

THE EFFECTS OF MULTINATIONALS ON HOST ECONOMIES: A COMPUTABLE GENERAL EQUILIBRIUM APPROACH^(*)

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INDEX

1. INTRODUCTION
2. THE MODEL
3. DATA AND SIMULATIONS
4. EMPIRICAL RESULTS
5. CONCLUDING REMARKS

APPENDIX

REFERENCES

SÍNTESIS. Principales implicaciones de política económica

ABSTRACT

This paper offers a new perspective regarding the effects on a host economy of the entry of multinational enterprises (MNEs). We use a computable general equilibrium (CGE) approach, through a version of the GTAP model extended to incorporate MNEs. The analysis is applied to the Czech Republic, a country that has received substantial inflows of foreign direct investment in the last few years. A special attention has been paid to the issue of profit repatriation. We find that the negative effects of profit repatriation are sizeable, and might even offset the positive impact of the entry of MNEs.

Key words: Multinational enterprises, Foreign direct investment, Computable general equilibrium, Profit repatriation, Czech Republic.

JEL Classification: C68, F21, F23.

I. INTRODUCTION

The effects of the multinational enterprises (MNEs) on host economies are the subject of much controversy. But, despite being a much debated topic in the media, most applied trade models have not considered the presence of MNEs. Although this could be largely related to data constraints on MNEs activities, it is probably fair to say that, at the theoretical level, the introduction of MNEs has posed an important challenge to trade models for a long time (Markusen, 2002). It is clear, however, that MNEs are behind many trade flows. So, for instance, according to the UNCTAD's 2000 *World Investment Report*, (i) one-third of the volume of world trade is made of transactions where MNEs are in one of the two sides of the exchange; and (ii) another one-third is intra-firm trade (i.e., trade within the MNEs, between the parent and the subsidiary, or between affiliates). Accordingly, including MNEs in the picture should improve, in a significant manner, our understanding of international trade flows.

Until very recently, the study of the effects of MNEs on host countries has been based mainly on either partial equilibrium econometric techniques or descriptive studies. So, for instance, the empirical literature has examined the relationship between MNEs activities and several aspects related to the performance of the host countries' economies, such as wages (Aitken, Harrison and Lipsey, 1996; Feenstra and Hanson, 1996; Lipsey and Sjöholm, 2004), the productivity of local firms (Görg and Greenaway, 2004; Smarzynska, 2004), foreign trade (Brainard, 1997; Bajo-Rubio and Montero-Muñoz, 2001; Helpman, Melitz and Yeaple, 2004), economic growth (Borensztein, De Gregorio and Lee, 1998; Campos and Kinoshita, 2002), or market structure (Aitken and Harrison, 1999; Barrios, Görg and Strobl, 2005).

Although still providing helpful results, these studies constitute a body of research mostly fragmented into separate parts, according to the particular effect analyzed. However, as pointed out by Markusen (2002, p. 77), "If one is to integrate the multinational into the theory of international trade, one needs to turn to a general-equilibrium framework". The use of a general equilibrium approach will allow one to concentrate on a set of effects arising from the presence of MNEs, and derive their economy-wide impact (on factor and commodity markets, trade flows, and so on) in a unified setting. More specifically, in this paper we will follow a computable general equilibrium (CGE) approach, which incorporates real data into a robust theoretical framework, namely, the Arrow-Debreu general equilibrium model. As an extension of this model, we will be able to present the interactions among economic agents as a system of equations derived from microeconomic optimization theory (Shoven and Whalley, 1992), where these microeconomic optimization decisions are embedded in national accounts identities. Thus, the potential of CGE models



lies in their ability to integrate micro and macro elements (Devarajan and Robinson, 2005). As an additional advantage, CGE modeling allows the evaluation of consumers' welfare, "one issue that is missing from the discussion of effects of foreign direct investment" (Lipsey, 2002, p. 60).

Studies of MNEs and foreign direct investment (FDI) within CGE models are scarce in the literature, though. Petri's (1997) paper is, to the best of our knowledge, the first CGE model incorporating FDI, and is concerned with the effects of FDI liberalization (i.e., the lowering or removal of barriers to FDI). This author analyzes MNEs in a 3-sector, 6-region, perfect competition setting, where FDI flows are allocated endogenously in the model responding to the fall in investment barriers. Following Petri's pioneering work, a research team in Australia's Productivity Commission developed a CGE model of FDI; see Hanslow, Phamduc and Verikios (1999) and Verikios and Zhang (2001). An important contribution of these models regards market structure, which adopts a large-group monopolistic competition character within a Dixit-Stiglitz framework; however, the assumption of symmetry across all kind of firms does not allow discriminating between MNEs and national firms' different technologies; this makes up a central feature of this paper (see below). Lee and van der Mensbrugghe (2001), in turn, introduce a small refinement in Petri's model just dealing with the order of the nesting in the demand for goods.

The paper by Jensen, Rutherford and Tarr (2004) also introduces FDI in order to analyze the impact of Russian accession to the World Trade Organization. They analyze the effects of a trade and FDI liberalization in services sectors by means of a monopolistic competition, 35-sector, Dixit-Stiglitz setting. By assuming that MNEs produce using both domestic and imported inputs, unlike national firms that use only domestically produced inputs, this paper means an important step forward in order to model MNEs as a "peculiar" type of firm, technologically differentiated from domestic firms. However, since the focus of the model of Jensen et al. is on the presence of MNEs in services sectors, they do not consider their impact in other sectors of the economy. Furthermore, as they simulate a reduction in FDI barriers in all services sectors simultaneously, they do not derive any differential effect across the various services sectors. Our approach, however, will be different since we are interested in analyzing the differential impact of the MNEs activities across sectors, both manufacturing and services.

Lastly, a first attempt of incorporating dynamics together with FDI in a CGE framework is Bchir et al. (2002). Note that these authors include FDI in a framework where MNEs are absent, i.e., FDI is modeled as mere capital flows crossing borders in response to different rates of return. Again, all firms are symmetric and there is no technological differentiation between MNEs and domestic firms. In addition, this study is addressed to the analysis of trade liberalization, instead of the effects of FDI.

In order to analyze the effects on a host economy of the entry of MNEs, in this paper we will make use of a well-known and widely-used CGE model, namely, the Global Trade Analysis Project (GTAP) model (Hertel, 1997; Rutherford, 2005), extended to incorporate MNEs. GTAP is a global network of researchers conducting quantitative analysis of international policy issues, by way of a unique database for the world economy, the GTAP database version 6 (Dimaranan, 2007). Notice that, since the GTAP model is continuously used and checked by many CGE modelers around the world, this provides a rich empirical literature making up a framework in which results can be better analyzed. Furthermore, the model is able to accommodate a number of possible extensions, already undertaken in the existing literature (trade liberalization, changes in taxation, and so on). Also, the GTAP model allows for different levels of regional and sectoral disaggregating, and is flexible enough to incorporate publicly available data on the activities of MNEs for several countries (OECD, 2005). This contrasts with most of the models above, which rely to an important extent on datasets originated in the activities of particular research teams.

A central feature of the approach in this paper is that, unlike previous CGE models, we do not simulate the impact of MNEs through a reduction of the (estimated) barriers to FDI. While being crucial to properly derive the effects of MNEs, an accurate estimation of these barriers to FDI proves to be a very difficult task, so assessing the impact of FDI through this procedure may introduce biases into the analysis. Our approach will be based instead on the assumption that FDI inflows lead to an increase in the capital stock of the host economy. Notice that the idea of MNEs leading to an inflow of capital, instead of a mere change in ownership resulting from mergers or acquisitions, proves to be particularly appropriate in the case of transition economies (as will be the case analyzed in this paper), at least for three reasons. First, because the weight of greenfield investment among FDI flows is larger than for developed countries (Schöllmann, 2001). The second reason lies in the evidence on large amounts of obsolete capital stocks (Bornstein, 2001; Lizal and Svegnar, 2002) so that even the flows linked to acquisitions need to replace the existing capital stocks and are, consequently, linked to an increase in capital. Third, it has been found, in the case of the Czech Republic, that foreign investors exhibit the highest propensities to invest in gross capital formation (Lizal and Svegnar, 2002).

More specifically, we will simulate an increase in the capital stock of the MNEs, which will be assumed to have a different production technology vis-à-vis its national competitors. This distinction between domestic firms and MNEs' technology relates to the "ownership advantages" in the well-known OLI paradigm (see Dunning, 1977, 2000). Indeed, MNEs have been shown to be more prevalent in sectors that employ a large number of nonproduction workers, and benefit from higher technological complexity, and higher levels of R&D (see, e.g., Markusen, 1995; Bajo-Rubio and López-Pueyo, 2002; or Barba



Navaretti and Venables, 2004). Such advantages give the MNEs a different and superior technology as compared to national firms, which is also reflected in their higher productivity (Helpman, 2006).

On the other hand, FDI inflows may have very different impacts depending on the sector to which they are addressed (see, e.g., Smarzynska, 2004; or Barba Navaretti and Venables, 2004). Hence, the simulations will be performed in five particular sectors of the host economy under study, including both manufacturing and services activities. Then, the differential impact across the rest of sectors of an increase in the capital stock of each of the above sectors will be analyzed, where the disaggregating level is 20 sectors.

A special attention is also paid to a mostly neglected aspect of the impact of MNEs, namely, profit repatriation. Data from the UNCTAD's 2006 *World Investment Report* suggest that, since the mid-1990s, MNEs tend to repatriate more than 50 percent of the total income they generate. Despite its relevance for MNEs activities, there are not many studies available on this issue, with most of them just offering a descriptive analysis. To the best of our knowledge, no study has quantified the general equilibrium impact that profit repatriation may have on the host economies, and the results from the simulations indicate that such effect may be quite relevant. In particular, we will evaluate the effects on the main variables according to the relative amount of profit repatriation, from zero to 100 per cent, which will allow us to find a threshold value where the sign of the results is reversed.

