} + \frac{\phi_{AC}}{DC}\right]$$
$$\Omega^*_{C} = (1-2\theta)\left[\frac{\phi_C\rho}{DA1} + \frac{\phi_C(1-\rho)}{DA2}\right] + \theta\left[\frac{\phi_C}{DB} + \frac{1}{DC}\right]$$

where $\Omega^*_r \equiv \dfrac{\pi^*_r \sigma H}{\mu(\pi H + L)} \quad \forall r$ (10)

The solution of this system characterises the interior equilibrium, which has the particularity of being always stable: capital movements lower the reward differential, and in turn reduce the incentive for further capital relocation[15]. Since in equilibrium $\pi^*_r = \pi\ \forall r$, then[16]:

$$\Omega^*_r = \frac{\pi\sigma H}{\mu(\pi H + L)} \equiv \Omega \quad \forall r$$

At this point, our main task is to analyse how distribution of firms between regions changes when RI takes place. Though this is in effect accomplished later in section 4, it is now convenient to present some intuition behind the system's dynamics within the two scenarios that will be the centre of our study. Therefore, the following sub-sections study how capital-services tend to move across regions within the 'No Border Effect' (NBE) setting, where all domestic firms regardless of their location have equal access to the preferential partner's market, and within the 'Border Effect' (BE) scenario, characterised by domestic locations that are heterogeneous in terms of that access.

3.A. "no border effect" inside the bloc

Within the NBE scenario, the following assumptions hold:

$$\text{'NBE'}: \quad \phi_{A1B} = \phi_{A2B} = \phi_{AB} \equiv (1 + d + \tau_{AB})^{1-\sigma}$$
$$\phi_{BA1} = \phi_{BA2} = \phi_{BA} \equiv (1 + d + \tau_{BA})^{1-\sigma}$$

---

[15] Within this model, since capital ownership is fixed and labour is immobile, when capital-services relocate no other agglomeration force is set into motion. So, there are no destabilising forces operating.

[16] It is worth mentioning that we keep the distinction between π_r^*, π, and an additional variable π^*–though they are equalised in the long-run equilibrium– in order to gain some insights from the analysis of the 'ad-hoc' adjustment process that should take place from any 'short-run equilibrium' to the 'final spatial equilibrium'. Although there is no real dynamics in the model, for analytical purposes the 'short-run' is understood as a situation in which capital-services hired in each region are given and immobile. During the 'adjustment' period, it is assumed that capitalists (everywhere) earn the world average reward π^* although regional rental rates can differ π_r^*. Specifically, it is assumed that a share θ of capital-services hired in each region belongs to capital owners residing in *C*; another share θ belongs to those living in *B*; a share $\rho(1-2\theta)$ corresponds to assets of capitalists in *A1*; and the remaining assets belong to capitalists from *A2*.

In other words, exchange costs are the same from/to any domestic location to/from the preferential partner, *B*.

For simplicity, we also assume that:

$\phi_{AB} = \phi_{BA} = \phi_{FTA}$ because $\tau_{AB} = \tau_{BA} = \tau_{FTA}$ and

$\phi_{CA} = \phi_{CB} = \phi_{C} = \phi_{GE}$ because $\tau_{CA} = \tau_{CB} = \tau_{C} = \tau_{GE}$

where *GE* is a mnemonic for 'Global External'[17]. These assumptions imply that intra-bloc trade liberalisation is symmetric, and that members maintain a common 'pre-RI' external trade policy with the RoW –which, besides, coincides with that the RoW applies uniformly.

The set Γ, or the spatial division of industry that equates rental rates across all regions can be expressed as a set of functions of both 'freeness' parameters and the full distribution of market sizes. Although these functions are somewhat unwieldy, we can briefly examine the behaviour of some key expressions in order to get intuition for how the model works.

Specifically, the focus is put on the rental rates differentials across regions, which are the engine of the spatial relocation of firms. Indeed, firms decide whether to move from region *r* to region *s* by evaluating their operating profit differential. From definition (10) we know that:

$$\Omega_s^* - \Omega_r^* = \frac{\sigma H}{\mu\left(\pi^* H + L\right)}\left(\pi_s^* - \pi_r^*\right)$$

Since the ratio is positive, it is true that: $\mathrm{sgn}\left(\pi_s^* - \pi_r^*\right) = \mathrm{sgn}\left(\Omega_s^* - \Omega_r^*\right)$

Plugging expressions for Ω_s^* and Ω_r^* one obtains an equation that shows how capital-services move between regions *s* and *r*. In the specific case of domestic firms one finds that:

$$\mathrm{sgn}\left(\pi_{A1}^* - \pi_{A2}^*\right) = \frac{(1-2\theta)(1-\phi_A)}{\Psi}\mathrm{sgn}\left[\rho DA2' - (1-\rho)DA1'\right] \qquad (11)$$

where Ψ, *DA1'* and *DA2'* are positive functions of 'freeness' parameters and industry shares (ϕ's and λ's)[18].

Thus, when domestic and international shipments are not perfectly free, ϕ's<1, the pressure for firms to move across domestic locations is driven by the interaction of opposing forces: the market-access and market-crowding effects. That is, producing in the largest domestic market –*A1*, when ρ>1/2– gives profit-advantage to local firms and promote domestic agglomeration in

[17] With these new assumptions, the system of equations (9) turns into a new system (A1), which is written down in the Appendix.

[18] Explicitly: $\Psi \equiv \phi_A\left(\lambda_{A1}^2 + \lambda_{A2}^2\right) + \left(1+\phi_A^2\right)\lambda_{A1}\lambda_{A2} + (1+\phi_A)(\lambda_{A1}+\lambda_{A2})(\phi_{FTA}\lambda_B + \phi_{GE}\lambda_C) + \phi_{FTA}^2\lambda_B^2 + \phi_{GE}^2\lambda_C^2 + 2\phi_{FTA}\phi_{GE}\lambda_C\lambda_B$, $DA1' \equiv \lambda_{A1} + \phi_A\lambda_{A2} + \phi_{FTA}\lambda_B + \phi_{GE}\lambda_C$ and $DA2' \equiv \phi_A\lambda_{A1} + \lambda_{A2} + \phi_{FTA}\lambda_B + \phi_{GE}\lambda_C$.

A1. On the other hand, the market-crowding effect operates; i.e. a larger number of firms in *A1* tend to reduce that profit-advantage, pushing firms towards *A2*[19].

We now try to get some insights about how industry relocation is driven between a foreign country and any domestic location. For instance, in the case of *A1* and *B* capital-services move responding to the following forces[20]:

$$\text{sgn}\left(\pi^*_{A1} - \pi^*_{B}\right) = \text{sgn}\left\{\frac{(1-2\theta)}{\Psi}\left[\rho(1-\phi_{FTA})DA2' + (1-\rho)(\phi_A - \phi_{FTA})DA1'\right] - \theta\frac{(1-\phi_{FTA})}{DB'}\right\} \qquad (12)$$

where *DB'* is a positive function of ϕ's and λ's[21].

Hence, a larger local market gives incentives for firms to enter location *A1*; and a bigger *A2*'s market is more advantageous for firms located within the domestic country rather than for firms in *B* due to the difference in exchange costs –i.e. when $\phi_A > \phi_{FTA}$. Finally the larger *B*'s market, the stronger the incentives for local firms to move inside the foreign country. On the other hand, the impact of dispersion forces on capital flows –which presence is symbolised by the interaction-terms of industry shares and exchange costs– tends to foster capital relocation towards less crowded markets, i.e. characterised by a lower λ_r.

