The Welfare Effects of Bilateral versus Multilateral Trade and Investment Liberalization

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Abstract

To assess the welfare effects of bilateral versus multilateral trade and/or investment liberalization in general equilibrium, we set-up a three country knowledge-capital model of trade and multinational activity. Furthermore, we explicitly highlight the different effects of bilateral liberalization on insiders and outsiders. Bilateral investment liberalization between a developed and a developing country increases the insiders’ welfare but reduces the welfare of a developing outsider. But a bilateral investment liberalization between developing economies unlikely exerts adverse effects on a developed outsider. A multilateral investment liberalization between these economies tends to benefit all involved countries, even after a bilateral liberalization at an earlier stage.

Key words: Investment Liberalization; Trade Liberalization; Bilateral versus Multilateral Liberalization; Welfare Effects

JEL classification: F12; F23

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1 Introduction

It is now common wisdom that large market size and a low ratio of fixed foreign plant set-up costs to transport costs stimulate the activity of horizontal multinational enterprises (MNEs) at the expense of trade (Markusen and Venables, 1998, 2000), and large international factor cost differences plus low levels of both fixed foreign plant set-up costs and transport costs favor vertical MNEs (Helpman, 1984; Zhang and Markusen, 1999). Both motives of multinational production have recently been incorporated into the knowledge-capital model of trade and MNEs (Carr et al., 2001, Markusen, 2002, Markusen and Maskus, 2002).

Two aspects are worth noting with respect to these trade models of MNEs. First, most of them focus on a world of only two countries (Ekholm et al., 2003, provide a theory of platform FDI and Yeaple, 2003, studies the effect of trade liberalization on complex firm integration patterns, being an exception in this respect). Second, they concentrate on the role of country size, factor endowments and, most importantly, trade and investment costs on the equilibrium firm configuration, but with the exception of Markusen (1997, 2002) theoretical evidence on the welfare effects of trade and investment liberalization is scarce.¹

Regarding investment liberalization, we observe that the number of signed investment treaties is extremely fast growing since the mid 60s. According to the United Nations (2000), 1856 bilateral investment treaties have been signed until 1999. These treaties reduce investment risks and they ensure firms of certain rights, preserve them from expropriation and, in turn, they reduce the firms’ costs of going multinational in a wide sense. As illustrated in Figure 1, the number of treaties between the developed OECD economies and the less developed rest of the world (RoW) initially increased most quickly, making up the largest share in 1999. However, since the early 90s the contracted treaties between RoW economies grows even faster. Intra-OECD relations make only a small share of the overall number of treaties.²

¹ Wong (2001) analyzes the impact of (unilateral and bilateral) investment liberalization but in a different setting, namely a specific factors model.
² Of course, one reason for the latter is that many of the OECD countries take part in free
We associate the establishment of bilateral investment treaties with a reduction of bilateral foreign plant set-up costs in a broad sense. In this respect, it is of special interest how bilateral treaties between the OECD and part of the RoW affect other RoW economies’ welfare.

Since a couple of years there is a vivid political discussion about multilateral investment liberalization. For instance, the Multilateral Agreement on Investment (MAI), launched by governments at the annual meeting of the OECD council at ministerial level in May 1995, intended to be a “free-standing agreement open to accession by all countries”. Accordingly, Argentina, Brazil, Chile, and Hong-Kong participated as observers from an early stage, and Estonia, Latvia, Lithuania, and the Slovak Republic followed later on. The proposed objective of the MAI was to “establish a broad multilateral framework for international investment with high standards for the liberalization of investment regimes and investment protection and with effective dispute settlement procedures”. At their last meeting in October 1998 member countries of the OECD failed to agree on this global investment pact. Now the EU promotes such an agreement with the developing economies, similar to the General Agreement on Trade and Services (GATS), but covering additionally the manufacturing sector. The latter agreement is argued to reduce investment costs through more transparency and a reduction of uncertainty with respect to impediments to foreign direct investment. In this regard, one could ask whether a multilateral reduction in investment costs raises welfare in all involved countries and whether it is preferable from an insider’s point of view to establish a multilateral agreement, if a bilateral one has already been in place. To the best of our knowledge, general equilibrium theory is so far silent on both questions.

trade areas or customs unions, where investment is protected by multilateral agreements on factor mobility and the protection of expropriation rather than bilateral treaties.


Insights into these issues cannot be derived from a two-country approach. Accordingly, we set-up a three-country knowledge-capital model of the multinational firm in order to study the different welfare effects of bilateral liberalization on insiders versus outsiders and that of bilateral versus multilateral liberalization. However, in a three-country setting additional degrees of freedom arise with respect to the modelling of plant configurations. The most important difference to the existing models is that (i) we allow horizontal firms to set-up either two plants (supplying consumers in only two economies) or three plants (serving each market locally), and (ii) vertical MNEs may establish either one or two foreign production plants. We do not restrict vertical two plants MNEs to serve their home market only from the cheapest production location, but they may export from both host economies to their home country. This is an Armington assumption in the sense that consumers perceive a variety from the same firm as different according to its country of production.\(^5\) There is broad evidence that similar goods from different countries are only imperfect substitutes for each other (Baier and Bergstrand, 2001, Blonigen and Wilson, 1999). In our context, the Armington assumption is extremely important. This shows up in the equilibrium firm configuration, where vertical MNEs (but not horizontal ones) are active even in completely similar economies as long as transport costs are not too high. In contrast, at given transport costs and world endowments horizontal MNEs arise if we reallocate factor endowments between two of the economies. Thereby, the paper may also contribute to the discussion of the determinants of horizontal and vertical firm activity. According to Hanson et al. (2001, 2003), vertical MNEs seem much more important than horizontal ones, also within the highly developed OECD economies. Our model (though only considering unbundling of service and production activities but ignoring vertical aspects in the

\(^5\)Noteworthy, (i) the Armington assumption is only relevant for vertical MNEs since no other firm supplies consumers from more than a single production location (horizontal MNEs by assumption do not engage in trade at all), (ii) though vertical two-plant MNEs may not serve the second host market via exports by assumption, relaxing the latter would not change our main results. Here, we stick to the traditional assumption that vertical MNEs trade only with their home country but serve the host countries locally, which inter alia implies that we exclude the possibility of platform FDI (see Ekholm et al., 2003, on the latter).
production process itself) is able to explain at least part of this stylized fact through Armington differentiation within multinational firms.