Finally, the empirical analysis is applied to the case of the Czech Republic, a country that has received substantial FDI inflows in the last few years, being for a long time the top recipient of FDI flows when measured in per capita terms in Central and Eastern Europe. In addition, this country provides the most comprehensive dataset on FDI and MNEs among transition economies.

The rest of the paper is organized as follows. A description of the model is provided in section 2. The data and the simulations performed are described in section 3. The results from the simulations, both at the macroeconomic and sectoral levels, are presented in section 4. Finally, section 5 concludes.

2. THE MODEL

In this section we offer a short description of the model used for simulations; a more detailed explanation can be found in Latorre (2007). The full set of equations, together with the complete list of the endogenous and exogenous variables and parameters of the model, are shown in the Appendix.

The particular model built for our analysis is a 2-region, 2-factor, 20-sector version of the GTAP model (Hertel, 1997), extended to incorporate MNEs. In

short, its main departure from GTAP lies on the supply side; in particular, the assumption of capital as a sector and firm type-specific factor, which allows us to differentiate MNEs' technology from that of national firms. Our model, on the other hand, follows Rutherford's (2005) version of GTAP, which is suitable for programming using GAMS. The general equilibrium of the model is derived from three groups of equations: (i) those defining zero profits, equations (1*) to (22); (ii) the income balance condition, equation (23) (replaced by equations (23*) and (23*bis) when profit repatriation is allowed for); and (iii) the market clearing conditions, equations (24) to (32*).

In its mathematical form, the model is a system of nonlinear equations derived from microeconomic optimization using a dual approach (Dixit and Norman, 1980), i.e., production activities face the standard minimization problem:

$$\min_v \{w'v \mid g(v) = x\}$$

where w is a vector of input prices, v a vector of factor inputs, and x a scalar denoting output, related to the inputs by a production function g . This optimal behavior shows the way of adjustment to shocks introduced in the model, and is also consistent with the macroeconomic framework embedded in national accounts identities which has to be satisfied.

The model involves two regions: a host region where MNEs, which are technologically differentiated from domestic firms, are active; and the rest of the world where, in contrast, firms are homogeneous. The production of all types of firms in the model is based on a nested technology of domestic and imported intermediate inputs, capital and labor. There is a representative household in each region, whose income stems from the domestic remuneration of all factors of production, together with fiscal revenues from several taxes; see equation (23). In the simulation allowing for profit repatriation, however, a portion of the domestic remuneration of the foreign capital is deducted from the income of the representative household of the host region and added to that in the rest of the world; see equations (23*) and (23*bis). The representative household fully spends her income. For the macroeconomic closure of the model, the real levels of the trade balance, investment, and public consumption are taken as exogenous.

Regarding firms' behavior, two main departures from the GTAP standard model arise due to the presence of MNEs. On the one hand, each good in the host economy will be produced not only by domestic firms but also by MNEs. On the other hand, capital, as a factor of production, now can be either domestic or foreign, i.e., national firms and MNEs will own different shares of the capital stock in each sector.

Following these departures, for each i good and sector there are two different "varieties" –one domestic and one foreign. Thus, in the country hosting MNEs, our model duplicates the sources of production of each good.



Further, capital is modeled as a specific factor which is sector and firm type-specific. This allows us to differentiate the technology of MNEs from that of national firms within each particular sector as well as across sectors, with MNEs being more capital intensive and showing a greater reliance on imported intermediates compared to their domestic counterparts operating in the same sector (OECD, 2005). This feature relates, in turn, to some relevant contributions from the academic literature, stressing that MNEs possess a “very distinctive bundle of capabilities” (Barba Navaretti and Venables, 2004, p. 278), “proprietary assets” (Caves, 2007), or “ownership advantages” (Dunning, 1977, 2000). And all these advantages, embedded in the assumption that capital is sector-specific, give MNEs a different and superior technology as compared to national firms.

Equation (4*) shows that sectoral prices resemble costs. The cost structures of MNEs versus those of national firms are different, in equilibrium, so the prices of the differentiated varieties of the same good can differ (and our empirical results show they indeed do differ). Such a disparity in costs and prices across varieties of the same good implies that goods are not homogeneous within the same sector. This violates the condition of homogeneous goods necessary for perfect competition to hold, thus creating a climate of competition more appropriate for the presence of MNEs.

The standard GTAP model (and this extension too) offers a detailed description of international trade flows, by taking into account not only the volume of commodities traded, but also transport and insurance services associated with trade flows. Furthermore, trade flows are subject to export subsidies and import tariffs which are specified at the level of commodities and region.

Some final comments relate to primary factor endowments. Labor is fully mobile across sectors and its endowment is fixed. Capital endowments, in turn, will vary following MNEs’ entry, which is modeled as leading to changes in the capital stock held by those MNEs already installed in the host economy.

3. DATA AND SIMULATIONS

As mentioned above, our model is an extension of a 2-region, 2-factor, 20-sector version of GTAP, applied to the Czech economy. Disaggregating to this level was made using the GEMPACK software, resulting in the maximum possible sectoral disaggregating in order to use three different sources of data. The main dataset is the GTAP6 Data Base (Dimaranan, 2007). In addition, most of the production data for the host economy (i.e., the Czech Republic) has been assigned to national firms and to MNEs using data from OECD (2005) and Czech National Bank (2003).

Table I shows the definition of the 20 sectors used in the analysis, together with their relative importance in the whole Czech economy in terms of gross output, total capital¹, imports, and exports; the table also shows the destination of each sector's production (i.e., the percentage of its production that goes to intermediates, gross capital formation, exports, private consumption, and public consumption), and the sectoral share of MNEs in terms of both gross output and capital. All the data refer to the year 2001, i.e., the last year for which the GTAP database is available. It is particularly remarkable the important share of MNEs in nearly all sectors of the economy; for the economy as a whole, the weights of MNEs in gross production and capital amount to 29.1 and 28.5 per cent, respectively.

From here, two simulations will be run:

- 1) An increase in the foreign-owned capital stock of a particular sector, due to the entry of MNEs, of 50 per cent over the capital stock previously held by MNEs in that sector; at the same time that the capital stock in the rest of the economy remains fixed.
- 2) An identical increase in the capital stock of a particular sector, coupled with the full repatriation of the remuneration of that extra capital. That is, unlike the previous simulation, the remuneration of the increased capital stock will not belong to the income of the representative household of the host economy, but will increase instead the income of the rest of the world².

The two simulations have been performed in five particular sectors of the Czech economy, namely: (i) Chemicals, rubber and plastics (Chemicals, henceforth); (ii) Motor vehicles; (iii) Electronics; (iv) Trade, repair; hotels and restaurants (Trade, henceforth); and (v) Finance, insurance, real estate, business activities (Finance, henceforth). The choice of sectors combines their importance as FDI recipients, as well as their relative share in the overall Czech economy. Notice that we incorporate into the analysis not only manufacturing but also services sectors; and, in the case of manufactures, the particular sectors chosen represent mostly medium- and high-technology sectors.

Finally, regarding the values of the elasticities needed to calibrate the model and perform the simulations, the elasticity of substitution of capital across sectors and across national firms and MNEs is set at 10^{-6} in order to fulfill the specific capital assumption³. In turn, the elasticity of substitution between national and foreign production is given the same value to that between domestic and imported goods, as supplied by GTAP. For the rest of elasticities,

¹ Here, "capital" stands for what National Accounts Statistics denote "property income".

² Recall that, although "profit repatriation" should be called, strictly speaking, "income repatriation", we prefer using that more common term (and will do it henceforth) once it is clear what we really denote.

³ This elasticity is set at 10^{-6} instead of 0, in order to facilitate the computation of the model.



the GTAP values, computed from econometric evidence, have been also taken; see Dimaranan (2007, chapter 20) for details. Finally, due to the Walrasian nature of the model, the monetary variables (values and prices) are set with respect to a numeraire; and, following the usual practice, the Consumer Price Index (CPI) has been taken as the numeraire⁴.

4. EMPIRICAL RESULTS

Macroeconomic results

Table 2 shows the results from the two simulations performed, i.e., the entry of MNEs with and without profit repatriation, denoted as *MNEs' entry* and *Profit Rep*, respectively, on the main macroeconomic variables. Each column in this table gives the percentage change in real terms with respect to the benchmark (i.e., the initial data set) for a particular variable, following a 50 per cent increase in the foreign share of the capital stock of each of the sectors in the first column of the table. The variables considered are: the real wage –the same in all sectors due to the assumption of perfect labor mobility; the real rental rate of capital –a weighted average of its price in all sectors due to the specific factor assumption; the real GDP measured at factor costs; welfare, proxied by the change in real private consumption (as in Hertel, 1997); the CPI⁵; and the real value of imports and exports, both measured at international prices.

In nearly all cases the entry of MNEs brings about a decrease in the rental rate of capital together with an increase in the aggregate wage. A higher volume of capital involves a lower marginal productivity of this production factor (i.e., its real rental rate decreases) and a higher marginal productivity of labor (i.e., a higher real wage). These results are consistent with the theory of international trade under the assumption of specific capital; see, e.g., Jones (1971), Mussa (1974) or Neary (1978). When profit repatriation is included into the simulation,

⁴ The GTAP6inGAMS selects by default a different numeraire, namely, the budget available for private consumption in the rest of the world (i.e., $raINC_{ROW}$; see equation (23)). The interpretation of the results with respect to this income would be complex, though. Therefore, in our results, we present all the monetary variables in terms of the CPI, i.e., using the CPI as the numeraire instead of the default numeraire. The only exception is, however, the CPI itself, which continues to be expressed in terms of the default numeraire.