3.B. "Border effect" inside the bloc

Now we analyse the case in which locations *A1* and *A2* are assumed to be heterogeneous in terms of their access to *B*. This implies that:

'BE': $\phi_{A1B} \neq \phi_{A2B}$ and $\phi_{BA1} \neq \phi_{BA2}$

However, for simplicity it is assumed that:

$\phi_{A1B} = \phi_{BA1} = \phi_{FTA1} \equiv (1 + d + \tau_{FTA})^{1-\sigma}$ and

$\phi_{A2B} = \phi_{BA2} = \phi_{FTA2} \equiv (1 + 2d + \tau_{FTA})^{1-\sigma}$

And, as before: $\phi_{CA} = \phi_{CB} = \phi_C = \phi_{GE}$ since $\tau_{CA} = \tau_{CB} = \tau_C = \tau_{GE}$

For the new system of equations –see expression (A3) in the Appendix– the equilibrium distribution of industry can be expressed as another set of functions of 'freeness' parameters and the full distribution of market sizes. As in the previous sub-section, we proceed to get some insights from the analysis of the system's ad-hoc 'dynamics'.

---

19 To be more illustrative, starting from a symmetric domestic equilibrium ($\lambda_{A1}=\lambda_{A2}$) an exogenous movement of firms from *A2* to *A1* tends to generate a market-crowding disadvantage for firms in *A1*. Since the denominator of the expression Ψ remains unchanged, operating profits of *A1*'s firms tend to diminish due to the fiercer local competition.

20 In the Appendix we present expression (A2) that shows how industry relocation between *C* and *A1* takes place.

21 Explicitly: $DB' \equiv \phi_{FTA}(\lambda_{A1} + \lambda_{A2}) + \lambda_B + \phi_{GE}\lambda_C$.

In the case of domestic locations, the sign of capital reward differential is given by that of the right hand side in the following expression:

$$\text{sgn}\left(\pi^*_{A1} - \pi^*_{A2}\right) = \text{sgn}\left\{\frac{(1-2\theta)(1-\phi_A)}{\Phi}\left[\rho DA2'' - (1-\rho)DA1''\right] + \theta\frac{\left(\phi_{FTA1} - \phi_{FTA2}\right)}{DB''}\right\} \quad (13)$$

where Φ, *DA1''*, *DA2''* and *DB''* are positive functions of ϕ's and λ's[22].

The first term between the curly brackets is very similar to the whole expression obtained for the NBE case. In other words, it reveals the interaction of two opposing forces governing firms' incentives to relocate: the market-access and market-crowding effects. As a subtle difference from that case, supposing $\phi_{FTA1}>\phi_{FTA}=\phi_{FTA2}$ one can notice that firms in *A1* suffer higher competition from firms located in *B* than before and thus incentives to relocate in *A1* are lower.

However, the presence of a border effect introduces one more noticeable difference. A new term, the last one appears in the domestic rental rate differential; it is again a combination of opposing forces. Domestic firms are attracted towards the border location, *A1*, in order to gain better access to *B*'s market –the larger this market, the stronger this force. On the other hand, firms are pushed towards the remote location, *A2*, where competition from *B*'s firms is softer, i.e. a higher λ_B implies a lower positive impact of the border effect (ϕ_{FTA1}-ϕ_{FTA2}>0) on the rental rate differential of location *A1*[23].

With respect to international capital movements, relocation from the preferential partner to *A1* is driven by the following expression[24]:

$$\text{sgn}\left(\pi^*_{A1} - \pi^*_{B}\right) = \text{sgn}\left\{\frac{(1-2\theta)}{\Phi}\left[\rho(1-\phi_{FTA1})DA2'' + (1-\rho)(\phi_A - \phi_{FTA2})DA1''\right] - \theta\frac{\left(1-\phi_{FTA1}\right)}{DB''}\right\} \quad (14)$$

Thus, the incentives for foreign firms to enter market *A1* are similar to those of the NBE case; however, there is one interesting difference which deserves some attention. When the gate effect is introduced, the impact of *A2*'s market size on capital flows from *B* to *A1* changes. Specifically, the access advantage of *A1*'s firms to the other local market does remain even after all trade barriers have been removed –ϕ_A is always larger than ϕ_{FTA2}. Consequently, the border effect continues stimulating industry dispersion from *B* towards *A1*.

Apart from that, another noticeable distinction introduced by the border effect is between the incentives for capital flows from *B* towards each particular domestic location. The negative impact of *B*'s market size on its capital outflows is always lower for the case of the border

---

22 Explicitly: $\Phi \equiv \phi_A\left(\lambda^2_{A1} + \lambda^2_{A2}\right) + \left(1+\phi^2_A\right)\lambda_{A1}\lambda_{A2} + \left(\lambda_{A1} + \phi_A\lambda_{A2} + \phi_{FTA1}\lambda_B + \phi_{GE}\lambda_C\right)\left(\phi_{FTA2}\lambda_B + \phi_{GE}\lambda_C\right) + \left(\phi_A\lambda_{A1} + \lambda_{A2}\right)\phi_{GE}\lambda_C + \left(\lambda_{A1} + \phi_A\lambda_{A2}\right)\phi_{FTA1}\lambda_B$ $DA1'' \equiv \lambda_{A1} + \phi_A\lambda_{A2} + \phi_{FTA1}\lambda_B + \phi_{GE}\lambda_C$, $DA2'' \equiv \phi_A\lambda_{A1} + \lambda_{A2} + \phi_{FTA2}\lambda_B + \phi_{GE}\lambda_C$ and $DB'' \equiv \phi_{FTA1}\lambda_{A1} + \phi_{FTA2}\lambda_{A2} + \lambda_B + \phi_{GE}\lambda_C$.

23 These effects seem to be directly associated with the *pull* and the *push* effects discussed by Crozet and Koening-Soubeyran (2002) within a 'Core-Periphery' model.

24 The corresponding expression (A4) for the case of the remote location is presented in the Appendix.

location; that is, capitalists in *B* have stronger incentives to move towards *A1* rather than towards *A2* –compare the last expression with (A4) in the Appendix.

In the case of capital relocation from *C* to domestic locations, the border effect introduces an appealing distinction between each particular domestic location, similar to that mentioned above. That is, flows from *C* to *A1* tend to be more abundant than those towards *A2* solely because of *A1*'s relative access advantage towards *B*'s market –see expressions (A5) and (A6) in the Appendix.

4. Regional integration

Within this section, the principal aim is to obtain some insights about how symmetric trade liberalisation between *B* and the domestic country can modify the economic landscape of the latter. Due to the characteristics of the model, such as unevenness of exchange costs, size-asymmetries and market-access heterogeneity, the analysis has to rely on numerical simulations. Simulations were run for a marginal and continuous reduction of τ_{FTA} from infinity –or complete intra-bloc autarky– to zero, within each of our two benchmark scenarios[25].

In order to find additional predictions that could be associated with some 'real' or hypothetical cases, different 'factor-endowment' settings –i.e. different values of θ and ρ– were considered. In the case of ρ, the levels used were: 0,6, 0,5 and 0,4; so we simulated both a symmetric domestic landscape and an asymmetric one, where the border location could be either the largest or the smallest one. With respect to θ, three different cases were considered. When foreign countries were assumed to be larger than the domestic country, θ could take values between 1/2 and 1/3[26]. When complete symmetry among countries was assumed, this parameter was set equal to 1/3. Finally, when all *regions* were supposed to be symmetric, θ was set equal to 1/4, and ρ equal to 0,5; implying a domestic country larger than *B* and *C*.