To draw conclusions about the welfare consequences of bilateral versus multilateral trade and/or investment liberalization, we look at three economies. In the center of the factor box, one of them is capital and skilled labor abundant and large, but the two RoW countries are (identical and) unskilled labor abundant and relatively small. We hold both the overall world’s and the capital abundant economy’s endowment constant and investigate the consequences of liberalization at different endowment allocations in the RoW factor box. Then, we focus on the consequences of bilateral liberalization versus multilateral liberalization on the one hand and bilateral liberalization between the fixed economy and one RoW country as compared to bilateral liberalization between the two RoW economies.

Regarding the stylized facts on bilateral investment treaties and the attempts to establish multilateral agreements on investment, the simulation results can be summarized in the following way. First, bilateral investment liberalization between the capital abundant and one unskilled labor abundant country exerts positive welfare effects on the insiders, but negative ones on the unskilled labor abundant outsiders. Second, a bilateral investment liberalization between developing, unskilled labor abundant economies is unlikely to adversely affect the developed, capital abundant outsider, since in this case a small investment liberalization is potentially not strong enough to stimulate FDI between these economies. The reason is that capital rentals are too high due to their factor endowments. From this perspective, it is not surprising that bilateral investment treaties between non-OECD economies have been mainly concluded since the early 90s, when part of the non-OECD countries (namely the south-east Asian and south American ones) exhibited already sizeable GDP per capita and capital-labor ratios. Third, a multilateral investment liberalization between the developed and the developing economies dominates the welfare effects of a bilateral liberalization, also for the insiders of the latter. Hence, from a knowledge-capital model of multinationals point of view we would recommend the involved parties to conclude such a multilateral agreement. Put differently, we should prob-
ably search for pure political rather than economic reasons of its potential failing. Fourth, bilateral liberalization between two relatively capital abundant countries dominates a multilateral liberalization between these two economies and a labor abundant, developing country. Hence, there are economic reasons why multilateral agreements on investment such as the MAI failed to come into existence so far.

The remainder of the paper is organized as follows. The next section sets up a three-factor and three-country knowledge-capital model of trade and multinational firms. Section 3 summarizes the findings from numerical simulations, and Section 4 concludes.

2 Theoretical Model

2.1 Households

We assume a nested homogeneous Z-goods and differentiated X-goods utility function, the latter are characterized by a love for variety à la Dixit and Stiglitz (1977):

\[
U_i = \left[ F_{ii} x_{ii}^{-\frac{\epsilon}{\epsilon-1}} + F_{ji} x_{ji}^{-\frac{\epsilon}{\epsilon-1}} + F_{ki} x_{ki}^{-\frac{\epsilon}{\epsilon-1}} \right] ^{\frac{\epsilon}{\epsilon-1}} (Z_{ii} + Z_{ji} + Z_{ki})^{1-\alpha},
\]

where

\[
\tilde{x}_{ji} = \frac{x_{ji}}{(1+\tau)(1+t_{ij})}
\]
\[
F_{ii} = (n_i + h_{ij} + h_{ik} + h_{ji} + h_{jik} + h_{ki} + h_{kij} + v_{ji} + v_{jik} + v_{ki} + v_{kij})
\]
\[
F_{ji} = (n_j + v_{ij} + v_{ijk})
\]
\[
F_{ki} = (n_k + v_{ik} + v_{ijk}),
\]

where \(U_i\) is country \(i\)’s welfare level, \(i = 1, 2, 3\), \(\alpha\) refers to the fixed Cobb-Douglas expenditure share for differentiated goods, and \(\epsilon > 1\) denotes the elasticity of substitution between varieties. Consumers in \(i\) buy goods from three main types of firms: NEs (\(n_i\)), horizontal MNEs (\(h\)), and vertical MNEs (\(v\)). Since there are three countries under consideration, horizontal MNEs may either run two or three production plants (only one at a market) to save transport costs and serve consumers locally.
Accordingly, there are up to three subscripts, where the first one indicates the parent country, and the other indices the host countries. Similarly vertical MNEs may run up to two plants abroad and serve the domestic market by imports from their foreign affiliates. This assumption leads to an Armington (1969)-type differentiation of products. Products are differentiated according to their origin of production. Consumers of a country headquartering a vertical MNE which produces in both foreign countries therefore perceive imported goods of the same firm from every foreign country as different.

To simplify the exposition of the model, we denote the number of firms serving market \( i \) from local production by \( F_{ii} \), and firms which serve market \( i \) from plants in \( j \) \((k)\) by \( F_{ji} (F_{ki}) \). Quantities \((x, Z)\) are indexed twice, where the first subscript denotes the country of origin (production) and the second one the country of consumption.

Identical iceberg transport costs \((\tau)\) on both types of goods and heterogeneous tariffs on both homogeneous and differentiated goods \((t_{ij} \forall i \neq j)\) impede goods trade, where subscripts again denote the source and destination country of exports, respectively. Hence, country \( j \) levies tariffs \( t_{ij} \) on imports of goods from country \( i \). In quantity terms, one unit of consumption of an \( X \)-variety in country \( j \) requires a firm in \( i \) to send \((1 + \tau)(1 + t_{ij})\) units. For convenience, export quantities of the differentiated product \((x_{ij} \forall i \neq j)\) are defined as (both national and vertical MNE) firm-specific productions for the respective foreign market, whereas the homogenous goods export quantities \((Z_{ij} \forall i \neq j)\) are normalized to represent consumed rather than produced quantities. Clearing of production markets and the complementary goods prices imply

\[
x_{ii} \geq p_i^{-\epsilon} s_i^{-1} \alpha E_i \quad \bot \quad p_i \geq 0. \tag{2}
\]
\[
x_{il} = p_i^{-\epsilon} ((1 + \tau)(1 + t_{il}))^{1-\epsilon} s_i^{-1} \alpha E_i, \quad l = j, k. \tag{3}
\]
\[
Z_{ii} + Z_{ji} + Z_{ki} \geq \frac{1 - \alpha}{q_i} E_i \quad \bot \quad q_i \geq 0. \tag{4}
\]

where \( \bot \) indicates that at least one of the adjacent conditions has to hold with equality. \( p \) is the price of an \( X \)-variety and \( q \) that one of the \( Z \)-good. All varieties produced and consumed at the same location \((x_{ii})\) sell at the same price due to
identical marginal costs. The consumer price in $i$ of varieties from $j$ amounts to $p_j(1 + \tau)(1 + t_{ji})$. Prices of the homogeneous good (produced under perfect competition) consumed in a country are identical irrespective of where the good originates from. $s_i$ denotes the price aggregator of varieties consumed in $i$:

$$s_i = [F_{ii}p_i^{1-\epsilon} + F_{ji}(p_j(1 + \tau)(1 + t_{ji}))^{1-\epsilon} + F_{ki}(p_k(1 + \tau)(1 + t_{ki}))^{1-\epsilon}]^{1/\epsilon}$$