⁵ As mentioned in note 4, the CPI is the numeraire for the rest of variables in the model, although the CPI itself is expressed with respect to the default numeraire set by GTAP6inGAMS, i.e., $raINC_{ROW}$. This means that the figures in this column cannot be interpreted strictly as a standard CPI. But note that, for the particular simulation performed here, the impact on $raINC_{ROW}$ is negligible, since shocks in the Czech Republic are unlikely to affect the rest of the world in an important extent. So, in this case the evolution of the CPI in terms of $raINC_{ROW}$ should be eventually a good proxy for the evolution of a standard CPI.

a reduction of the income available for the representative household appears compared to the case with no profit repatriation, since there is less income available for the domestic representative consumer. As a consequence, lower factor remunerations are obtained, i.e., the increase in the wage is smaller, and the decrease in the rental rate of capital is higher. This evolution of factor prices is an important force driving the results for GDP and welfare.

As can be seen, GDP and welfare experience a small increase after the entry of MNEs when there is no profit repatriation, but fall unambiguously in all cases when there is profit repatriation. The least favorable results are those for Motor vehicles, since in this case the amount of capital whose profit is repatriated is the highest among all sectors (see table I); in the opposite extreme, Electronics leads to the smallest fall in GDP, due to the smaller volume of capital involved in the shock.

The general reduction in the CPI associated with profit repatriation would be due to the fall in aggregate demand following a reduction in income. In the absence of profit repatriation, there appear different results for the CPI depending on the sector, related to a complex interplay of their weight in final consumption as well as their role as intermediates used in other sectors in the economy. The evolution of the CPI will be of importance for sectoral results. Finally, the impact on imports and exports would depend on the share of aggregate imports of the sector where MNEs entry (see table I). Thus, clearly, the impact on foreign trade for manufactures is higher than for the services sectors. Note also that the impact of profit repatriation on foreign trade is small.

Summing up, the introduction of profit repatriation leads to a very different panorama compared to the mere entry of MNEs. Under profit repatriation, the entry of MNEs may still benefit workers whose wages increase (except for the case of Motor vehicles). However, at the aggregate level the benefits of higher wages are offset by a larger fall in the remuneration of capital. This results in a decrease in GDP and welfare, whose magnitude slightly differs across sectors. Profit repatriation, however, does not affect the volume of external trade.

Sectoral results

Tables 3, 4 and 5 show, respectively, the effects on the levels of production, imports and exports of the 20 sectors representing the whole Czech economy, following the entry of MNEs in each of the five sectors selected, with and without profit repatriation.

We begin with the impact of the shock on the sector receiving MNEs. As can be seen, the results are not significantly affected by the presence or absence of profit repatriation. In both cases the impact is rather clear. The amount of capital used by the sector receiving MNEs is increased as a result of the shock, so its production would always rise (table 3). Increases in production are sizeable except for the case of Finance, the sector with the smallest MNEs'



share on gross output and capital among the five sectors selected. On the other hand, note that production in each sector relies to an important extent on intermediates from the same sector. As a consequence, imports of the sector receiving MNEs also increase (table 4), due to the higher levels of intermediates imports from foreign firms operating in that sector. Finally, since the increase in the capital stock strongly reduces its rental rate, driving costs of production and prices down in that sector, export competitiveness improves, which results in a significant increase in exports (table 5).

The impact on the rest of sectors tends to be small. The demand side of the model explains the responses of those sectors not receiving MNEs. The evolution of demand, in turn, boils down to the impact of MNEs on two variables, namely, the CPI (which determines exports) and the aggregate level of income (which determines private consumption). There are two broad patterns. One is for most manufacturing sectors, which are highly responsive to the evolution of their own exports – as a large part of their production is devoted to exports. The other applies to most services sectors as well as to Food and Petroleum, whose production responds to the evolution of private consumption. Finally, imports tend to follow the production pattern of the corresponding sector, although in some cases they are related to private consumption.

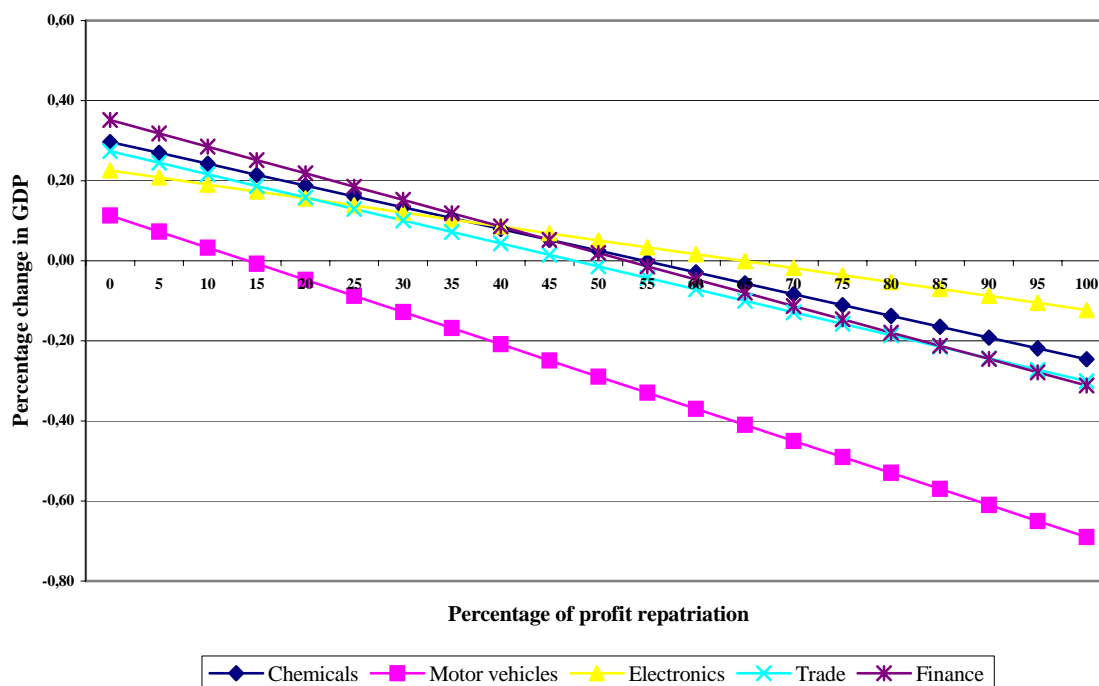
To sum up, the entry of MNEs leads to significant effects in the particular sector where they arrive, with a rather clear pattern: production, imports and exports rise, and the price falls. In turn, the effects on the rest of sectors of the economy tend to be small, with some clear patterns arising according to the demand side of the model.

How important is profit repatriation?

The effects presented so far follow from two extreme scenarios. Next, we look at how different levels of profit repatriation could affect the results on GDP and welfare shown in table 2. More specifically, we will obtain the percentage changes with respect to the benchmark, for GDP and welfare that follow from percentages of profit repatriation ranking from 0 (i.e., the scenario termed *MNEs' entry*) to 100 (i.e., the scenario termed *Profit Rep*). Our purpose would be finding the threshold values for profit repatriation, such that the favorable effects on the host economy of a mere increase in the capital stock are reverted once that profit repatriation is allowed for.

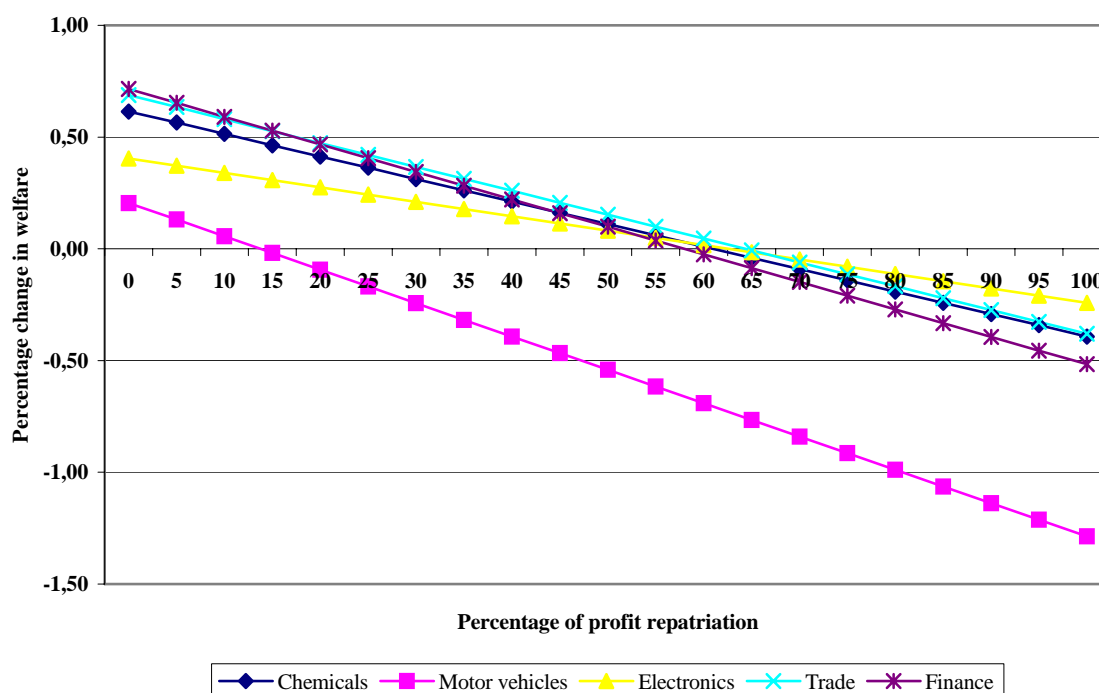
The results for GDP are presented in figure 1. As can be seen, in the case of Motor vehicles, GDP growth turns to be negative with a degree of profit repatriation above 15 per cent. On the contrary, the entry of MNEs in Electronics yields a negative GDP growth only for a degree of profit repatriation above 65 per cent. For the rest of sectors, in turn, we find somewhat intermediate results, with the growth of GDP becoming negative when profit repatriation exceeds around 50 per cent.