[25] Simulations were run using Maple 8. With respect to robustness, a modest analysis was carried out in order to get insights of how the results were modified when some key parameters, such as d, ρ, θ and τ_{GE} were altered. The results are the expected ones and can be requested to the author.

[26] In fact, θ was set equal to 3/8. In the case of the other parameters, the following values were applied: σ=4, τ_{GE}=0,5 and d=0,5. The values of σ and τ_{GE} are around the average values used by similar studies. In the case of d, it was assumed to equal τ_{GE} in order to simplify some side effects.

4.A. "No border effect" case

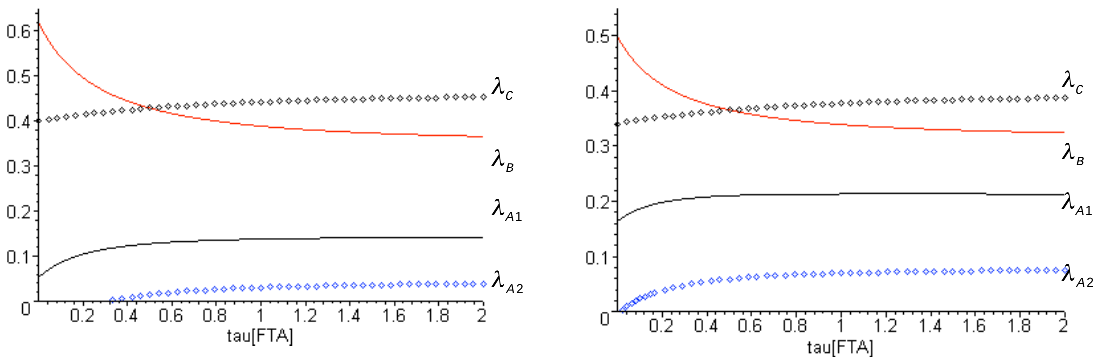
For this scenario, numerical simulations were run for θ equal to 3/8, 1/3 and 1/4, assuming in each case both domestic symmetry and asymmetry $-\rho$= 0,6 and 0,5 respectively. The results, which are summarised in the following figures, show that in every scenario there is a 'production shifting' effect from the RoW to the bloc as a whole[27]. That is, *C*'s industry share always diminishes when preferential trade liberalisation takes place, and thus the bloc benefits.

Additionally, it is also true that country *B* always receives new entrants; *B*'s relative market size and its freer access to (and from) the domestic country may explain this result. In fact, as figures reveal, the spatial impacts on *B* diminish as its market size decreases and, simultaneously, competition from firms in *A1* and *A2* becomes fiercer[28].

Domestic inequalities or, in other words size-asymmetries between *A1* and *A2* do not have any impact on industry shares within foreign countries when no location is unindustrialised. More clearly, the spatial effects that RI have on those markets is unaffected by the internal geography of the industrialised domestic country. This is because *B* and *C* do not have any access advantage to any *particular* domestic location; hence, the domestic market as a whole and competition within it are the only important features for foreign firms[29].

Figure 1: NBE case. Location effects when domestic locations are asymmetric (ρ=0,6)[30]

Case of large foreign countries (θ=3/8) Case of symmetrically sized countries (θ=1/3)



---

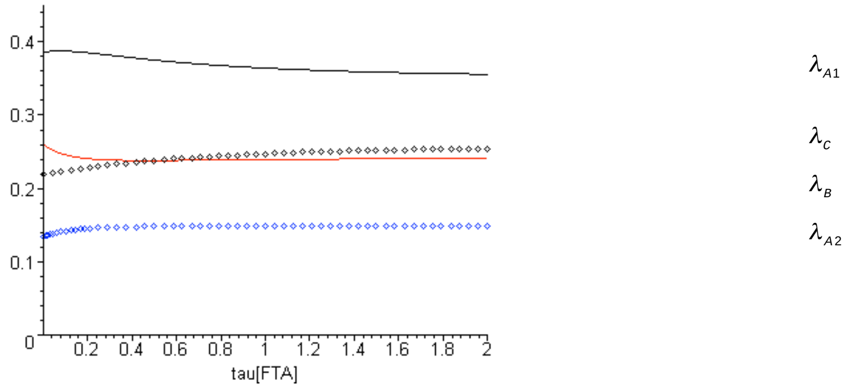
27 The name 'production shifting' given for that effect is due to Baldwin and Venables (1995). Since in this model industrial delocation is synonymous of international capital flows, preferential trade liberalisation implies also what Baldwin, et al. (1996) call 'investment diversion'.

28 Some of λ_B's change is explained by capital inflows coming from domestic locations. From expression (12) it is evident that when θ is high, though (1-ϕ_{FTA}) diminishes with trade liberalisation, the sign of the rental-rate differential tends to be negative as the second term also vanishes with intra-bloc free trade.

29 In fact, that result relies on the absence of cumulative causation effects, such as vertical linkages among firms or embodied-factor mobility.

30 When domestic locations are equally sized (ρ=0,5), both domestic locations suffer exactly the same relocation process –see table 1– while spatial impacts within *B* and *C* are like in the asymmetric case.

Case of a big domestic country (θ=1/4)



Considering now the domestic country's landscape, it can be grasped from the following table that, in general terms, there is a displacement of national firms towards foreign regions. This phenomenon might occur to the extreme point in which its modern sector disappears. The only case in which delocation does not happen, and instead the country receives new entrants is when it is the largest country in the world (θ=1/4).

In this last case, the domestic country benefits since its relative market size is large enough to overcome its 'disadvantage' in terms of internal transport infrastructure. During the process of trade liberalisation, while $\tau_{FTA}>0$, *B*'s capitalists may have incentives to hire their capital-services inside that large market[31]. Additionally, some firms from *C* may also find it profitable to move inside the domestic market.

Inside the domestic country, the economic landscape remains unchanged with RI when both locations are totally homogeneous. On the contrary, when domestic locations are asymmetric, preferential trade liberalisation tends to worsen pre-existent internal disparities. The largest location, *A1*, is either less damaged in terms of firms' outflow or the only location that receives new entrants.

Interestingly, for the domestic country as a whole, internal inequalities can only improve the overall effects of RI on its geography. Indeed, when the country is larger than or as big as foreign countries, inner asymmetries are globally innocuous; but when the country is small enough, to have a relatively more developed location helps. The explanation for this seems to be that, when the country is very small the domestic agglomeration force is almost inexistent; and therefore trade liberalisation can only imply industry delocation. Nonetheless, if some internal region is large enough, some firms may agglomerate there, and in turn 'survive' to RI.

[31] No relocation from *B* to the domestic country would have happened instead with a big-bang liberalisation.

4.B. "Border effect" case

The BE scenario, where domestic location *A1* is closer to *B* than *A2*, is numerically simulated with θ equal to 3/8, 1/3 and 1/4 as before, and with ρ equal to 0,6, 0,5 and 0,4. The latter implies that any domestic location, the border or the remote location, can be the richest or most developed.

The results reveal that the 'production shifting' effect from RoW towards the integrating countries is again present in every factor-endowment scenario (see table 2). Besides, country *B* is generally benefited by firms' relocation, though it suffers some delocation when the domestic country is the biggest in the world and the border location is relatively large.