(5)

### 2.2 Factor Markets and Production

Assuming that $Z$-production uses only unskilled labor ($L$) and taking the price of $Z$ in market 1 ($q_1$) as the numéraire, marginal costs satisfy

$$c_{zi} \geq w_{Li} \perp Z_{ii} \geq 0,$$

(6)

where $w_{Li}$ denotes the wage rate of unskilled labor in $i$. Hence, we have

$$c_{zi}(1 + \tau)(1 + t_{li}) \geq q_l \perp Z_{li} \geq 0, \quad l = j, k.$$  

(7)

$K$, $L$ and $S$ are endowments of capital, unskilled labor and skilled labor. The fixed input coefficients for country $i$ are $a_{Kx}$, $a_{Lx}$, $a_{Sx}$. Since national firms, and horizontal and vertical MNEs use capital to set-up plants ($a_{Kn}$, $a_{Khij}$, $a_{Kvij}$, $a_{Khij2}$ and $a_{Kvij2}$ for MNEs with two foreign affiliates, respectively) and skilled labor to generate firm-specific assets like blue-prints ($a_{Sn}$, $a_{Sh}$, $a_{Sv}$), factor market clearing implies

$$K_i \geq a_{Kx}(F_{ii}x_{ii} + F_{ij}x_{ij} + F_{ik}x_{ik}) + a_{Kn}n_i + a_{Khij}h_{ij} + a_{Khik}h_{ik} + a_{Khi2}h_{ijk} + a_{Khi}2 + a_{Kvij} + a_{Kvij2} + a_{Kvij2} + a_{Kvij2} =$$

$$a_{Khij2}h_{ijk} + a_{Kvij} + a_{Kvij2}v_{ij} + a_{Kvij2}v_{ijk} \perp w_{Ki} \geq 0$$  

(8)

$$L_i \geq a_{Lx}(F_{ii}x_{ii} + F_{ij}x_{ij} + F_{ik}x_{ik}) + Z_{ii} + (Z_{ij}(1 + t_{ij}) + Z_{ik}(1 + t_{ik}))(1 + \tau) \perp w_{Li} \geq 0$$

(9)

$$S_i \geq a_{Sx}(F_{ii}x_{ii} + F_{ij}x_{ij} + F_{ik}x_{ik}) + a_{Sn}n_i + a_{Sh}(h_{ij} + h_{ik} + h_{ijk}) + a_{Sv}(v_{ij} + v_{ik} + v_{ijk}) \perp w_{Si} \geq 0,$$

(10)

with $w_{Ki}$, $w_{Li}$, and $w_{Si}$ denoting factor rewards in $i$. We define $a_{Kn} = a_{Sn} = 1$, $a_{Sh} = a_{Sv} = 1 + \delta$, $a_{Khij} = 2 + \gamma_{ij}$, $a_{Khij2} = 3 + \gamma_{ij} + \gamma_{ik}$, $a_{Kvij} = 1 + \gamma_{ij}$, $a_{Kvij2} =
2 + γij + γik, where δ is the additional skilled labor usage to generate firm specific assets required in a multinational network, and γij denotes the additional capital requirement for firms of parent country i running a foreign affiliate in j. Variable unit costs of X-production in i are 

\[ c_{xi} = a_{Kx}w_{Ki} + a_{Lx}w_{Li} + a_{Sx}w_{Si} \]

Fixed markup pricing obtains

\[ p_i \leq c_{xi} \frac{\epsilon}{\epsilon - 1} \quad \perp \quad x_{ii} \geq 0. \] (11)

Free entry implies zero profits, since operating profits are used to cover fixed costs. The number of firms is determined by Chamberlin’s ”tangency solution”. Since national firms i have to bear fixed costs of 

\[ a_{Kn}w_{Ki} + a_{Sn}w_{Si}, \]

we have

\[ a_{Kn}w_{Ki} + a_{Sn}w_{Si} \geq \frac{p_i(x_{ii} + x_{ij} + x_{ik})}{\epsilon} \quad \perp \quad n_i \geq 0 \] (12)

and similarly for vertical and horizontal MNEs:

\[ a_{Khi}w_{Ki} + a_{Shi}w_{Si} \geq \frac{p_i x_{ii} + p_j x_{jj}}{\epsilon} \quad \perp \quad h_{ij} \geq 0 \] (13)

\[ a_{Khi2}w_{Ki} + a_{Shi}w_{Si} \geq \frac{p_i x_{ii} + p_j x_{jj} + p_k x_{kk}}{\epsilon} \quad \perp \quad h_{ijk} \geq 0 \] (14)

\[ a_{Kii}w_{Ki} + a_{Si}w_{Si} \geq \frac{p_j(x_{jj} + x_{ji})}{\epsilon} \quad \perp \quad v_{ij} \geq 0 \] (15)

\[ a_{Kii}w_{Ki} + a_{Si}w_{Si} \geq \frac{p_j(x_{jj} + x_{ji}) + p_k(x_{kk} + x_{ki})}{\epsilon} \quad \perp \quad v_{ijk} \geq 0. \] (16)

### 2.3 Income, Balance of Payments and Welfare

We assume that all factors are owned by households, so that consumer income (i.e., GNP) in country i is given by

\[ E_i = \underbrace{w_{Ki}K_i + w_{Li}L_i + w_{Si}S_i + t_{ji}F_{ji}p_jx_{ji} + t_{ki}F_{ki}p_kx_{ki}}_{A} + \underbrace{t_{ji}q_jZ_{ji} + t_{ki}q_kZ_{ki}}_{B} - \underbrace{t_{ij}q_jZ_{ij} - t_{ik}q_kZ_{ik}}_{C} \]

\[ - \underbrace{t_{ij}q_jZ_{ij} - t_{ik}q_kZ_{ik}}_{D} + \underbrace{t_{ji}F_{ji}p_jx_{ji} - t_{ik}F_{ik}p_kx_{ki}}_{E}, \] (17)

where ”A” are factor rewards, ”B” is tariff income from X-sector imports, ”C” are tariff revenues from Z-sector imports, ”D” is country i’s tariff payments to j and k.
from X-sector exports, which has to be subtracted in order to avoid double counting due to the formulation of \( x_{ij} \). Note that tariff payments are included in country \( i \)'s factor rewards. Similarly, we subtract country \( i \)'s tariff payments to \( j \) and \( k \) from Z-sector exports labelled as "E".\(^6\) The equivalence of total factor income (\( E_i, E_j, E_k \)) and demand in each economy implicitly balances international payments.