Figure 1
EFFECTS ON GDP OF DIFFERENT LEVELS OF PROFIT REPATRIATION



Finally, the evolution of welfare, shown in figure 2, provides similar results than in the case of GDP for Motor vehicles and Electronics. However, for the rest of sectors, welfare begins to decrease for a somewhat higher degree of profit repatriation, of around 60 per cent.

Figure 2
EFFECTS ON WELFARE OF DIFFERENT LEVELS OF PROFIT REPATRIATION





Sensitivity analysis

To conclude, a sensitivity analysis of the above results has been performed. For that purpose we have re-run our two simulations (i.e., the entry of MNEs into the five sectors above, with and without profit repatriation), but now changing the values of three crucial elasticities: (i) the elasticity of substitution between imports and domestic production, (ii) the elasticity of substitution between national firms and MNEs' production, and (iii) the elasticity of substitution between labor and capital. Obviously, the different combinations of elasticities across sectors are enormous, so that the costs of performing the so-called Unconditional Systematic Sensitivity Analysis are quite high (Harrison et al., 1993). For that reason, we have opted for a simplifying strategy, namely, a Conditional Systematic Sensitivity Analysis, which consists of choosing one of the three elasticities, double and halve its value in all of the twenty sectors (while holding the rest of elasticities at their initial benchmark level), and then compare the results for the variables already analyzed before.

Table 6 shows the results for the macroeconomic variables, in a structure analogous to that of table 2, where the rows *double* and *half* denote, respectively, the results obtained when the benchmark value of each elasticity is multiplied or divided by two; sectoral results are not shown due to space constraints but are available in Latorre (2007). The main conclusion to be found from this table is that changes in elasticities preserve the general outcomes obtained before. So, the differences are small for the elasticity of substitution between imports and domestic production (part A of the table), tiny for the elasticity of substitution between national firms and MNEs' production (part B), and virtually non-existent for the elasticity of substitution between labor and capital (part C). Hence, all this evidence leads us to conclude that the results of the model are mainly unaffected when moving from a higher to a lower value of each of the elasticities analyzed.

5. CONCLUDING REMARKS

In this paper we have analyzed the effects of the entry of MNEs, on a particular host economy, the Czech Republic, which has received significant amounts of FDI in the last few years. The empirical methodology has made use of a CGE approach, through a 2-region, 2-factor, 20-sector version of the GTAP model, extended to incorporate MNEs. Unlike previous CGE models, the impact of MNEs has not been approximated through a reduction of the estimated barriers to FDI, but through an increase in the capital stock of the MNEs, which have been assumed to have a different and superior technology as compared to national firms. This approach, on the other hand, proves to be

particularly appropriate in the case of transition economies. The simulations have been performed in five particular sectors of the economy (Chemicals, Motor vehicles, Electronics, Trade, and Finance), including both manufacturing and services activities. Finally, a special attention has been also paid to a mostly neglected aspect of the impact of MNEs, namely, profit repatriation.

We found a small increase in GDP and welfare of the host country, following the entry of MNEs in any of the selected sectors; both imports and exports also increased. However, the effects on GDP and welfare turned to be negative if the extent of profit repatriation was large. In particular, GDP would decrease if profit repatriation goes beyond 15 per cent in the case of Motor vehicles; around 50 per cent for Chemicals, Trade, and Finance; and 65 per cent for Electronics. This suggests that profit repatriation would be an important issue when analyzing the economic effects of MNEs, despite being generally overlooked in the available empirical literature.

In addition, the results from the simulations show the differential impact of MNEs across sectors, which has two relevant features. On the one hand, our results show that patterns are rather similar across sectors with and without profit repatriation, but the size of the effects is related to the particular sector in which MNEs enter; in particular, the empirical analysis suggests that the most unfavorable results for GDP and welfare are those of Motor vehicles, an information that should be relevant for the policy-maker. On the other hand, the model shows that the sectoral patterns of responses to the shock across sectors are related to the demand side of the model.

The analysis in this paper can be extended in a number of ways. First, the literature has analyzed extensively the possible presence of spillovers of the MNEs activities, which would lead to higher productivity levels for the host country's local firms. Although the empirical evidence on these spillovers is at best mixed (Barba Navaretti and Venables, 2004; Görg and Greenaway, 2004), an interesting simulation could deal, however, with the increase in productivity in national firms and/or MNEs necessary to offset the negative effect of profit repatriation. Also, recall that the model, in its current version, incorporates a simple way of differentiating between national firms and MNEs (and their corresponding "varieties" of products), due to the assumption of sector and type-of-firm capital specificity. Other alternatives such as introducing either Cournot competition or monopolistic competition, as well as relaxing the assumption of full employment, may seem quite appropriate for the analysis of MNEs, and can be implemented along the lines of Bajo-Rubio and Gómez-Plana (2004, 2005).

To conclude, it is important to note that the results above are applicable to a short and medium run period, which is the timing associated to our model. But, in the real world, the positive effects of MNEs entry would usually appear before the negative effects associated with profit repatriation. This would



suggest that the host economy may benefit from the presence of MNEs for some time; however, the sooner profits were repatriated, the sooner their negative effects would develop.

Table 1

DEFINITION OF SECTORS AND THEIR RELATIVE IMPORTANCE IN THE CZECH ECONOMY, 2001

	% on gross output	% on capital	% on imports	% on exports	% of sectoral gross output devoted to:					MNEs' % on gross output	MNEs' % on capital
					intermediates	gross capital formation	exports	private consumption	public consumption		
01/05 Agriculture, hunting and fishing	3.0	4.5	2.2	1.1	66.9	8.5	8.6	15.5	0.5	0.6	0.6
10/14 Mining and quarrying	1.0	3.1	4.7	0.9	76.4	2.7	19.2	1.8	0.0	18.7	27.3
15/16 Food, beverages and tobacco	7.6	8.3	3.0	2.9	34.6	0.0	9.8	55.5	0.0	31.5	50.9
17/19 Textiles, wearing apparel, leather, footwear	3.1	2.0	5.3	5.7	28.9	0.0	46.5	24.4	0.2	26.5	23.9
20 Wood and wood products, except furniture	1.9	1.8	1.7	4.0	40.2	5.1	50.2	4.5	0.0	23.8	22.0
21/22 Paper; printing, publishing and recorded media	2.4	2.5	3.0	2.8	54.0	7.9	28.5	9.5	0.0	45.3	52.5
23 Petroleum	1.0	0.1	1.4	0.4	74.9	0.0	9.5	15.5	0.0	1.0	1.0
24/25 Chemicals, rubber and plastics	4.4	3.7	12.8	8.7	38.3	3.4	49.2	6.3	2.8	42.6	49.1
26 Non-metallic mineral products	2.6	3.4	2.5	4.5	44.2	13.3	41.7	0.9	0.0	49.0	58.6
27/28 Basic and fabricated metal products	7.6	5.3	9.9	10.7	56.7	8.3	34.6	0.4	0.0	24.0	28.9

(Signe)

(Continuación)

	% on gross output	% on capital	% on imports	% on exports	% of sectoral gross output devoted to:					MNEs' % on gross output	MNEs' % on capital
					intermediates	gross capital formation	exports	private consumption	public consumption		
34 Motor vehicles	6.5	3.0	7.5	14.1	35.1	2.5	55.8	6.7	0.0	90.7	89.5
35 Other transport equipment	1.1	0.4	1.1	1.5	38.6	17.1	35.0	9.3	0.0	23.0	18.5
30/33 Electronics	2.7	2.0	9.4	6.6	30.7	2.8	62.6	3.6	0.3	63.0	58.8
29 Machinery and equipment n.e.c.	8.6	3.8	20.4	19.5	31.7	3.7	57.9	6.7	0.1	29.3	24.1
36/37 Furniture, manufacturing n.e.c.	1.3	1.1	1.1	1.5	40.6	7.5	30.1	21.9	0.0	29.9	34.3
40/45 Electricity, gas and water supply; construction	11.0	9.9	1.6	2.6	72.2	10.6	6.3	9.8	1.1	11.9	12.6
50/55 Trade, repair; hotels and restaurants	4.1	5.3	1.2	0.6	32.9	50.0	3.9	13.0	0.2	30.8	36.2
60/64 Transport, storage and communication	6.4	8.5	2.6	4.7	58.1	0.2	28.9	12.6	0.2	10.8	9.5
65/74 Finance, insurance, real estate, business activities	11.9	20.6	6.6	4.7	58.6	10.7	10.4	15.8	4.6	22.6	10.7
75-79 NACE Other services	11.7	10.7	1.9	2.5	17.3	11.9	5.7	16.6	48.5	1.0	1.0
01/99 Total	100.0	100.0	100.0	100.0	—	—	—	—	—	29.1	28.5

Note: Authors' own elaboration from Dimaranan (2007), OECD (2005), and Czech National Bank (2003). The definitions of the sectors follow the ISIC Rev 3 Classification.

Table 2
SIMULATION RESULTS: EFFECTS ON MACROECONOMIC VARIABLES (percent change from benchmark)

	Wage		Rental rate of capital		GDP		Welfare		CPI		Imports		Exports	
	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep
Chemicals	0.23	0.17	-0.55	-0.64	0.30	-0.24	0.61	-0.39	0.08	-0.09	1.30	1.32	1.36	1.38
Motor vehicles	0.05	-0.06	-1.17	-1.30	0.11	-0.69	0.20	-1.28	-0.10	-0.35	0.59	0.62	0.61	0.65
Electronics	0.21	0.16	-0.34	-0.40	0.23	-0.12	0.40	-0.24	0.09	-0.02	0.93	0.95	0.97	0.98
Trade	0.09	0.02	-0.51	-0.61	0.27	-0.30	0.69	-0.38	-0.01	-0.20	0.18	0.20	0.19	0.21
Finance	0.20	0.10	-0.61	-0.71	0.35	-0.31	0.72	-0.52	-0.14	-0.35	0.50	0.52	0.52	0.54

Note: MNEs' entry stands for the simulation of a 50% increase in the foreign share of the capital stock of each of the sectors in the first column of the table, due to the entry of MNEs; and Profit Rep stands for the simulation that combines a 50% increase in the capital stock with the full repatriation of the remuneration of this extra capital.