Table 2: BE case. Location effects outside the domestic country

Relative changes

	$\Delta\lambda_B/\lambda_{B0}$			$\Delta\lambda_C/\lambda_{C0}$
	ρ=0,4	ρ=0,5	ρ=0,6	
θ=3/8	38%	38%	34%	-11%
θ=1/3	31%	25%	19%	-10%
θ=1/4	0%	-8%	-21%	-11%

Note: In general terms, $\Delta\lambda_C$ does not vary with ρ. In the case it does, a simple average of the values that this increment takes when ρ varies are used to calculate $\Delta\lambda_C/\lambda_{C0}$.

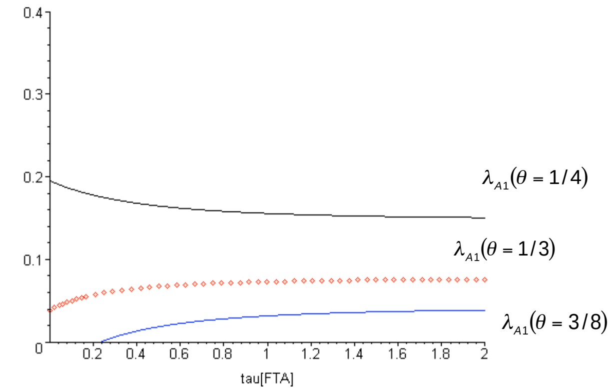
Moreover, comparing with the NBE case, one can conclude that the presence of a gate effect tends to diminish *B*'s gains in terms of industrial location, and to softly reduce the negative impact of RI on *C*'s industrial landscape. Hence as it was referred to in the last part of section 3, the model predicts that the border effect, which weakens *B*'s access advantage to the domestic market, leaves *B*'s firms in a less profitable position.

As in the previous case, domestic size asymmetries do not affect firms' location behaviour within market *C* as long as every region is industrialised. However, those asymmetries do modify the way in which firms tend to move from and towards country *B* because of heterogeneity in access possibilities. The larger the border location, the smaller *B*'s industry share after preferential trade liberalisation.

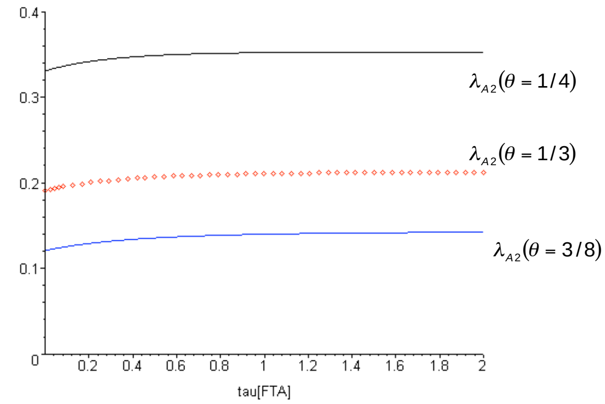
With respect to the domestic country, in general terms there is a displacement of firms from its market to outside –see the following figures. Similarly to the NBE case, internal size-asymmetries tend to improve the global spatial effects of RI, unless domestic competition faced by the border region is too high.

Figure 2: BE case. Location effects inside the domestic country.

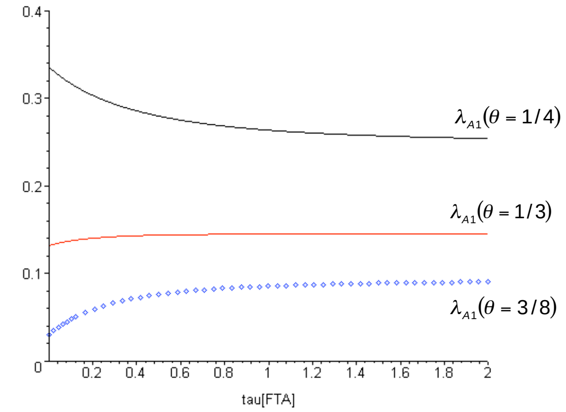
λ_{A1}, case of a big remote location (ρ=0,4)



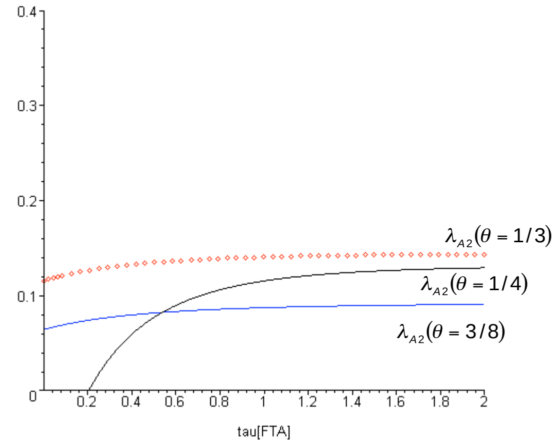
λ_{A2}, case of a big remote location (ρ=0,4)



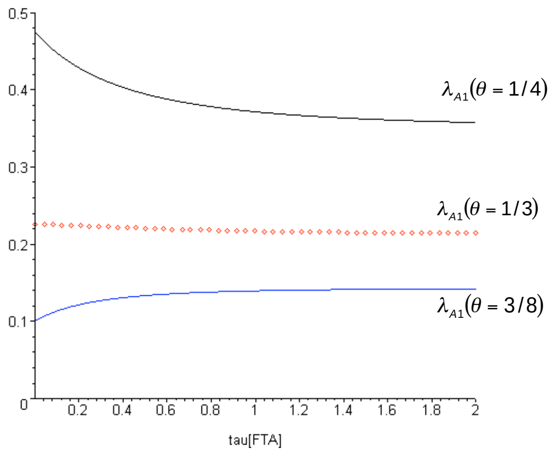
λ_{A1}, case of symmetrically sized locations (ρ=0,5)



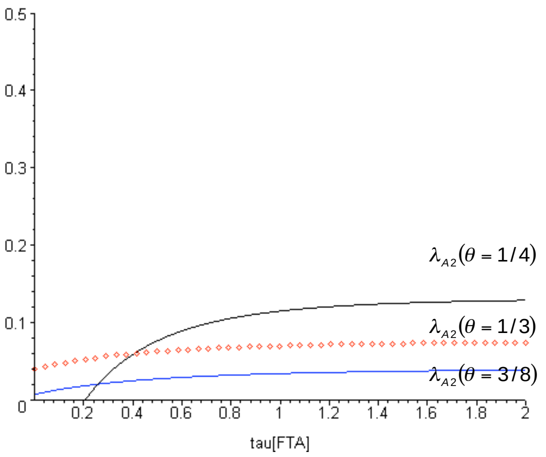
λ_{A2}, case of symmetrically sized locations (ρ=0,5)



λ_{A1}, case of a large border location (ρ=0,6)



λ_{A2}, case of a large border location (ρ=0,6)



Further comparisons with that previous scenario show us that the relative outflow of firms is always weaker than before, and that in average inflows are larger. So, taking the country as a whole the border effect seems to play a favourable role in reducing the negative impacts of RI. In fact, the gate effect means that the domestic market is not so opened as before; it can be viewed as an additional force that pushes firms inside the country. Unlike the NBE case, in the BE scenario *something* would still have happened in terms of capital inflows from *B* with a big-bang liberalisation.