Welfare is measured by the direct utility function, as we are interested in either the relative welfare outcomes between experiments or only the sign of the corresponding welfare change. The overall change in utility induced by liberalization is

\[
\Delta U_i = U_{i1} - U_{i0},
\]

where superscript 1 (0) indicates the post-liberalization (pre-liberalization) values.

### 3 The Welfare Effects of Liberalization

It is well known that the knowledge-capital model is not analytically tractable due to numerous slackness conditions (see Markusen, 2002). This holds even more true for our approach, which departs from the standard assumptions of two production factors and countries. Accordingly, we solve the model numerically to provide insights in the welfare effects of trade and investment liberalization.

Regarding the stylized facts about the occurrence of bilateral investment liberalization and the political discussion of the establishment of multilateral agreements on investment, liberalization of investment and trade between a large, capital and skilled labor abundant economy (to be associated with, e.g., the EU) and two smaller, unskilled labor abundant economies (associated with the developing countries or blocs thereof) is of special interest for our purpose. In this case, dissimilarity in both size and factor endowments between countries/blocs dominates, even if the two developing economies are identical.

To infer the relevance of country size and relative factor endowments, we hold coun-

\(^6\)Remember that, in quantity terms, one has to send \( x_{ij}(1 + \tau)(1 + t_{ij}) \) or \( Z_{ij}(1 + \tau)(1 + t_{ij}) \) units in order that \( x_{ij} \) or \( Z_{ij} \) units arrive.
try 1 fixed at a single endowment point, but we look at different endowments of the two developing economies (RoW). We focus on the consequences of trade and investment liberalization, pure investment liberalization, and pure trade liberalization. Thereby, we distinguish between bilateral and multilateral liberalization of the same magnitude. Hence, we once reduce $t$ and/or $\gamma$ between only two and once between all three economies under consideration. The three factors of production involve a factor cube rather than a rectangle, however we confine ourselves to two segments of the cube: one where skilled labor ($S$) is set at 50% of the respective RoW endowment, and one with unskilled labor ($L$) set at 50% of the RoW endowment. To draw conclusions on the welfare effects, we ”pool” the insights from both segments. Each of the two segments consists of $51 \times 51$ endowment points for the RoW, so that for each liberalization experiment we extract information from 5202 endowment points altogether. Table 1 provides information on the factor endowment assumptions, model parameters which are identical for all liberalization experiments, and the policy parameters of both the baseline case and the different liberalization experiments. Additionally, we introduce for each experiment an abbreviation, which is referred to below.

Before we summarize the welfare effects of different liberalization experiments based on our numerical exercises, we briefly discuss the firm regimes in the baseline scenario.

## 3.1 Firm Regimes in the Baseline Scenario

Note again that country 1 is large and both relatively capital and skilled labor abundant as compared to the RoW, there are no RoW-based national firms active in the center of the endowment cube. All trade is either in homogeneous goods or in vertical MNE exports of varieties. Interestingly, country 1 runs both horizontal and vertical MNEs with production plants in both RoW countries. Horizontal three-plant firms are profitable, since the two foreign markets are large enough. Vertical two-plant MNEs bear lower plant specific fixed costs (there is no plant in country 1) than horizontal three-plant enterprises, they may exhaust specialization gains from
international factor cost differences and are attractive for the headquartering country due to the variety effect. Noteworthy, it is especially attractive to run horizontal three-plant firms, if one of the RoW countries exhibits an extremely high capital to unskilled labor ratio (e.g., in the upper left corner of the capital to unskilled labor segment of the cube, where $S$ is identical in both RoW economies). Then, fixed country 1’s capital rental is very low, since one of the RoW economies is relatively capital abundant (even more so than country 1) and runs foreign plants even in economy 1. In this case, cheap capital and the skilled labor abundance together motivate economy 1-based horizontal MNEs to run a plant in each foreign market. Further, it does not pay then for a vertical country 1-based MNE to operate two foreign plants, since in one of the RoW economies unskilled labor is so scarce that production possibilities in that country are very limited and therefore the gains from supplying an additional variety are low. In the center of the RoW endowment cube, both RoW economies run vertical MNEs with a single plant in country 1. From the perspective of a RoW firm, there are three options to serve the RoW home market and country 1’s market together: (i) local production and exporting by national firms, (ii) local production abroad and re-exporting by vertical MNEs, and (iii) local production by horizontal MNEs in both markets. By and large, serving market 1 by foreign MNE production and re-exporting to the small home market induces less transport costs than exports from there to country 1 by RoW national firms. Additionally, plant specific fixed costs are lower for vertical MNEs than for horizontal ones, and the home market is too small to justify the set-up of a second plant.

If the three economies were identical in the center of the factor cube at the assumed world factor endowment, all three economies would run both national firms and two-plant vertical MNEs, whereas no three-plant horizontal MNEs would exist. This highlights the difference between our set-up and the two-country outcome in Carr et al. (2001), Markusen (2002) or Markusen and Maskus (2002). There, vertical MNEs do not exist, if countries are identically endowed, since the main reason of their existence is the possible exploitation of specialization gains through international factor price differences. Our outcome is driven by two effects: (i) ver-
tical MNEs save fixed plant set-up costs as compared to horizontal three-plant ones (cost-savings-effect), and (ii) they serve the home market from two foreign locations (Armington effect). Since the cost-savings argument applies also to Carr et al. (2001) or Markusen (2002), it is obviously insufficient to explain the activity of vertical MNEs in identically endowed economies. The Armington effect is the important one. Due to our Dixit and Stiglitz (1977) love of variety assumption, consumers perceive imports from a single MNE from different countries of production as different varieties. Accordingly, they would strictly prefer imports from two countries over the same amount of local supply by a horizontal MNE. This holds true up to a critical value of transport costs. This mechanism is not present in the two-country case, since both horizontal and vertical MNEs only supply a single variety at each market. In the essence, the argument is less technical than it seems. For instance, Volkswagen operates several production plants in different European economies, exhibiting relatively similar factor endowments (Seat in Spain, Audi and Volkswagen in Germany, Skoda in Czech Republic; research and development is concentrated in Germany).\(^7\) At least, all these economies are part of the OECD, where factor price differences are much lower than between OECD and non-OECD countries. Obviously, consumers perceive these cars as different, although they are relatively similar in technical terms.\(^8\) On the other hand, there are MNEs which

\(^7\)Of course, that Volkswagen produces also in the home country is at odds with the standard assumptions about vertical MNEs in the knowledge-capital model. However, that it re-exports similar products squares with the assumptions of the horizontal model. We nevertheless believe that the vertical aspects (disentangling research and production in principle) in the organization of Volkswagen dominate the horizontal ones (producing only for the local market). In our model, we could also allow firms to trade and produce at the home location, but this would render the analysis of the existence of vertical versus horizontal firms impossible. Our model implies that German consumers prefer Volkswagen to produce slightly different varieties (also) in Spain and Czech Republic and re-export cars from there as compared to supplying just Volkswagen from German production.