Table 3

SIMULATION RESULTS: EFFECTS ON SECTORAL PRODUCTION (percent change from benchmark)

	Chemicals		Motor Vehicles		Electronics		Trade		Finance	
	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep
Agriculture, hunting and fishing	-0.01	-0.02	0.03	0.02	-0.04	-0.05	0.06	0.05	0.06	0.05
Mining and quarrying	-0.01	0.00	0.00	0.02	-0.01	-0.01	0.00	0.01	0.00	0.02
Food, beverages and tobacco	0.24	-0.16	0.10	-0.49	0.13	-0.12	0.33	-0.09	0.36	-0.13
Textiles, wearing apparel, leather, footwear	-0.05	0.14	0.08	0.37	-0.31	-0.19	0.13	0.34	0.26	0.51
Wood and wood products, except furniture	-0.24	0.07	0.07	0.54	-0.31	-0.11	-0.01	0.32	0.11	0.50
Paper; printing and publishing	-0.12	0.06	0.07	0.35	-0.20	-0.08	0.02	0.22	0.23	0.47
Petroleum	0.16	-0.12	0.04	-0.33	0.09	-0.10	0.21	-0.11	0.22	-0.16
Chemicals, rubber and plastics	13.97	14.30	0.08	0.39	-0.21	-0.07	-0.01	0.21	0.12	0.38
Non-metallic mineral products	-0.14	0.09	0.08	0.43	-0.18	-0.03	0.00	0.25	0.12	0.41
Basic and fabricated metal products	-0.41	0.01	0.08	0.73	-0.42	-0.14	-0.04	0.42	0.20	0.74
Motor vehicles	-0.11	0.03	16.89	17.13	-0.12	-0.02	0.03	0.18	0.17	0.35
Other transport equipment	-0.16	0.01	0.29	0.55	-0.08	0.04	0.19	0.37	0.35	0.56
Electronics	-0.20	0.13	0.07	0.56	17.95	18.20	-0.01	0.34	0.21	0.62
Machinery and equipment n.e.c.	-0.18	0.02	1.80	2.12	-0.16	-0.02	0.06	0.28	0.24	0.50
Furniture, manufacturing n.e.c.	-0.05	0.04	0.08	0.22	-0.21	-0.15	0.14	0.23	0.24	0.35
Electricity, gas and water supply; construction	0.05	-0.12	0.09	-0.15	0.03	-0.08	0.23	0.06	0.33	0.13
Trade, repair; hotels and restaurants	0.06	-0.22	0.18	-0.22	0.00	-0.17	5.65	5.39	0.59	0.25
Transport, storage and communication	-0.12	-0.08	0.11	0.17	-0.13	-0.10	0.12	0.17	0.18	0.23
Finance, insurance, real estate, business activities	-0.02	-0.08	0.05	-0.02	-0.05	-0.08	0.10	0.04	2.12	2.05
Other services	0.03	-0.09	0.05	-0.13	0.00	-0.08	0.12	-0.01	0.18	0.03

Note: See table 2.

Table 4
SIMULATION RESULTS: EFFECTS ON SECTORAL IMPORTS (percent change from benchmark)

	Chemicals		Motor vehicles		Electronics		Trade		Finance	
	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep
Agriculture, hunting and fishing	0.31	-0.23	0.05	-0.74	0.22	-0.13	0.31	-0.27	0.26	-0.40
Mining and quarrying	0.06	-0.05	0.01	-0.15	0.04	-0.03	0.07	-0.05	0.06	-0.07
Food, beverages and tobacco	0.83	-0.56	0.11	-1.94	0.61	-0.29	0.76	-0.72	0.62	-1.08
Textiles, wearing apparel, leather, footwear	0.30	-0.20	0.07	-0.67	0.13	-0.19	0.35	-0.19	0.34	-0.27
Wood and wood products, except furniture	-0.06	-0.03	0.04	0.09	-0.12	-0.10	0.06	0.10	0.11	0.15
Paper; printing and publishing	0.07	-0.07	0.06	-0.15	-0.01	-0.10	0.15	0.00	0.25	0.08
Petroleum	0.25	-0.21	0.05	-0.56	0.18	-0.12	0.29	-0.22	0.26	-0.34
Chemicals, rubber and plastics	10.24	10.26	0.07	0.03	-0.07	-0.09	0.08	0.05	0.16	0.13
Non-metallic mineral products	-0.06	0.09	0.08	0.30	-0.06	0.04	0.04	0.19	0.11	0.29
Basic and fabricated metal products	-0.30	-0.04	0.02	0.42	-0.32	-0.15	-0.05	0.23	0.10	0.43
Motor vehicles	0.06	-0.01	3.87	3.79	0.07	0.02	0.12	0.05	0.14	0.05
Other transport equipment	0.05	-0.09	0.17	-0.03	0.05	-0.04	0.23	0.08	0.29	0.12
Electronics	-0.07	0.06	0.08	0.28	10.55	10.66	0.07	0.21	0.21	0.38
Machinery and equipment n.e.c.	0.01	-0.07	0.79	0.69	-0.01	-0.06	0.13	0.05	0.19	0.10
Furniture, manufacturing n.e.c.	0.31	-0.22	0.07	-0.71	0.17	-0.17	0.35	-0.21	0.33	-0.32
Electricity, gas and water supply; construction	0.38	-0.30	0.06	-0.93	0.26	-0.18	0.39	-0.33	0.34	-0.49
Trade, repair; hotels and restaurants	0.46	-0.35	0.11	-1.08	0.32	-0.20	1.43	0.60	0.49	-0.49
Transport, storage and communication	0.15	-0.11	0.04	-0.35	0.11	-0.06	0.17	-0.11	0.15	-0.17
Finance, insurance, real estate, business activities	0.29	-0.20	0.10	-0.61	0.20	-0.12	0.32	-0.19	2.67	2.06
Other services	0.47	-0.15	0.02	-0.91	0.41	0.01	0.29	-0.38	0.09	-0.68

Note: See table 2.

Table 5
SIMULATION RESULTS: EFFECTS ON SECTORAL EXPORTS (percent change from benchmark)

	Chemicals			Motor vehicles			Electronics			Trade			Finance		
	MNEs' entry	Profit Rep		MNEs' entry	Profit Rep		MNEs' entry	Profit Rep		MNEs' entry	Profit Rep		MNEs' entry	Profit Rep	
Agriculture, hunting and fishing	-0.57	0.36		-0.03	1.36		-0.46	0.14		-0.46	0.54		-0.37	0.78	
Mining and quarrying	-0.04	0.02		0.00	0.09		-0.03	0.01		-0.03	0.04		-0.03	0.05	
Food, beverages and tobacco	-1.01	0.65		-0.02	2.49		-0.83	0.24		-0.73	1.05		-0.45	1.61	
Textiles, wearing apparel, leather, footwear	-0.35	0.35		0.04	1.10		-0.57	-0.11		-0.14	0.62		0.06	0.93	
Wood and wood products, except furniture	-0.28	0.09		0.05	0.62		-0.33	-0.08		-0.07	0.34		0.05	0.52	
Paper; printing and publishing	-0.28	0.14		0.02	0.66		-0.32	-0.04		-0.14	0.31		0.07	0.60	
Petroleum	-0.12	0.12		0.00	0.35		-0.13	0.03		-0.11	0.16		-0.05	0.27	
Chemicals rubber and plastics	15.09	15.38		0.05	0.49		-0.25	-0.06		-0.08	0.23		0.05	0.41	
Non-metallic mineral products	-0.15	0.05		0.04	0.34		-0.20	-0.07		-0.03	0.19		0.07	0.32	
Basic and fabricated metal products	-0.34	0.01		0.06	0.59		-0.34	-0.11		-0.04	0.34		0.15	0.59	
Motor vehicles	-0.20	0.05		21.26	21.71		-0.21	-0.04		-0.03	0.24		0.15	0.47	
Other transport equipment	-0.30	0.11		0.24	0.86		-0.19	0.08		0.03	0.47		0.20	0.70	
Electronics	-0.22	0.13		0.05	0.59		17.11	17.37		-0.05	0.33		0.16	0.60	
Machinery and equipment n.e.c.	-0.24	0.07		1.70	2.17		-0.20	0.00		-0.01	0.32		0.18	0.56	
Furniture, manufacturing n.e.c.	-0.44	0.29		0.04	1.14		-0.53	-0.05		-0.21	0.58		-0.03	0.88	
Electricity, gas and water supply; construction	-0.68	0.24		0.00	1.38		-0.53	0.07		-0.35	0.64		-0.10	1.04	
Trade, repair; hotels and restaurants	-0.80	0.20		0.12	1.64		-0.68	-0.02		11.22	12.40		0.18	1.43	
Transport, storage and communication	-0.36	0.06		0.09	0.73		-0.32	-0.04		-0.07	0.39		0.03	0.56	
Finance, insurance, real estate, business activities	-0.58	0.31		0.08	1.44		-0.47	0.12		-0.35	0.60		6.37	7.47	
Other services	-0.75	0.09		0.09	1.37		-0.73	-0.18		-0.22	0.69		0.27	1.33	

Note: See table 2.