Within the domestic country and in the case of symmetrically-sized locations, RI tends to propitiate the emergence of an uneven economic landscape. To be the border region is an advantage when the country is large enough because, in addition to the 'local' market-access effect, it has relatively better access than the distant location to *B*'s market. However, at the same time, *A1* may be the most seriously damaged location when foreign regions are very large or in other words, competition from abroad is too high.

When domestic locations are heterogeneous in terms of their market size, inequalities tend to be deepened after RI. Size asymmetries relatively diminish only when the country is the biggest and its remote location is the richest or most developed. Within every other scenario, the border location is the most favoured.

To sum up, the collection of examples provided by this section are suggestive of the following main conclusions:

The RoW is harmed by industrial relocation when there is a process of preferential trade liberalisation.

The bloc and its largest member benefit from capital inflows.

Within the domestic country and for every scenario, RI tends to foster industry spatial concentration, creating an uneven landscape or deepening already existent imbalances.

The location with better access to the partner's market is generally favoured by industry agglomeration.

The results found by this paper are close to those reported by previous research. Indeed, the 'inside-outside' effects and the intra-bloc spatial impacts of preferential trade liberalisation have already been put forth by Baldwin et al. (2003, Ch.14) within a very similar framework, and by Puga and Venables (1997) using a 'Core-Periphery' setting.

With respect to the impact of trade liberalisation policies on the internal geography of a country, our findings appear to coincide with those obtained by Alonso-Villar (2001), Monfort and Nicolini (2000), Paluzie (2001), and Crozet and Koening-Soubeyran (2002) within different settings. What can be concluded is that trade liberalisation, either unilateral or preferential, is likely to foster agglomeration inside the country which opens to trade, even if there is no cumulative agglomeration [32].

Moreover, our results seem to support Crozet and Koening-Soubeyran's findings in relation with the spatial impacts of trade liberalisation in the presence of a border or gate effect. This type of effect introduces two opposing forces in the model: a 'pull' pressure towards border locations and a 'push' force inside remote ones, the balance of which is shaped by the strength of both the 'external' market-access effect and the 'external' market-crowding effect. In addition, our model shows that this outcome is also dependent on size imbalances inside the country.

[32] It is worth mentioning that some other studies –i.e. Krugman and Livas Elizondo (1996), Krugman (1996), Fujita et al. (1999, Ch.18), Behrens et al. (2003) and Moncarz (2004)– conclude instead that trade liberalisation tend to foster *dispersion* of economic activity within the country. The contradiction between these two groups of studies is explained by the different assumptions each makes on how dispersion forces are affected by trade costs reductions –see Behrens et al. (2003) and Crozet and Koening-Soubeyran (2002) for discussion on this issue.

5. Welfare effects

We now proceed to analyse the welfare implications of preferential trade liberalisation[33]. To do this, and for the case of region *r*, we first differentiate the indirect utility function (4) with respect to τ_{FTA}, which yields[34]:

$$\frac{\partial V_r}{\partial \tau_{FTA}} = \Theta_r \left[\sum_{s \neq r} \frac{\partial \phi_{sr}}{\partial \tau_{FTA}} \lambda_s + \left(\frac{\partial \lambda_r}{\partial \tau_{FTA}} + \sum_{s \neq r} \phi_{sr} \frac{\partial \lambda_s}{\partial \tau_{FTA}} \right) \right] \qquad (15)$$

where Θ_r is a positive function of λ's and ϕ's[35].

Since regional nominal incomes remain constant across spatial equilibria, welfare in region *r* increases with trade liberalisation if and only if the 'location effects' imply a reduction in consumer prices –i.e. an increase in real income; in other words, if consumers after RI are better off due to lower local prices[36]. Specifically, the first summation inside brackets shows the direct effect of preferential trade liberalisation on local prices, while the expression between parentheses accounts for the indirect effects which operate through industry relocation.

To be more illustrative, in the case of domestic location *A1* we have[37]:

$$\frac{\partial V_{A1}}{\partial \tau_{FTA}} = \Theta_{A1} \left\{ \frac{\partial \phi_{FTA1}}{\partial \tau_{FTA}} \lambda_B + \left[(1 - \phi_{GE}) \frac{\partial \lambda_{A1}}{\partial \tau_{FTA}} + (\phi_A - \phi_{GE}) \frac{\partial \lambda_{A2}}{\partial \tau_{FTA}} + (\phi_{FTA1} - \phi_{GE}) \frac{\partial \lambda_B}{\partial \tau_{FTA}} \right] \right\}$$

Inside the curly brackets, the first term shows the welfare-improving effect that a fall in prices for those goods imported from the preferential partner *B* provokes. The second expression, in turn, reveals that production shifting has three indirect effects that depend on the exchange-costs differentials across regions, which in turn varies as trade costs diminish. More specifically, if firms located inside the bloc have better access to *A1*'s market than firms located in RoW, relocation towards (beyond) the bloc may benefit (harm) consumers in region *A1*.

In order to determine what the welfare effects of RI are within our particular and multiple scenarios, we proceed to run numerical simulations, the results of which are summarised in the Appendix. As one could expect from results in section 4, while RoW's welfare level diminishes within every scenario due to industry delocation, *B*'s consumers are always better off since

---

33 For simplicity, in analyzing such impacts, we neglect the proceeds that governments obtain through tariffs on imports.

34 Since *Z* is the numeraire, we have chosen units such that: *H*=1, *Y*=1 and $m=\frac{\sigma-1}{\sigma}$, so $L=\frac{\sigma-\mu}{\sigma}$.

35 Specifically: $\Theta_r \equiv \Xi_r \frac{\mu}{\sigma-1} \left(\lambda_r + \sum_{s \neq r} \phi_{sr} \lambda_s \right)^{\frac{\mu-\sigma+1}{\sigma-1}}$, where Ξ_r is the share of world expenditure (income) that corresponds to consumers in region *r*, that is: $\Xi_{A1} \equiv \rho(1-2\theta)$, $\Xi_{A2} \equiv (1-\rho)(1-2\theta)$, $\Xi_B \equiv \theta$ and $\Xi_C \equiv \theta$.

36 The name 'location effects' is used as in Baldwin et al. (2003).

37 The equation for location *A2* is very similar to the latter. In the Appendix, we present the derivatives of V_B and V_C –(A7) and (A8).

capital inflows are the most probable, and because the potential negative impact of industry relocation within the domestic country on *B*'s welfare diminishes as intra-bloc trade liberalisation takes place.

In the case of domestic locations, *A1* always gain in terms of well-being, and *A2* is very unlikely damaged. In fact, *A2*'s welfare only decreases when the domestic country is very large and there is a gate effect and/or the location is underindustrialised. Furthermore, just in this peculiar scenario both the domestic country and the bloc as a whole tend to suffer a reduction in their welfare levels after intra-bloc trade barriers fall below a critical value[38].

To sum up, for member countries and the bloc as a whole, preferential trade liberalisation tends to be a welfare-improving policy, while the RoW is 'the loser' in this story[39]. Furthermore, even though domestic delocation may take place and regional inequalities tend to be deepened, domestic welfare may increase, and every location is very likely better off in terms of real income. These results are again in line with previous theoretical studies; in addition, our study shows that the presence of a gate effect may not introduce strong enough counterbalancing or welfare-reducing effects within the 'FC' setting[40].