\(^8\)Of course, we observe that vertical MNEs not only supply their goods in the host and home country but also to consumers in third markets. This is precluded by assumption in our theoretical model. However, relaxing this assumption would only enforce the Armington effect but render the general results unchanged, with the exception that liberalization between the RoW economies may exert a different welfare effect, since country 1 based two-plant vertical MNEs are then affected
produce varieties for a specific local market without trading them. For instance, Japanese cars produced in Europe are not exported to Japan.

Summing up, our approach may contribute to the discussion about the relative importance of horizontal and vertical MNEs. Hanson et al. (2001, 2003) for instance argue that vertical MNEs are much more important than horizontal ones. Our model suggests that this phenomenon may easily be explained by the knowledge-capital model if one considers more than two economies, as long as consumers perceive imports from different source economies as different varieties, irrespective of whether they originate from different firms or not.

With respect to the RoW countries, it is important to know how a reallocation of factor endowments within the RoW (i.e., moving away from the RoW center of the endowment cube) affects the firm regimes. Concentrating on the existence of three-plant horizontal and two-plant vertical MNEs headquartered in country $j$, this issue is illustrated in Figure 2. Due to symmetry, it is sufficient to only look at one RoW economy. It is obvious that the RoW country’s capital to skilled labor endowment ratio is essential. Horizontal three-plant firms only arise in large countries, where the capital to skilled labor ratio is sufficiently high. Vertical two-plant MNEs come into existence in large countries, where the capital to skilled labor ratio is lower. In an intermediate range, both types of firms may co-exist.

![Figure 2](image)

3.2 Bilateral versus Multilateral Liberalization

Table 2 summarizes our main findings of the welfare effects of bilateral or multilateral liberalization. To give the analysis more focus, we concentrate on the comparison of multilateral and bilateral liberalization, where we allow the latter to take place either between country 1 and one of the RoW economies (2) or between two RoW countries (2 and 3). All reported relations between the liberalization scenarios refer to the median of the distribution of welfare changes.

differently.
In our case, multilateral liberalization dominates bilateral liberalization in welfare terms, irrespective of whether MUTIL, MUIL, or MUTL are concerned. It turns out that bilateral trade liberalization negatively affects any outsider. Bilateral investment liberalization only reduces an unskilled labor abundant, small, developing outsider’s welfare. In contrast, bilateral investment liberalization between the developing RoW economies exerts at the median neither an impact on the developed outsider nor on the insiders. The reason is that liberalization between the developing countries is not strong enough to motivate MNE activity between them. Put differently, small-scale bilateral investment liberalization between RoW economies is likely an irrelevant policy at the median.

Further insights on the distribution of the welfare effects of multilateral versus bilateral liberalization arise, if we look at the dominant policies in different areas of the factor cube. Therefore, we distinguish between four different regions in the two segments of the factor cube: two, where the RoW economies differ in size (but less in relative endowments), and another two, where they exhibit different relative factor endowments at similar size (see Figure 3). In each of the four regions as indicated in the figure, we look at the dominant policy evaluated at its median. The results are summarized in Table 3.

What needs to be explained from Table 3 is the following. (i) Why a capital abundant RoW economy prefers a bilateral liberalization over a multilateral one? (ii) Why can a capital scarce RoW economy not gain from investment liberalization of any kind as compared to no change? (iii) Why is BIIL for a small RoW insider preferable over MUIL? (iv) Why is country 3 (outsider of bilateral liberalization between capital abundant country 1 and developing country 2) not better off with any investment liberalization as compared to no change?

First, capital abundant RoW economies run at risk that foreign firms relocate the plants to a third economy, if investment is multilaterally liberalized. Accordingly,
they are in favor of a bilateral liberalization, where no incentive exists to do so. This rationalizes the failure of previous attempts to establish multilateral investment agreements such as the MAI. Second, extremely capital scarce economies do not run MNEs. Accordingly, a small-scale investment liberalization is likely not strong enough to encourage headquarters there. Third and similar to the first argumentation, a small insider is not very attractive for foreign MNEs. On the other hand, the large insider market 1 is extremely attractive for a small RoW country. Accordingly, the RoW insider is in favor of a bilateral liberalization, so that both relocation of firm activity to a third country and sharing the large insider market 1 with a third economy are costly. Fourth, country 3 may for exogenous reasons not establish a \( BIIL \) with economy 1. It is not better off from a \( BIIL \) with the other RoW economy, since a small-scale bilateral reduction in investment barriers is not strong enough to motivate firms from the second RoW country to go multinational. On the other hand, if the remaining two economies form a \( BIIL \) but one RoW country remains outside, there is a strong incentive for country 1 to relocate its MNE activity from this RoW economy to the other. This is also the case if a \( MUIL \) is established.

### 3.3 Decomposing Welfare: The Role of Import Consumption and Consumption from MNE Production

Above we have explained the most important mechanisms at work, which drive the welfare effects of trade and investment liberalization. Now, we focus on the \textit{structure} of these changes. For this, it seems useful to look at two important components of the welfare change: trade-induced ones arising from the change in a country’s share of import consumption \((CI)\), and MNE-induced ones originating from the change in the share of consumption of varieties supplied by MNEs \((CM)\). Noteworthy, import consumption also consists of two components: products of national firms and of vertical MNEs. Similarly, consumption of varieties produced by MNEs are either locally supplied or imported. Hence, \(CI\) and \(CM\) do not sum up to zero. Rather an increase in \(CI\) implies that the share of consumption of locally produced goods \((CL)\)
has declined, and a rise in $CM$ means that consumption from (foreign or domestic) national firms ($CN$) has declined.