Table 6

**SENSITIVITY ANALYSIS: EFFECTS ON MACROECONOMIC VARIABLES OF CHANGES IN ELASTICITIES
(percent change from benchmark)**

A) Elasticity of substitution between imports and domestic production

	Wage		Rental rate of capital		GDP		Welfare		CPI		Imports		Exports	
	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep
Chemicals	0.23	0.14	-0.57	-0.67	0.28	-0.27	0.59	-0.44	0.08	-0.11	1.37	1.47	1.42	1.53
	Double	0.20	-0.52	-0.59	0.32	-0.20	0.65	-0.32	0.08	-0.06	1.21	1.12	1.26	1.16
Motor vehicles	0.03	-0.09	-1.19	-1.34	0.09	-0.73	0.19	-1.33	-0.11	-0.40	0.73	0.88	0.76	0.92
	Double	0.08	-0.01	-1.23	0.14	-0.63	0.24	-1.21	-0.09	-0.29	0.36	0.22	0.37	0.23
Electronics	0.20	0.15	-0.34	-0.41	0.22	-0.13	0.40	-0.26	0.10	-0.03	0.95	1.02	0.99	1.06
	Double	0.22	0.19	-0.34	-0.39	-0.10	0.42	-0.21	0.08	-0.01	0.88	0.83	0.92	0.87
Trade	0.05	-0.03	-0.52	-0.63	0.25	-0.34	0.66	-0.43	-0.03	-0.24	0.23	0.33	0.24	0.34
	Double	0.15	-0.50	-0.58	0.31	-0.25	0.72	-0.32	0.01	-0.14	0.14	0.04	0.15	0.04
Finance	0.18	0.07	-0.63	-0.74	0.33	-0.35	0.69	-0.57	-0.16	-0.39	0.58	0.70	0.60	0.72
	Double	0.21	0.09	-0.57	-0.59	-0.25	0.75	-0.43	-0.11	-0.26	0.39	0.25	0.40	0.26

(*Figure*)

(Continuación)

B) Elasticity of substitution between national firms and MNEs' production

	Wage		Rental rate of capital		GDP		Welfare		CPI		Imports		Exports		
	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	
Chemicals	Half	0.22	0.15	-0.56	-0.65	0.28	-0.26	0.59	-0.09	0.08	-0.42	1.29	1.31	1.34	1.36
	Double	0.26	0.19	-0.52	-0.61	0.33	-0.22	0.67	-0.08	0.10	-0.34	1.33	1.35	1.38	1.41
Motor vehicles	Half	0.05	-0.06	-1.17	-1.30	0.11	-0.69	0.20	-0.35	-0.10	-1.29	0.59	0.62	0.61	0.65
	Double	0.06	-0.05	-1.16	-1.29	0.12	-0.68	0.22	-0.35	-0.10	-1.27	0.59	0.62	0.62	0.65
Electronics	Half	0.20	0.16	-0.35	-0.40	0.22	-0.13	0.39	-0.02	0.09	-0.25	0.92	0.94	0.95	0.98
	Double	0.22	0.17	-0.33	-0.39	0.23	-0.11	0.42	-0.02	0.10	-0.23	0.94	0.96	0.98	0.99
Trade	Half	0.08	0.00	-0.52	-0.62	0.26	-0.31	0.66	-0.20	-0.02	-0.41	0.19	0.21	0.20	0.22
	Double	0.13	0.05	-0.49	-0.59	0.30	-0.27	0.74	-0.18	0.00	-0.32	0.17	0.18	0.17	0.19
Finance	Half	0.19	0.10	-0.62	-0.73	0.34	-0.32	0.70	-0.35	-0.14	-0.54	0.50	0.52	0.52	0.54
	Double	0.21	0.11	-0.57	-0.68	0.37	-0.29	0.75	-0.34	-0.13	-0.48	0.49	0.51	0.51	0.53

(Sigue)

(Continuación)

C) Elasticity of substitution between labor and capital

	Wage		Rental rate of capital		GDP		Welfare		CPI		Imports		Exports	
	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep	MNEs' entry	Profit Rep
Chemicals	0.23	0.17	-0.55	-0.64	0.30	-0.24	0.61	-0.39	0.08	-0.09	1.30	1.32	1.36	1.38
	0.23	0.17	-0.55	-0.64	0.30	-0.24	0.61	-0.39	0.08	-0.09	1.30	1.32	1.36	1.38
Motor vehicles	0.05	-0.06	-1.17	-1.30	0.11	-0.69	0.20	-1.29	-0.10	-0.35	0.59	0.62	0.61	0.65
	0.05	-0.06	-1.17	-1.30	0.11	-0.69	0.21	-1.28	-0.10	-0.35	0.59	0.62	0.61	0.65
Electronics	0.21	0.16	-0.34	-0.40	0.23	-0.12	0.40	-0.24	0.09	-0.02	0.93	0.95	0.97	0.98
	0.21	0.16	-0.34	-0.40	0.23	-0.12	0.40	-0.24	0.09	-0.02	0.93	0.95	0.97	0.98
Trade	0.09	0.02	-0.51	-0.61	0.27	-0.30	0.69	-0.38	-0.01	-0.20	0.18	0.20	0.19	0.21
	0.09	0.02	-0.51	-0.61	0.27	-0.30	0.69	-0.38	-0.01	-0.20	0.18	0.20	0.19	0.21
Finance	0.20	0.10	-0.61	-0.71	0.35	-0.31	0.72	-0.52	-0.14	-0.35	0.50	0.52	0.52	0.54
	0.20	0.10	-0.61	-0.71	0.35	-0.31	0.72	-0.52	-0.14	-0.35	0.50	0.52	0.52	0.54

Note: See table 2.

APPENDIX

We preserve GTAP's notation wherever possible (Hertel, 1997). Indices i and j denote sectors and commodities, respectively, i.e., $i, j = 1, \dots, n$; r and s denote regions, which may be either the rest of the world (ROW) or the economy hosting MNEs (H), i.e., $r, s = ROW, H$; and f denotes factors of production, which may be either labor (L) or capital (K), i.e., $f = L, K$. An o superscript stands for origin of production according to the three types of firms existing in the model. Firms may be either national (N) or MNEs (F) in the country hosting MNEs, or domestic (D) in the region in which MNEs are absent, i.e., $o = N, F, D$, where $o = N, F$ if $r = H$ and $o = D$ if $r = ROW$. Equations with an asterisk indicate that they are either an addition, or have been modified with respect to the GTAP standard version.

Model equations

Production

$$cf_{fjr}^o = \left(\sum_f \theta_{fjr}^o (\bar{p}_{jr}^{fo})^{(1-\sigma_j^{LK})} \right)^{1/(1-\sigma_j^{LK})} \quad (1^*)$$

$$ci_{ijr}^o = \left[\left(\theta_{dijr}^o (\bar{p}_{ijr}^d)^{(1-\sigma_i^A)} \right) + \left((1-\theta_{dijr}^o) (\bar{p}_{ijr}^m)^{(1-\sigma_i^A)} \right) \right]^{1/(1-\sigma_i^A)} \quad (2^*)$$

$$c_{jr}^{yo} = \left(\sum_i \theta_{ijr}^o ci_{ijr}^o \right) + \left(\theta_{fjr}^{fo} c_{fjr}^o \right) \quad (3^*)$$

$$c_{jr}^{yo} = p_{jr}^{Yo} (1 - t_{jr}^y) \quad (4^*)$$

$$ddfm_{ijr}^o = vdfm_{ijr}^o Y_{jr}^o \left(\frac{ci_{ijr}^o}{\bar{p}_{ijr}^d} \right)^{\sigma_i^A} \quad (5^*)$$

$$difm_{ijr}^o = vifm_{ijr}^o Y_{jr}^o \left(\frac{ci_{ijr}^o}{\bar{p}_{ijr}^m} \right)^{\sigma_i^A} \quad (6^*)$$

$$dfm_{fjr}^o = vfm_{fjr}^o Y_{jr}^o \left(\frac{cf_{fjr}^o}{\bar{p}_{jr}^{fo}} \right)^{\sigma_j^{LK}} \quad (7^*)$$

$$p_{iH}^Y = \left(\left(\theta_{iH}^{YF} (p_{iH}^{YF})^{(1-\sigma_{iH}^{FN})} \right) + \left((1-\theta_{iH}^{YF}) (p_{iH}^{YN})^{(1-\sigma_{iH}^{FN})} \right) \right)^{1/(1+\sigma_{iH}^{FN})} \quad (8^*)$$

Remuneration of capital as a specific factor

$$p_{jH}^K = \left(\left(\theta_{vfmjF} (p_{jH}^{KF})^{(1+\eta)} \right) + \left((1 - \theta_{vfmjF}) (p_{jH}^{KN})^{(1+\eta)} \right) \right)^{\frac{1}{(1+\eta)}} \quad (9^*)$$

$$p_r^K = \left(\sum_j \theta_{jr}^K (p_{jr}^K)^{(1+\eta)} \right)^{\frac{1}{(1+\eta)}} \quad (10)$$

Public consumption

$$p_{ir}^g = \left[\left(\theta_{ir}^{dg} (\bar{p}_{ir}^{dg})^{(1-\sigma_i^A)} \right) + \left((1 - \theta_{ir}^{dg}) (\bar{p}_{ir}^{mg})^{(1-\sigma_i^A)} \right) \right]^{\frac{1}{(1-\sigma_i^A)}} \quad (11)$$

$$\sum_i (\theta_{ir}^g p_{ir}^g) = p_r^G \quad (12)$$

$$ddgm_{ir} = vdg m_{ir} G_r \left(\frac{p_{ir}^g}{\bar{p}_{ir}^{dg}} \right)^{\sigma_i^A} \quad (13)$$

$$digm_{ir} = vimg m_{ir} G_r \left(\frac{p_{ir}^g}{\bar{p}_{ir}^{mg}} \right)^{\sigma_i^A} \quad (14)$$