6. Concluding remarks

This paper has extended one very tractable NEG model in order to acknowledge for the spatial impacts of preferential trade liberalisation on the internal geography of a member country. Inspired by Henderson's (1996, p.33) suggestion, the focus has been put in analysing those spatial effects within different geographical scenarios, namely considering that the economic landscape of the country and its trade partners can vary.

Our theoretical exercise has shown that RI tends to foster agglomeration inside the country, and to deepen initial regional imbalances. Moreover, the model predicts that the domestic location with some advantage in terms of access to the preferential partner is generally favoured. However, our examples also show that RIAs tend to be welfare-enhancing for member countries and their inner regions.

---

[38] This result, which is not general but very specific, can be taken as a counterexample to that found by Baldwin et al. (2003, Ch.14), namely that in the 'FC' model the degree of delocation within the bloc is small enough to ensure that all member countries are better off after any level of preferential liberalisation. We conjecture that the presence of a border effect in our model reinforces agglomeration, so that delocation is stronger and thus welfare in the more disadvantageous region can decrease.

[39] In the case of both the domestic country and the integrated bloc, total welfare was defined as the simple sum of indirect utility levels of their component regions.

[40] For a complete analysis of trade policy welfare effects see Baldwin et al. (2003).

Coming back to the illustrative example at the beginning, our analysis suggests that from the point of view of Argentina within MERCOSUR –in a scenario where θ equals 3/8– the picture is not very promising since firms would tend to move towards Brazil. However, if central-eastern regions of Argentina take advantage of their better access to the bloc and of their pre-integration higher level of industrialisation, that capital outflow may be considerably lessened and those border regions can benefit greatly. On the other hand, less developed and more remote regions –such as Patagonia and some western areas– would be damaged[41].

The predictions of our model, to certain extent stark or hopeless in terms of industry relocation, may be however eased by the introduction of some other 'more realistic' features, such as comparative advantage differences across regions, capital relocation costs, chances for intra-bloc asymmetric liberalisation, among others[42]. As we propose to build a model which can provide a basis for future empirical assessments, the challenge for forthcoming research is to move from this simple setting to one where vertical linkages among firms and a two-sector industry, encompassing comparative advantage, are assumed.

[41] These 'predictions' are in line with some related empirical studies carried out for Brazil, i.e. de Sá Porto (2000) and Volpe Martincus (2004).

[42] Baldwin and Robert-Nicoud (2000) studied that last extension and concluded that asymmetric liberalisation can be designed to avoid delocation during preferential trade liberalisation.

Appendix

1. The spatial equilibrium

1.a. "No Border Effect" inside the bloc

The system of equations can now be re-written as follows:

$$\begin{aligned}
\Omega^*_{A1} &= (1-2\theta)\left[\frac{\rho}{DA1'}+\frac{\phi_A(1-\rho)}{DA2'}\right]+\theta\left[\frac{\phi_{FTA}}{DB'}+\frac{\phi_{GE}}{DC'}\right]\\
\Omega^*_{A2} &= (1-2\theta)\left[\frac{\phi_A\rho}{DA1'}+\frac{(1-\rho)}{DA2'}\right]+\theta\left[\frac{\phi_{FTA}}{DB'}+\frac{\phi_{GE}}{DC'}\right]\\
\Omega^*_{B} &= (1-2\theta)\phi_{FTA}\left[\frac{\rho}{DA1'}+\frac{(1-\rho)}{DA2'}\right]+\theta\left[\frac{1}{DB'}+\frac{\phi_{GE}}{DC'}\right]\\
\Omega^*_{C} &= (1-2\theta)\phi_{GE}\left[\frac{\rho}{DA1'}+\frac{(1-\rho)}{DA2'}\right]+\theta\left[\frac{\phi_{GE}}{DB'}+\frac{1}{DC'}\right]
\end{aligned} \qquad \text{(A1)}$$

and denominators are re-defined: $DA1' \equiv \lambda_{A1}+\phi_A\lambda_{A2}+\phi_{FTA}\lambda_B+\phi_{GE}\lambda_C$, $DA2' \equiv \phi_A\lambda_{A1}+\lambda_{A2}+\phi_{FTA}\lambda_B+\phi_{GE}\lambda_C$, $DB' \equiv \phi_{FTA}(\lambda_{A1}+\lambda_{A2})+\lambda_B+\phi_{GE}\lambda_C$ and $DC' \equiv \phi_{GE}(\lambda_{A1}+\lambda_{A2}+\lambda_B)+\lambda_C$.

The following expression shows the direction that capital flows may take between location *A1* and the RoW.

$$\text{sgn}(\pi^*_{A1}-\pi^*_C)=\text{sgn}\left\{\frac{(1-2\theta)}{\Psi}\left[\rho(1-\phi_{GE})DA2'+(1-\rho)(\phi_A-\phi_{GE})DA1'\right]+\theta\,\frac{[(\phi_{FTA}-\phi_{GE})DC'-(1-\phi_{GE})DB']}{DB'DC'}\right\} \qquad \text{(A2)}$$

The first two terms imply that a larger domestic country gives incentives for *C*'s firms to relocate inside *A1*. The third term shows that those incentives increase (diminish) if the domestic country has better (worse) access to *B* than the one that *C*'s firms have $-\phi_{FTA}>\phi_{GE}$ ($\phi_{FTA}<\phi_{GE}$). Finally, the last term reflects the fact that a larger RoW's market implies a profit-advantage for firms located there, so it reduces capital outflows from *C*. As before, market-crowding forces may push *C*'s firms towards *A1* if local and external competition is relatively low within that market.

1.b. "Border Effect" inside the bloc

The system of equations is now:

$$\begin{aligned}
\Omega^*_{A1} &= (1-2\theta)\left[\frac{\rho}{DA1''}+\frac{\phi_A(1-\rho)}{DA2''}\right]+\theta\left[\frac{\phi_{FTA1}}{DB''}+\frac{\phi_{GE}}{DC''}\right]\\
\Omega^*_{A2} &= (1-2\theta)\left[\frac{\phi_A\rho}{DA1''}+\frac{(1-\rho)}{DA2''}\right]+\theta\left[\frac{\phi_{FTA2}}{DB''}+\frac{\phi_{GE}}{DC''}\right]\\
\Omega^*_{B} &= (1-2\theta)\left[\frac{\phi_{FTA1}\rho}{DA1''}+\frac{\phi_{FTA2}(1-\rho)}{DA2''}\right]+\theta\left[\frac{1}{DB''}+\frac{\phi_{GE}}{DC''}\right]\\
\Omega^*_{C} &= (1-2\theta)\phi_{GE}\left[\frac{\rho}{DA1''}+\frac{(1-\rho)}{DA2''}\right]+\theta\left[\frac{\phi_{GE}}{DB''}+\frac{1}{DC''}\right]
\end{aligned} \qquad \text{(A3)}$$

and denominators are: $DA1'' \equiv \lambda_{A1} + \phi_A \lambda_{A2} + \phi_{FTA1}\lambda_B + \phi_{GE}\lambda_C$, $DA2'' \equiv \phi_A \lambda_{A1} + \lambda_{A2} + \phi_{FTA2}\lambda_B + \phi_{GE}\lambda_C$, $DB'' \equiv \phi_{FTA1}\lambda_{A1} + \phi_{FTA2}\lambda_{A2} + \lambda_B + \phi_{GE}\lambda_C$ and $DC'' \equiv \phi_{GE}(\lambda_{A1} + \lambda_{A2} + \lambda_B) + \lambda_C$.