We define the changes in welfare according to $CI$ ($CL$) and $CM$ ($CN$) in the following way (superscript 0 denotes pre-liberalization and 1 post-liberalization):

\[
\Delta U_{CLi} = \left( F_{ii}^1 (x_{ii})^{\frac{\alpha_i}{1-\alpha}} + F_{ji}^0 (\bar{x}_{ji})^{\frac{\alpha_i}{1-\alpha}} + F_{ki}^0 (\bar{x}_{ki})^{\frac{\alpha_i}{1-\alpha}} \right)^{\alpha_i}
\times \left( Z_{ii} + Z_{ji}^0 + Z_{ki}^0 \right)^{1-\alpha} - U_{i0}. 
\]

\[
\Delta U_{CIi} = \left( F_{ii}^0 (x_{ii})^{\frac{\alpha_i}{1-\alpha}} + F_{ji}^1 (\bar{x}_{ji})^{\frac{\alpha_i}{1-\alpha}} + F_{ki}^1 (\bar{x}_{ki})^{\frac{\alpha_i}{1-\alpha}} \right)^{\alpha_i}
\times \left( Z_{ii}^0 + Z_{ji} + Z_{ki}^1 \right)^{1-\alpha} - U_{i0}. 
\]

\[
\Delta U_{CMi} = \left( n_{i}^0 (x_{ii})^{\frac{\alpha_i}{1-\alpha}} + (F_{ii}^1 - n_{i}^1) (x_{ii})^{\frac{\alpha_i}{1-\alpha}} + n_{j}^0 (\bar{x}_{ji})^{\frac{\alpha_i}{1-\alpha}}
+ (F_{ji}^1 - n_{j}^1) (\bar{x}_{ji})^{\frac{\alpha_i}{1-\alpha}} + n_{k}^0 (\bar{x}_{ki})^{\frac{\alpha_i}{1-\alpha}}
+ (F_{ki}^1 - n_{k}^1) (\bar{x}_{ki})^{\frac{\alpha_i}{1-\alpha}} \right)^{\alpha_i}
\times \left( Z_{ii} + Z_{ji}^0 + Z_{ki}^0 \right)^{1-\alpha} - U_{i0}. 
\]

\[
\Delta U_{CNi} = \left( n_{i}^1 (x_{ii})^{\frac{\alpha_i}{1-\alpha}} + (F_{ii}^0 - n_{i}^0) (x_{ii})^{\frac{\alpha_i}{1-\alpha}} + n_{j}^1 (\bar{x}_{ji})^{\frac{\alpha_i}{1-\alpha}}
+ (F_{ji}^0 - n_{j}^0) (\bar{x}_{ji})^{\frac{\alpha_i}{1-\alpha}} + n_{k}^1 (\bar{x}_{ki})^{\frac{\alpha_i}{1-\alpha}}
+ (F_{ki}^0 - n_{k}^0) (\bar{x}_{ki})^{\frac{\alpha_i}{1-\alpha}} \right)^{\alpha_i}
\times \left( Z_{ii}^1 + Z_{ji} + Z_{ki}^1 \right)^{1-\alpha} - U_{i0}. 
\]

Of course, there are several technical possibilities to decompose welfare changes into these components. One could alternatively use the total differential to do so. In our case, the total differential approximates the utility change rather well for the average RoW economy. But it is less suited to capture the direction of changes as compared to our approach. This is illustrated in the Appendix, where we compare the two possibilities based on the mean squared error criterion (see the MSE values under the heading "Binary overall" in Table 5).

Table 4 summarizes the welfare decomposition. Again, the signs of the changes refer to the median of the distribution. The table looks at the changes in the components due to multilateral and bilateral liberalization.
Three issues are worth emphasizing. First, a bilateral liberalization between the two small RoW countries has either a positive effect on CI and/or CM or no effect at all, irrespective of which economy we look at. The reason is that small-scale investment liberalization within the RoW is likely irrelevant for intra-RoW FDI and trade. Second, investment liberalization and trade liberalization tend to work in different directions with respect to their impact on CI and CM as far as multilateral liberalization or bilateral liberalization between the large, capital abundant economy 1 and one of the developing RoW countries is concerned. Third, both MUTIL and MUTL tend to raise CI and to reduce CM in contrast to MUILL and BIIL. The reason is that MUTIL is particularly in favor of vertical MNEs, which engage in trade.

4 Conclusions

Over the last decades, we observe rising political interest in the reduction of trade and investment barriers at both the bilateral and the multilateral level. In a three factor knowledge-capital model of trade and multinational activity, this paper focuses on the potential welfare effects of bilateral versus multilateral liberalization on the one hand and on the consequences of bilateral liberalization on insiders versus outsiders on the other hand. We set up a model of three economies, where both horizontal and vertical multinationals are able to set up an affiliate in each foreign market. Further, vertical multinationals have an incentive to supply their home market from each host country due to Armington-type product differentiation. The latter involves an equilibrium plant configuration, where vertical multinationals dominate and arise also between completely similar economies. This seems well in accordance with the recent empirical evidence on the subject (Hanson et al., 2002, 2003). We choose the world allocation of factor endowments to obtain one large, developed (i.e., capital abundant) country and two remaining small, unskilled labor abundant (developing) economies. In this setting, we compare bilateral trade and/or investment liberalization with a corresponding multilateral counterpart. Regarding the welfare effects of liberalization policies, the findings from this model can
be summarized in the following way.

First, bilateral investment liberalization between a developed (capital abundant) and a developing (unskilled labor abundant) country positively (negatively) affects the insiders (developing outsider) in welfare terms. Second, a bilateral investment liberalization between developing economies unlikely exerts adverse effects on a developed outsider, since it is unlikely strong enough to stimulate FDI between these economies. Third, a multilateral investment liberalization between the developed and developing economies tends to generate welfare gains in all involved countries, also after a bilateral liberalization at an earlier stage. Fourth, two capital abundant economies prefer bilateral over multilateral liberalization to prevent the relocation of MNE activity to a third, unskilled labor abundant developing country.

According to these results, the model is able to cope with some of the most important stylized facts regarding the conclusion of bilateral investment treaties in the last decades. First, most bilateral investment treaties take place between the developed and the developing economies. Second, bilateral investment treaties between developing countries have been mainly concluded since the early 90s, after some of them (namely the south-east Asian and south American ones) have already accumulated sizeable own capital stocks. Third, the model rationalizes the facilitation of foreign direct investment between capital abundant economies such as the EU or NAFTA members. Finally, the failure of the OECD’s Multilateral Agreement on Investment may be explained by the capital abundant countries’ fear of plant relocation to third, unskilled labor abundant, developing countries.
5 References


A Decomposition of the Utility Function

We decompose the utility function in order to find out whether utility is positively or negatively influenced by the changes of real import consumption and real consumption from MNE production due to liberalization.