Private consumption

$$p_{ir}^c = \left[\left(\theta_{ir}^{dc} (\bar{p}_{ir}^{dc})^{(1-\sigma_i^A)} \right) + \left((1 - \theta_{ir}^{dc}) (\bar{p}_{ir}^{mc})^{(1-\sigma_i^A)} \right) \right]^{\frac{1}{(1-\sigma_i^A)}} \quad (15)$$

$$\prod_i (p_{ir}^c)^{\theta_i^p} = p_r^C \quad (16)$$

$$ddpm_{ir} = vdp m_{ir} C_r \left(\frac{p_{ir}^c}{\bar{p}_{ir}^{dc}} \right)^{\sigma_i^A} \left(\frac{p^C}{p_{ir}^c} \right) \quad (17)$$

$$dipm_{ir} = vip m_{ir} C_r \left(\frac{p_{ir}^c}{\bar{p}_{ir}^{mc}} \right)^{\sigma_i^A} \left(\frac{p^C}{p_{ir}^c} \right) \quad (18)$$

Imports

$$p_{ir}^M = \theta_{isr}^{ym} \cdot \bar{p}_{isr}^m + \sum_j \theta_{jisr}^t \bar{p}_{jisr}^m \quad (19)$$

$$dxmd_{isr} = vxmd_{isr} \times M_{ir} \quad (20)$$

$$dtwr_{jisr} = vtwr_{jisr} \times M_{ir} \quad (21)$$

Transport services

$$\prod_r (p_{ir}^Y)^{\theta_{ir}^t} = p_i^T \quad (22)$$

Income balance condition

$$\begin{aligned} \text{raINC}_r = & vb_r - (p_r^G \overline{v g m}_r) - \sum_i (p_{ir}^Y \bar{l}_{ir}) + \sum_f (p_r^f \text{evom}_{fr}) + \text{revt}_r^Y + \text{revt}_r^L + \text{revt}_r^K + \\ & + \text{revt}_r^{\text{fd}} + \text{revt}_r^{\text{fm}} + \text{revt}_r^{\text{pd}} + \text{revt}_r^{\text{pm}} + \text{revt}_r^{\text{gd}} + \text{revt}_r^{\text{gm}} + \text{revt}_r^{\text{xs}} + \text{revt}_r^{\text{ms}} \end{aligned} \quad (23)$$

In the case where profit repatriation is allowed for, equation (23) should be replaced by equations (23*) and (23*bis), for ROW and the host region, respectively:

$$\begin{aligned} \text{raINC}_{\text{ROW}} = & vb_{\text{ROW}} - (p_{\text{ROW}}^G \overline{v g m}_{\text{ROW}}) - \sum_i (p_{i\text{ROW}}^Y \bar{l}_{ir}) + \sum_f (p_{\text{ROW}}^f \text{evom}_{f\text{ROW}}) + \\ & + \text{revt}_{\text{ROW}}^Y + \text{revt}_{\text{ROW}}^L + \text{revt}_{\text{ROW}}^K + \text{revt}_{\text{ROW}}^{\text{fd}} + \text{revt}_{\text{ROW}}^{\text{fm}} + \text{revt}_{\text{ROW}}^{\text{pd}} + \text{revt}_{\text{ROW}}^{\text{pm}} + \\ & + \text{revt}_{\text{ROW}}^{\text{gd}} + \text{revt}_{\text{ROW}}^{\text{gm}} + \text{revt}_{\text{ROW}}^{\text{xs}} + \text{revt}_{\text{ROW}}^{\text{ms}} + \% \text{Profit Rep}_j [(FDIf_{KjH} - 1) p_H^K \text{vfm}_{KjH}^F] \end{aligned} \quad (23^*)$$

$$\begin{aligned} \text{raINC}_H = & vb_H - (p_H^G \overline{v g m}_H) - \sum_i (p_{iH}^Y \bar{l}_{ir}) + \sum_f (p_r^f \text{evom}_{fH}) + \text{revt}_H^Y + \\ & + \text{revt}_H^L + \text{revt}_H^K + \text{revt}_H^{\text{fd}} + \text{revt}_H^{\text{fm}} + \text{revt}_H^{\text{pd}} + \text{revt}_H^{\text{pm}} + \text{revt}_H^{\text{gd}} + \\ & + \text{revt}_H^{\text{gm}} + \text{revt}_H^{\text{xs}} + \text{revt}_H^{\text{ms}} - \% \text{Profit Rep}_j [(FDIf_{KjH} - 1) p_H^K \text{vfm}_{KjH}^F] \end{aligned} \quad (23^* \text{bis})$$

Market-clearing equations

$$\text{raINC}_r = C_r \text{vpm}_r p_r^C \quad (24)$$

$$G_r = 1 \quad (25)$$

$$Y_{ir} \text{vom}_{ir} = \sum_j \text{ddfm}_{ijr} + \text{ddpm}_{ir} + \text{ddgm}_{ir} + \text{dxmd}_{irs} + \text{dst}_{ir} + \bar{l}_{ir} \quad (26)$$

$$M_{ir} \text{vim}_{ir} = \sum_j \text{difm}_{ijr} + \text{dipm}_{ir} + \text{digm}_{ir} \quad (27)$$

$$YT_j \text{vtw}_j = \sum_i \sum_s \sum_r \text{dtwr}_{jisr} \quad (28)$$

$$\text{evom}_{Lr} = \sum_i \text{dfm}_{Lir} \quad (29)$$

$$\text{NEWevom}_{Kr} = \text{evom}_{Kr} \text{FT}_{Kr} \quad (30^*)$$

$$\text{vfm}_{Kjr}^o \text{FDIf}_{Kjr} \left(\frac{p_{jr}^{\text{Ko}}}{p_{jr}^K} \right)^\eta = \text{dfm}_{Kjr}^o \quad (31^*)$$

$$\text{vfm}_{Kjr} \text{FDI}_{Kjr} \left(\frac{p_{jr}^K}{p_r^K} \right)^\eta = \text{dfm}_{Kjr} \quad (32^*)$$



Variables and parameters

Endogenous variables

Production

$difm_{ijr}^o$	Demand for imported intermediates from sector i to be used by o -type firms in sector j in region r
$difm_{ijr}$	Total demand for the imported intermediate i in sector j in region r
$ddfm_{ijr}^o$	Demand for domestic purchases of intermediates from sector i to be used by o -type firms in sector j in region r
$ddfm_{ijr}$	Total demand for domestic purchases of intermediate i in sector j in region r
dfm_{fir}^o	Demand for primary factor f by o -type firms in sector i in region r
dfm_{fir}	Total demand for primary factor f in sector i in region r
$NEW_{evom_{Kr}}$	Value of the capital stock after MNEs' entry in region r
FT_{Kr}	One plus the percentage change in the capital stock in region r
\bar{p}_{jr}^{fo}	Tax-inclusive price of factor f used by o -type firms in sector j in region r
\bar{p}_r^L	Tax-inclusive wage in region r
\bar{p}_{jr}^{Ko}	Tax-inclusive price of capital in o -type firms in sector j in region r
\bar{p}_{ijr}^d	Tax-inclusive price of the domestically purchased intermediate i to be used in sector j in region r
\bar{p}_{ijr}^m	Tax-inclusive price of the imported intermediate i to be used in sector j in region r
p_{jr}^{Yo}	Price of good j produced by o -type firms, excluding taxes or subsidies, in region r
p_{jr}^K	Price of capital in sector j in region r
p_r^K	Price of capital in region r
p_{jr}^Y	Price of good j before taxes
Y_{jr}^o	One plus the percentage change in gross output of o -type firms in sector j in region r
Y_{jr}	One plus the percentage change in total gross output in sector j in region r

Public consumption

$ddgm_{ir}$	Demand for domestic purchases of good i for public consumption in region r
$digm_{ir}$	Demand for imports of good i for public consumption in region r
G_r	One plus the percentage change in national public consumption in region r
\bar{p}_{ir}^{dg}	Tax-inclusive price of public consumption of the i^{th} domestic good in region r
\bar{p}_{ir}^{mg}	Tax-inclusive price of public consumption of the i^{th} imported good in region r
p_{ir}^g	Tax-inclusive price of good i purchased for public consumption in region r
p_r^G	Price of public consumption in region r

Private consumption

$ddpm_{ir}$	Demand for domestic purchases of good i for private consumption in region r
$dipm_{ir}$	Demand for imports of good i for private consumption in region r
$raINC_r$	Budget available for private consumption of the representative household in region r
C_r	One plus the percentage change in national private consumption in region r
\bar{p}_{ir}^{dc}	Tax-inclusive price of private consumption of the i^{th} domestic good in region r
\bar{p}_{ir}^{mc}	Tax-inclusive price of private consumption of the i^{th} imported good in region r
p_{ir}^c	Tax-inclusive price of good i purchased for private consumption in region r
p_r^C	Price of private consumption in region r

Imports and transport services

$dxmd_{isr}$	Demand for physical units of imports of good i in region r coming from region s
$dtwr_{jisr}$	Demand for the transport service j needed for transport of good i from region s to region r
dst_{ir}	Production of good i used as a transport service in region r



M_{ir}	One plus the percentage increase in imports of good i in region r
p_{ir}^M	Price of imports of good i , including transport services, in region r
\overline{p}_{isr}^m	Price of the volume of physical imports, including tariffs and subsidies, of good i in the route from s to r
\overline{p}_{jisr}^m	Price of the transport service j , including tariffs, of good i in the route from s to r
p_i^T	Price of the transportation service i
YT_j	One plus the percentage change in the world production of the j^{th} international transport service

Taxes and subsidies

rev_r^y	Total payments of subsidies on output in region r
rev_r^f	Total income from taxes on primary factors in region r
rev_r^{fd}	Total income from taxes on domestic intermediates in region r
rev_r^{fm}	Total income from taxes on imported intermediates in region r
rev_r^{pd}	Total income from taxes on private consumption of domestic goods in region r
rev_r^{pm}	Total income from taxes on private consumption of imported goods in region r
rev_r^{gd}	Total income from taxes on public consumption of domestic goods in region r
rev_r^{gm}	Total income from taxes on public consumption of imported goods in region r
rev_r^{xs}	Total payments of subsidies on exports in region r
rev_r^{ms}	Total income from tariffs on imports in region r