Referring now to capital movements, the following expression reflects why firms may relocate from *B* to *A2*.

$$\text{sgn}\left(\pi^*_{A2} - \pi^*_B\right) = \text{sgn}\left\{\frac{(1-2\theta)}{\Phi}\left[\rho(\phi_A - \phi_{FTA1})DA2'' + (1-\rho)(1-\phi_{FTA2})DA1''\right] - \theta\frac{(1-\phi_{FTA2})}{DB''}\right\} \quad \text{(A4)}$$

And the expressions below show how and why capital movements take place between each domestic location and *C*.

$$\text{sgn}\left(\pi^*_{A1} - \pi^*_C\right) = \text{sgn}\left\{\frac{(1-2\theta)}{\Phi}\left[\rho(1-\phi_{GE})DA2'' + (1-\rho)(\phi_A - \phi_{GE})DA1''\right] + \theta\frac{\left[(\phi_{FTA1} - \phi_{GE})DC'' - (1-\phi_{GE})DB''\right]}{DB''DC''}\right\} \quad \text{(A5)}$$

$$\text{sgn}\left(\pi^*_{A2} - \pi^*_C\right) = \text{sgn}\left\{\frac{(1-2\theta)}{\Phi}\left[\rho(\phi_A - \phi_{GE})DA2'' + (1-\rho)(1-\phi_{GE})DA1''\right] + \theta\frac{\left[(\phi_{FTA2} - \phi_{GE})DC'' - (1-\phi_{GE})DB''\right]}{DB''DC''}\right\} \quad \text{(A6)}$$

2. Welfare effects of regional integration

The expressions below show how welfare of consumers in *B* and *C* changes with preferential trade liberalisation.

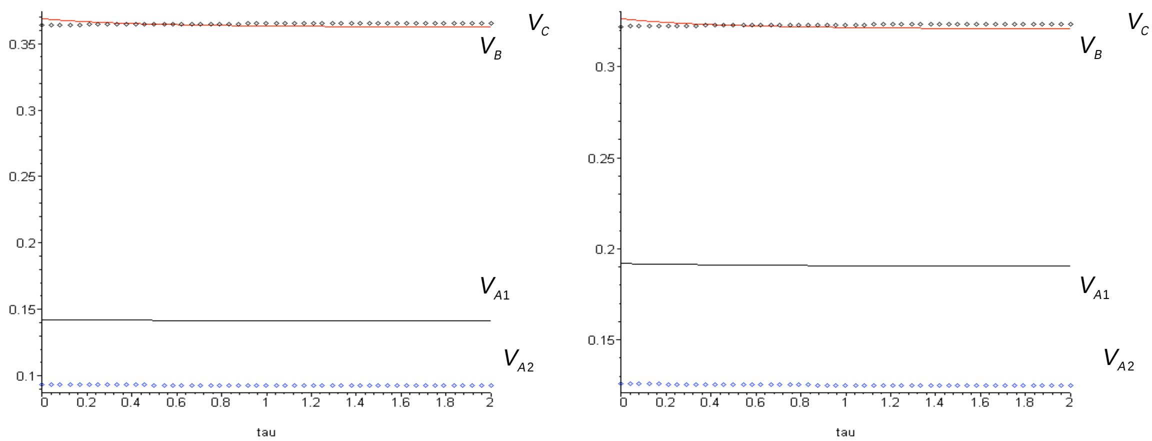
$$\frac{\partial V_B}{\partial \tau_{FTA}} = \Theta_B\left\{\left[\frac{\partial \phi_{FTA1}}{\partial \tau_{FTA}}\lambda_{A1} + \frac{\partial \phi_{FTA2}}{\partial \tau_{FTA}}\lambda_{A2}\right] + \left[(1-\phi_{GE})\frac{\partial \lambda_B}{\partial \tau_{FTA}} + (1-\phi_{FTA1})\frac{\partial \lambda_{A1}}{\partial \tau_{FTA}} + (1-\phi_{FTA1})\frac{\partial \lambda_{A2}}{\partial \tau_{FTA}}\right]\right\} \quad \text{(A7)}$$

$$\frac{\partial V_C}{\partial \tau_{FTA}} = \Theta_C(1-\phi_{GE})\frac{\partial \lambda_C}{\partial \tau_{FTA}} \quad \text{(A8)}$$

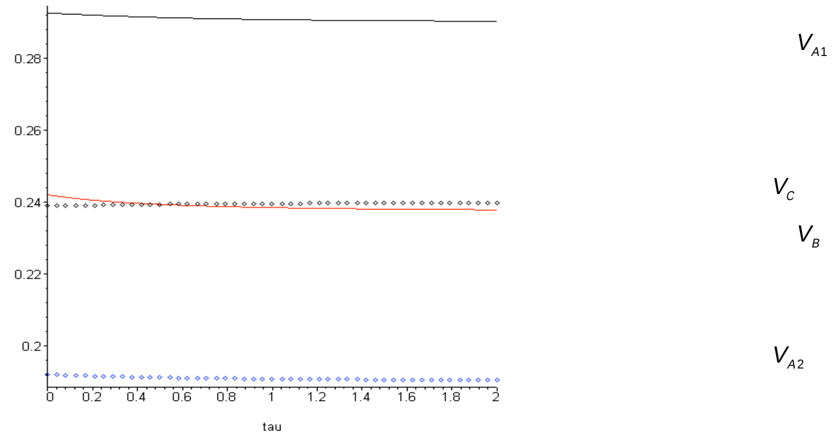
The following figures summarise how welfare levels in each region are modified as regional integration takes place when there is no gate effect.

Figure 3: NBE case. Welfare implications

Case of large foreign countries (θ=3/8) | Case of symmetrically sized countries (θ=1/3)



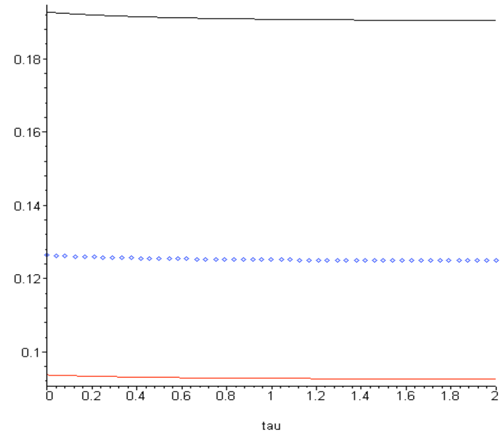
Case of a big domestic country (θ=1/4)



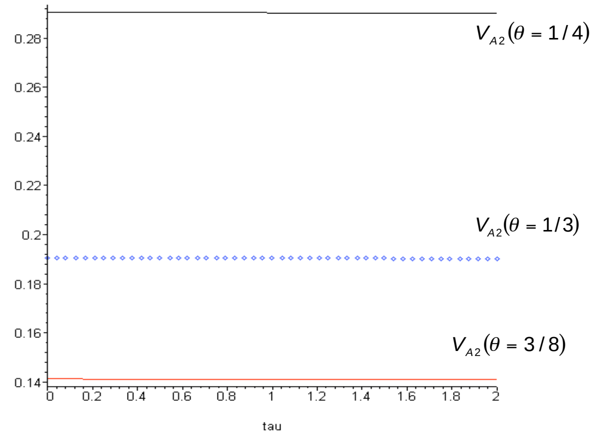
Finally, figure 4 shows the welfare impacts of RI on each domestic location for different scenarios when there is a border effect.