The first and natural way would be to take the total differential from the utility function and then change the variables of interest to isolate their effect on utility.

The total differential of the direct utility function is given by:

\[
dU_i = \left( \frac{\alpha}{\epsilon - 1} \right) U_{xi}^{(\frac{(\alpha-1)(\epsilon+1)}{\epsilon-1})} \left( \frac{\epsilon - 1}{\epsilon} \right) \left[ (x_i^0)^{-\frac{1}{\epsilon}} F_{xi}^0 dx_i^0 + (\ddot{x}_j^0)^{-\frac{1}{\epsilon}} F_{ji}^0 d\ddot{x}_j^0 \right.
\]

\[
+ \left( \frac{\alpha}{\epsilon - 1} \right) F_{ki}^0 d\ddot{x}_ki + \left( x_i^0 \right)^{-\frac{1}{\epsilon}} dF_ki + (\ddot{x}_j^0)^{-\frac{1}{\epsilon}} dF_ji + \left( \frac{\alpha}{\epsilon - 1} \right) F_{ki}^0 d\ddot{x}_ki + (\ddot{x}_j^0)^{-\frac{1}{\epsilon}} dF_ji + \left( \frac{\alpha}{\epsilon - 1} \right) F_{ki}^0 d\ddot{x}_ki + (\ddot{x}_j^0)^{-\frac{1}{\epsilon}} dF_ji \right]
\]

\[
\times \left( Z_i^0 + Z_j^0 + Z_k^0 \right)^{1-\alpha}
\]

\[
+ U_{xi}^{\frac{\alpha}{\epsilon - 1}} (1 - \alpha) \left( Z_i^0 + Z_j^0 + Z_k^0 \right)^{-\alpha} (dZ_i + dZ_j + dZ_k),
\]

(23)

where \( d \) is the differential operator and

\[
U_{xi} = \left( F_{xi}^0 \left( x_i^0 \right)^{-\frac{1}{\epsilon}} + F_{ji}^0 \left( \ddot{x}_j^0 \right)^{-\frac{1}{\epsilon}} + F_{ki}^0 \left( \ddot{x}_k^0 \right)^{-\frac{1}{\epsilon}} \right).
\]

In our context, there are two problems with the application of the total differential. First, we can not directly disentangle the effects of \( CI \) and \( CM \) on welfare. We would have to change several variables simultaneously, which leads to an accumulation of the approximation error. Second, as total welfare changes can be substantial, the approximation error of the linear approximation may be large. Even the direction of the approximation error may be difficult to predict in these circumstances. It depends on which variable changes and on the direction of this change.

We apply the decomposition exposed in Section 2.3. The total welfare change in this case is given by

\[
\Delta U_{CILi} = \Delta U_{CLi} + \Delta U_{CI}.
\]

(24)

\[
\Delta U_{CNMi} = \Delta U_{CMi} + \Delta U_{CNI}.
\]

(25)
For reasons of comparison, Table 5 gives an overview of the mean squared error (MSE) criterion of both the total differential and the applied welfare decomposition. Specifically, we look at the MSE based on the deviations of the approximated utility change from its true counterpart. Additionally, we look at the direction of the utility change, reflected by a discrete variable. The latter is set at zero if the direction of the change was correctly predicted, 2 if it predicts an opposite sign and 1 if it predicts a change although there is none or vice versa. What we can learn from this table is that the total differential is better than the alternative decomposition if changes in utility are small and real import consumption is of interest. In all other cases our decomposition has a lower MSE. Especially for the real consumption of MNE production and in the prediction of the direction of the welfare change our approximation is much better than the total differential approximation.

– Table 5 –

The reason for the very good approximation in the MNE case is that $Z$-good consumption is not decomposed. With the chosen parameters, especially large changes in the $Z$-sector are badly approximated in magnitude with our decomposition, as changes enter into the utility function with the power of 0.2. $X$-goods consumption enters the utility function with the power of 1.067 (i.e., more linearly) and, therefore, a decomposition is less harmful. We know that changes in $Z$-sector production are underestimated and changes in $X$-sector production are overestimated (see Figure 4) due to the powers with which they enter the utility function.

– Figure 4 –
Endowment configurations

<table>
<thead>
<tr>
<th>factor</th>
<th>values</th>
</tr>
</thead>
<tbody>
<tr>
<td>capital</td>
<td>$K_1 = 180; K_2 + K_3 = 60; 0.0005 &lt; K_2/(K_2 + K_3) &lt; 0.9995$</td>
</tr>
<tr>
<td>unskilled labor</td>
<td>$L_1 = 50; L_2 + L_3 = 50; 0.0005 &lt; L_2/(L_2 + L_3) &lt; 0.9995$</td>
</tr>
<tr>
<td>skilled labor</td>
<td>$S_1 = 72; S_2 + S_3 = 18; 0.0005 &lt; S_2/(S_2 + S_3) &lt; 0.9995$</td>
</tr>
</tbody>
</table>

Constant parameters

<table>
<thead>
<tr>
<th>parameter</th>
<th>value / source</th>
</tr>
</thead>
<tbody>
<tr>
<td>elasticity of substitution</td>
<td>$\epsilon = 4$ (see Markusen, 2002)</td>
</tr>
<tr>
<td>income share spent on differentiated products</td>
<td>$\alpha = 0.8$</td>
</tr>
<tr>
<td>iceberg transport costs</td>
<td>$\tau = 0.07$ (see Baier and Bergstrand, 2001)</td>
</tr>
<tr>
<td>additional skilled labor requirement</td>
<td>$\delta = 0.01$</td>
</tr>
<tr>
<td>input coefficients</td>
<td>$a_{Kx} = 0.6, a_{Lx} = 0.3, a_{Sx} = 0.1$</td>
</tr>
</tbody>
</table>

Policy parameters: baseline scenario

<table>
<thead>
<tr>
<th>parameter</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>tariffs</td>
<td>$t_{ij} = 0.15 \ \forall \ i \neq j$</td>
</tr>
<tr>
<td>additional capital</td>
<td>$\gamma_{ij} = 0.2 \ \forall \ i \neq j$</td>
</tr>
</tbody>
</table>