Exogenous variables and parameters

Production

$evom_{fr}$	Total endowment of factor f in region r
θ_{ijr}^o	Share of the factor f in value added in o -type firms in sector j in region r
θ_{dijr}^o	Share of the domestic intermediate input i in its total use in o -type firms in sector j in region r
θ_{ijr}^o	Share of the intermediate input i (domestic plus imported) in gross production of the o -type firms in sector j

θ_{jr}^{fo}	Share of value added in gross production of the <i>o</i> -type firms in sector <i>j</i> in region <i>r</i>
θ_{iH}^{YF}	Share of MNEs' production in gross production in the host economy
θ_{vmjF}	Share of MNEs' capital in total capital in sector <i>j</i> in the host economy
θ_{jr}^K	Share of capital employed in sector <i>j</i> in region <i>r</i>
$vdfm_{ijr}^o$	Benchmark value of the domestic purchases of intermediates from sector <i>i</i> to be used by <i>o</i> -type firms in sector <i>j</i> in region <i>r</i>
$vdfm_{ijr}$	Benchmark value of the total domestic purchases of intermediates from sector <i>i</i> in sector <i>j</i> in region <i>r</i>
vfm_{fir}^o	Benchmark value of the demand for the primary factor <i>f</i> by <i>o</i> -type firms in sector <i>j</i> in region <i>r</i>
vfm_{fir}	Benchmark value of the total demand for the primary factor <i>f</i> in sector <i>j</i> in region <i>r</i>
$vifm_{ijr}^o$	Benchmark value of the imported intermediates from sector <i>i</i> to be used by <i>o</i> -type firms in sector <i>j</i> in region <i>r</i>
$vifm_{ijr}$	Benchmark value of the total demand for the imported intermediate <i>i</i> in sector <i>j</i> in region <i>r</i>
vom_{ir}	Benchmark value of the sectoral gross production in region <i>r</i>
<i>Demand</i>	
\bar{i}_r	Fixed investment expenditure in sector <i>i</i> in region <i>r</i>
<i>Public consumption</i>	
θ_{ir}^{dg}	Share of the domestic good <i>i</i> in public consumption in region <i>r</i>
θ_{ir}^g	Share of the good <i>i</i> in total public consumption in region <i>r</i>
$vdgm_{ir}$	Benchmark value of the domestic purchases of good <i>i</i> for public consumption in region <i>r</i>
$vigm_{ir}$	Benchmark value of the imports of good <i>i</i> for public consumption in region <i>r</i>
\overline{vgm}_r	Benchmark value of total (imported plus domestic) national public consumption in region <i>r</i>
<i>Private consumption</i>	
θ_{ir}^{dc}	Share of the domestic good <i>i</i> in private consumption in region <i>r</i>



θ_{ir}^p	Share of the good i in total private consumption in region r
$vdpm_{ir}$	Benchmark value of the domestic purchases of good i for private consumption in region r
$vipm_{ir}$	Benchmark value of the imports of good i for private consumption in region r
vpm_r	Benchmark value of total national private consumption in region r
<i>Foreign sector</i>	
vb_r	Negative value of the current account balance of region r in the benchmark
vim_{ir}	Benchmark physical volume of imports in sector i in region r
<i>Transport services</i>	
θ_{isr}^{ym}	Share of the amount of physical units of goods (excluding transport services) in imports of region r
θ_{jisr}^t	Share of the amount of transport services in imports of region r
θ_{ir}^t	Share of the part of production of good i devoted to transport services in region r in the part of world production of good i devoted to transport services
$vxmd_{isr}$	Benchmark amount of physical units of imports of the good i in region r coming from region s
$vtwr_{jisr}$	Benchmark amount of the transport service j needed for transport of good i from region s to region r
vst_{jr}	Benchmark production of good j used as a transport service in region r
vtw_j	Benchmark aggregate of international transport services in sector j in the world
<i>Taxes</i>	
t_{ijr}^{fd}	Tax rate of the domestic intermediates from sector i to be used in sector j in region r
t_{ijr}^{fm}	Tax rate of the imported intermediates from sector i to be used in sector j in region r
t_{jr}^f	Tax rate on the factor f used in sector j in region r
t_{jr}^y	Output subsidy rate in sector j in region r
t_{ir}^{gd}	Tax rate on the domestic public good i purchased domestically in region r

t_{ir}^{gm}	Tax rate on the imported public good i in region r
t_{ir}^{pd}	Tax rate on the domestic private good i purchased domestically in region r
t_{ir}^{pm}	Tax rate on the imported private good i in region r
t_{isr}^{ms}	Import tariff rate on the good i exported from s to r
t_{isr}^{xs}	Export subsidy rate on the good i exported from s to r

Elasticities

σ_i^A	Elasticity of substitution between imports and domestic production in sector i (Armington elasticity)
σ_i^{LK}	Elasticity of substitution between labor and capital in sector i
σ_{iH}^{FN}	Elasticity of substitution between domestic and foreign production in sector i in the host economy
η	Elasticity of transformation of capital across sectors

Simulation parameters

$\%Profit Rep_j$	Percentage of extra capital in the foreign part of sector j , whose remuneration is repatriated
FDI_{Kjr}	One plus the percentage increase in the stock of capital held by foreign MNEs in sector j in region r
FDI_{Kjr}	One plus the percentage increase in the total stock of capital of sector j in region r

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SÍNTESIS

PRINCIPALES IMPLICACIONES DE POLÍTICA ECONÓMICA

El análisis de los efectos de las empresas multinacionales (EMNs) sobre las economías receptoras es en la actualidad objeto de una gran controversia. Sin embargo, a pesar de constituir un tema muy debatido en los medios, la mayoría de los modelos aplicados de comercio internacional no suelen tener en cuenta la presencia de EMNs. Aunque ello podría deberse a problemas de datos, también es cierto que, a nivel teórico, la introducción de EMNs ha planteado durante mucho tiempo un desafío importante a los modelos de comercio internacional.

Hasta hace poco tiempo, el estudio de los efectos de las EMNs sobre las economías receptoras se ha basado fundamentalmente, bien en técnicas econométricas de equilibrio parcial, o bien en estudios descriptivos. Aunque todos estos trabajos han proporcionado resultados útiles, representan no obstante un conjunto sumamente fragmentado en partes separadas, en función del efecto particular analizado. La utilización de un enfoque de equilibrio general aplicado, por el contrario, nos permitiría concentrarnos en una serie de efectos originados en la presencia de EMNs, y derivar su impacto sobre el conjunto de la economía (sobre los mercados de bienes y factores, los flujos comerciales, etc.) en un marco unificado. En particular, en este trabajo seguiremos un enfoque de equilibrio general aplicado (CGE en sus iniciales inglesas), que incorpora datos reales en un marco teórico robusto, como es el modelo de equilibrio general de Arrow-Debreu.

A la hora de analizar los efectos de la entrada de EMNs sobre una economía receptora, en este trabajo emplearemos un modelo CGE conocido y ampliamente utilizado, el modelo del Global Trade Analysis Project (GTAP), ampliado con objeto de incorporar EMNs. GTAP es una red global de investigadores que llevan a cabo análisis cuantitativos de diversos aspectos de política económica a nivel internacional, mediante una base de datos única para la economía mundial, la base de datos GTAP versión 6. Un aspecto importante del modelo GTAP es que permite diferentes grados de desagregación regional y sectorial, y es lo suficientemente flexible para incorporar datos disponibles sobre las actividades de las EMNs para varios países, publicados por la OCDE.

Así pues, en este trabajo simularemos un incremento en el stock de capital propiedad de las EMNs, las cuales supondremos que poseen una tecnología productiva diferente a la de sus competidoras nacionales. Las simulaciones se llevarán a cabo en cinco sectores particulares de la economía estudiada, incluyendo tanto actividades manufactureras como de servicios, analizándose su impacto sobre el resto de sectores a partir de un grado de desagregación de 20 sectores. Asimismo, se examina un aspecto relacionado con el impacto de las EMNs que apenas ha sido objeto de atención en la literatura, a pesar de su relevancia en la práctica: la repatriación de beneficios. Por último, el análisis empírico se aplica al caso de la

República Checa, un país que ha recibido unas entradas sustanciales de inversión extranjera directa (IED) en los últimos años, habiendo sido durante mucho tiempo el mayor receptor de flujos de IED en términos per capita entre los países de Europa Central y Oriental. Además, este país suministra la base de datos sobre IED y EMNs más completa entre las economías en transición.

Los resultados obtenidos muestran pequeños incrementos en el PIB y el bienestar del país receptor, a consecuencia de la entrada de EMNs en cualquiera de los sectores seleccionados; las importaciones y las exportaciones aumentaban también. Sin embargo, los efectos sobre el PIB y el bienestar se hacían negativos si el grado de repatriación de beneficios era elevado. En particular, el PIB disminuiría si la repatriación de beneficios se situara por encima de un 15 por ciento en el caso del sector de Vehículos de motor; alrededor de un 50 por ciento para Química, Comercio y Finanzas; y por encima de un 65 por ciento para Electrónica. Ello indicaría que la repatriación de beneficios sería un aspecto de gran importancia a la hora de analizar los efectos económicos de las EMNs, a pesar de que apenas ha recibido atención en la literatura empírica disponible.

Asimismo, los resultados de las simulaciones muestran un impacto diferenciado por sectores, caracterizado por dos rasgos relevantes. Por una parte, nuestros resultados muestran que los patrones son bastante similares entre sectores con y sin repatriación de beneficios, pero el tamaño de los efectos está relacionado con el sector particular en las que entran las EMNs; en particular, el análisis empírico indica que los resultados más desfavorables en términos de PIB y bienestar son los del sector Vehículos de motor. Por otra parte, el modelo muestra que los patrones sectoriales de las respuestas a la perturbación inicial están relacionados con el lado de la demanda del modelo.

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