Figure 4: BE case. Welfare implications

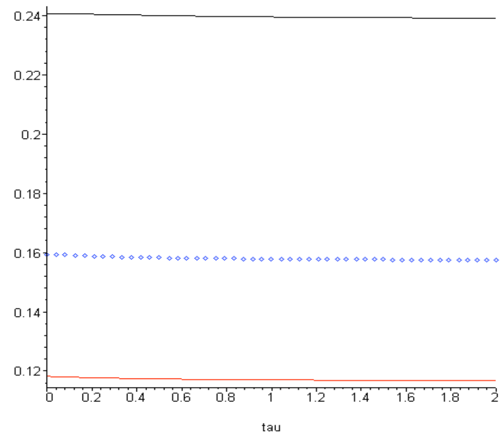
V_{A1}, case of a big remote location (ρ=0,4)



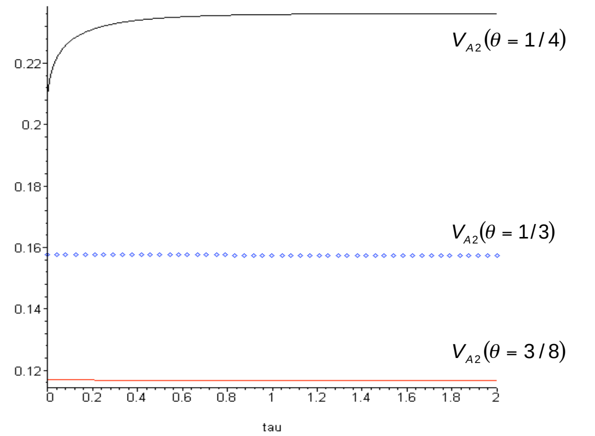
V_{A2}, case of a big remote location (ρ=0,4)



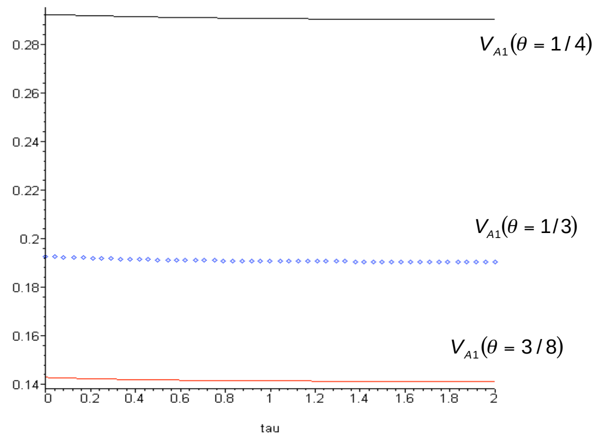
V_{A1}, case of symmetrically sized locations (ρ=0,5)



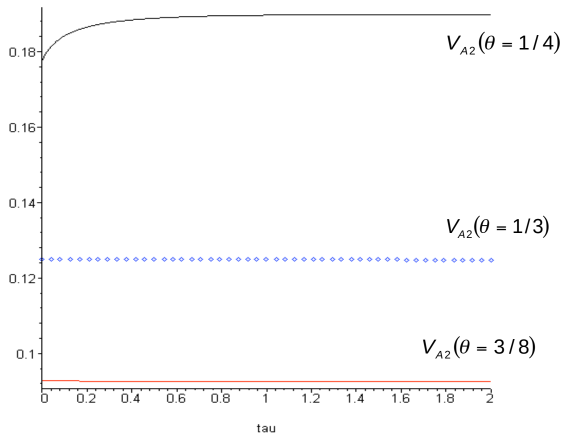
V_{A2}, case of symmetrically sized locations (ρ=0,5)



V_{A1}, case of a large border location (ρ=0,6)



V_{A2}, case of a large border location (ρ=0,6)



References

Alonso-Villar, O. (2001).“Large metropolies in the Third World: an explanation”, *Urban Studies* 38 (8), pp.1359-1371.

Baldwin, R. and F. Robert-Nicoud (2000). “Free trade agreements without delocation”, *Canadian Journal of Economics* 33 (3), pp. 766-786.

Baldwin, R. and F. Venables (1995). “Regional Economic Integration” in *Handbook of International Economics*, Volume III, Ed Grossman and Rogoff, pp. 1597-1644.

Baldwin, R., R. Forslid and J. Haland (1996). “Investment Creation and Diversion in Europe” *The World Economy* 19(6), pp. 635-659.

Baldwin, R., R. Forslid, P. Martin, G.I.P. Ottaviano and F. Robert-Nicoud (2003). **Economic Geography and Public Policy**. CUP.

Behrens, K., C. Gaigné, G.I.P. Ottaviano and J-F. Thisse (2003). “Interregional and international trade: Seventy years after Ohlin”, mimeo.

Crozet M. and P. Koening-Soubeyran (2002). “Trade liberalization and the internal geography of countries”, *CREST Discussion Paper* N 2002-37.

de Sá Porto, Paulo C. (2000). “MERCOSUR and Regional Development in Brazil: A Gravity Model Approach”, CD-ROM Annual Meeting LACEA.

Dixit, A. and J. Stiglitz (1977). “Monopolistic competition and the optimum product diversity”, *American Economic Review* 67, pp. 297-308.

Fujita, M., P. Krugman and A. Venables (1999). **The Spatial Economy. Cities, Regions and International Trade**. Cambridge, MA: MITPress.

Henderson, V. (1996). “Ways to Think about Urban Concentration: Neoclassical Urban Systems versus the New Economic Geography”, *International Regional Science Review* 19 (1&2), pp. 31-36.

Krugman, P. (1991). “Increasing returns and economic geography”, *Journal of Political Economy* 99, pp. 483-499.

Krugman, P. (1996). “Urban Concentration: The Role of Increasing Returns and Transport Costs”, *International Regional Science Review* 19 (1&2), pp. 5-30.

Krugman, P. and R. Livas Elizondo (1996). “Trade policy and the third world metropolies”, *Journal of Development Economics* 49(1)), pp. 137-150.

Martin, P. and C.A. Rogers (1995). “Industrial location and public infrastructure”, *Journal of International Economics* 39, pp. 335-351.

Moncarz, P. (2004). “Unilateral trade liberalisation and the spatial distribution of economic activity within a country”, mimeo, University of Nottingham.

Monfort, P. and R. Nicolini (2000). “Regional convergence and international integration”, *Journal of Urban Economics* 48, pp. 286-306.

Ottaviano, G.I.P. and J-F. Thisse (2004). “Agglomeration and economic geography” in *Handbook of Regional and Urban Economics*, Volume 4, Part III, Ed. Henderson and Thisse.

Paluzie, E. (2001). “Trade policies and regional inequalities”, *Papers in Regional Science* 80, pp. 67-85.

Puga, D. and A. Venables (1997). “Preferential trading arrangements and industrial location”, *Journal of International Economics* 43, pp. 347-368.

Terra, M.I. and M. Vaillant (1997). “Política comercial y política de infraestructura: un ejercicio de simulación de los impactos regionales en el Mercosur”, Documento No.7/97, Departamento de Economía, Universidad de la República, Uruguay.

Volpe Martincus, C. (2004). “Do economic integration and fiscal competition help to explain location patterns?”, ZEI, University of Bonn.

INSTITUTE OF DEVELOPMENT
POLICY AND MANAGEMENT

UNIVERSITY
OF ANTWERP