Policy parameters: liberalization experiments

<table>
<thead>
<tr>
<th>experiment</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>multilateral investment liberalization</td>
<td>$\Delta \gamma_{ij} = -0.1 \ \forall \ i \neq j$</td>
</tr>
<tr>
<td>multilateral trade liberalization</td>
<td>$\Delta t_{ij} = -0.075 \ \forall \ i \neq j$</td>
</tr>
<tr>
<td>multilateral trade and investment liberalization</td>
<td>$\Delta t_{ij} = -0.075; \Delta \gamma_{ij} = -0.1 \ \forall \ i \neq j$</td>
</tr>
<tr>
<td>bilateral investment liberalization between countries 1 and 2</td>
<td>$\Delta \gamma_{12} = \Delta \gamma_{21} = -0.1$</td>
</tr>
<tr>
<td>bilateral trade liberalization between countries 1 and 2</td>
<td>$\Delta t_{12} = \Delta t_{21} = -0.075$</td>
</tr>
<tr>
<td>bilateral trade and investment liberalization, countries 1 and 2</td>
<td>$\Delta t_{12} = \Delta t_{21} = -0.075; \Delta \gamma_{12} = \Delta \gamma_{21} = -0.1$</td>
</tr>
<tr>
<td>bilateral investment liberalization between countries 2 and 3</td>
<td>$\Delta \gamma_{23} = \Delta \gamma_{32} = -0.1$</td>
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<tr>
<td>bilateral trade liberalization between countries 2 and 3</td>
<td>$\Delta t_{23} = \Delta t_{32} = -0.075$</td>
</tr>
<tr>
<td>bilateral trade and investment liberalization, countries 2 and 3</td>
<td>$\Delta t_{23} = \Delta t_{32} = -0.075; \Delta \gamma_{23} = \Delta \gamma_{32} = -0.1$</td>
</tr>
</tbody>
</table>

Table 1: Parameter values and numerical simulation set-up
\[ \Delta U_j = \Delta U_k > \Delta U_i \] holds for all multilateral liberalizations on average.

Table 2: Ranking of welfare changes after different liberalization scenarios

<table>
<thead>
<tr>
<th>Country</th>
<th>Trade and investment liberalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MUTIL (&gt;) BITIL_{12} (&gt;) 0 (&gt;) BITIL_{23}</td>
</tr>
<tr>
<td>2</td>
<td>MUTIL (&gt;) BITIL_{12} (&gt;) BITIL_{23} (&gt;) 0</td>
</tr>
<tr>
<td>3</td>
<td>MUTIL (&gt;) BITIL_{23} (&gt;) BITIL_{12} (&gt;) 0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country</th>
<th>Investment liberalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MUIL (&gt;) BIIL_{12} (&gt;) BIIL_{23} (=) 0</td>
</tr>
<tr>
<td>2</td>
<td>MUIL (&gt;) BIIL_{12} (&gt;) BIIL_{23} (=) 0</td>
</tr>
<tr>
<td>3</td>
<td>MUIL (&gt;) BIIL_{23} (=) 0 (&gt;) BIIL_{12}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country</th>
<th>Trade liberalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MUTL (&gt;) BITL_{12} (&gt;) 0 (&gt;) BITL_{23}</td>
</tr>
<tr>
<td>2</td>
<td>MUTL (&gt;) BITL_{12} (&gt;) BITL_{23} (&gt;) 0</td>
</tr>
<tr>
<td>3</td>
<td>MUTL (&gt;) BITL_{23} (&gt;) 0 (&gt;) BITL_{12}</td>
</tr>
</tbody>
</table>

Table 3: Preferred policy in different areas in the factor box

<table>
<thead>
<tr>
<th>Country 2:</th>
<th>Capital abundant</th>
<th>Capital scarce</th>
<th>Large</th>
<th>Small</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>Trade and investment liberalization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MUTIL</td>
<td>MUTIL</td>
<td>MUTIL</td>
<td>MUTIL</td>
</tr>
<tr>
<td>2</td>
<td>BITIL_{12}</td>
<td>MUTIL</td>
<td>MUTIL</td>
<td>MUTIL</td>
</tr>
<tr>
<td>3</td>
<td>MUTIL</td>
<td>MUTIL</td>
<td>MUTIL</td>
<td>MUTIL</td>
</tr>
<tr>
<td>Country</td>
<td>Investment liberalization</td>
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</tr>
<tr>
<td>1</td>
<td>MUIL</td>
<td>MUIL</td>
<td>MUIL</td>
<td>MUIL</td>
</tr>
<tr>
<td>2</td>
<td>BIIL_{12}</td>
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<td>Trade liberalization</td>
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<td>1</td>
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<td>MUTL</td>
<td>MUTL</td>
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</tr>
<tr>
<td>2</td>
<td>BITL_{12}</td>
<td>MUTL</td>
<td>MUTL</td>
<td>MUTL</td>
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<tr>
<td>3</td>
<td>MUTL</td>
<td>MUTL</td>
<td>MUTL</td>
<td>MUTL</td>
</tr>
</tbody>
</table>
Trade and investment liberalization

<table>
<thead>
<tr>
<th>CI of country 1</th>
<th>CI of country 2</th>
<th>CI of country 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>+</td>
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<tr>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>−</td>
<td>−</td>
<td>0</td>
</tr>
</tbody>
</table>

CI is real import consumption and CM is consumption from production of MNEs.

Table 4: Decomposition of welfare changes

<table>
<thead>
<tr>
<th>Overall</th>
<th>$dU$</th>
<th>$\Delta U_{CIL}$</th>
<th>$\Delta U_{CNM}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.520</td>
<td>0.092</td>
<td>0.008</td>
</tr>
<tr>
<td>2</td>
<td>0.371</td>
<td>1.921</td>
<td>0.001</td>
</tr>
<tr>
<td>3</td>
<td>0.284</td>
<td>1.636</td>
<td>0.001</td>
</tr>
</tbody>
</table>

"Binary" overall

| 1       | 0.688| 0.136            | 0.025            |
| 2       | 0.445| 0.039            | 0.006            |
| 3       | 0.567| 0.035            | 0.004            |

Table 5: MSE of approximations
Figure 1: Number of bilateral investment treaties in different country blocs

![Number of Bilateral Investment Treaties in Different Country Blocs](image1)

Data source: World Bank and UNCTAD.

Figure 2: Firm structure (capital to skilled labor factor endowment box)

![Firm Structure](image2)
Figure 3: Areas

Figure 4: Graphical illustration of approximation error