"A computable general equilibrium evaluation of market performance after the entry of multinationals"

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Abstract

The main novelty of this article is the use of a computable general equilibrium (CGE) model to study market performance. We analyse the responses of national firms and multinationals across the 20 different sectors in which the economy of Czech Republic has been split. In particular, we offer a quantitative estimation of the impact on production, prices and costs for both types of firms. The results are derived by replicating the real data of the arrival of multinationals to the Motor vehicles' sector in that transition economy. They suggest the existence of a differential pattern of behaviour between both types of firms in production and to a lesser extent in prices. These patterns are put in relation with their different production structures, as manifested in the contrasting evolution of their intermediate and factor costs. Additionally, we offer the effects at the aggregate level (GDP, welfare, foreign trade, wages, CPI…) consistent with the microeconomic adjustment in the period 2001-3.

1. Introduction

This paper takes a new perspective to study market performance after the arrival of multinationals enterprises (MNEs). As befits an applied economics congress, we adopt an empirical approach based on a computable general equilibrium (CGE) model. With this methodology we try to incorporate several angles of the process of the entry of MNEs in a unified framework. We combine real data on the magnitude of MNEs operations and of FDI flows, together with the demand side of the process, as well as the interactions of goods and factor markets. In this setting we derive a quantitative approximation of the responses of both national firms and MNEs in different sectors of the host economy. In particular, we estimate their differential patterns of production, prices, factor costs and intermediate costs. We also offer an assessment for the outcomes at the aggregate level (GDP, Welfare, wages, foreign trade,…).

There is scarce evidence analysing the responses of national firms and MNEs from a general equilibrium perspective. In general, studies facing this issue are troubled with methodological problems (Altomonte and Pennings, 2009, chapter 7; Barba Navaretti and Venables, 2004; Kosova, 2004). Furthermore, the reduced number of previous CGE models which include the operations of MNEs have focused on other aspects different than market performance (see Latorre, 2009, for a review of that literature). Among them, to the best of our knowledge, none descends to the detailed microeconomic information displayed here.

Our model is applied to the arrival of MNEs to the Motor vehicles sector of the Czech Republic. We are all aware of the opening of plants of Western MNEs of that sector in Eastern Europe. The case of the Czech Republic stands out in the area. As noted by Pavlínek et al. (2009), this country has experienced the highest increase in production of passenger cars (399 percent) among East European economies in the period 1989-2007. Furthermore, in 2006 it achieved the largest trade surplus in automotive products in Europe, except for Germany. This evidence points to the idea that the Czech

Republic offers an interesting "natural experiment", providing us with new data to study market performance.

To this aim the present paper is organised as follows. The next section analyses the previous studies on market performance. Section 3, briefly describes the model, while in Section 4 we present the data. The aggregate and sectoral results are discussed, in that order, in section 5. The sensitivity analysis is presented in section 6. Finally, section 7 offers the main conclusions.

2. Previous studies of market performance

Even though MNEs have attracted a lot of attention, studies analysing their impact on market structure are rather scarce. Barba Navaretti and Venables (2004, chapter 7) explain that it is difficult to disentangle the effects derived from market competition itself from those produced by the presence of MNEs (such as spillovers, backward and forward linkages...etc). The entry of MNEs may promote competition and reduce price-cost mark-ups or may result in a more concentrated structure, with MNEs "crowding out" (less efficient) domestic firms. Aitken and Harrison (1999) point out that more FDI inflows may induce a reduction in the output of domestic firms due to stronger competition. Therefore, domestic firms could produce in less efficient points of their declining average cost curve, reducing their productivity. They find this negative impact for domestic firms in Venezuela.

Markusen and Venables (1998, 2000) use the so called "numerical CGE models" to analyse several effects of MNEs' operations. Contrasting with the CGE presented in this paper, theirs is "numerical" because they simplify the dataset in order to derive interesting taxonomies in the possible outcomes. This means that their model does not strictly reflect any particular economy, which allows them to express the impact of MNEs in terms of characteristics such as the relative endowments and size of countries, the level of transport costs, and of firm-level and plant-level economies of scale. They derive that horizontal MNEs are more common among countries exhibiting similar size and factor endowments, when trade costs among those countries tend to be high and when firm-level economies

of scale are high with respect to plant-level economies of scale. Under these circumstances, MNEs will tend to displace national exporters.

Some econometric studies have also looked at market performance. Co (2001) obtains that several factors interact and may lead to different outcomes. In particular, the initial levels of concentration, the type of FDI undertaken (i.e., greenfield versus non greenfield) and the timing of adjustments in the levels of concentration, influence the impact of the entry of MNEs in the US economy. Barrios et al. (2005) and Sembenelli and Siotis (2005) find that FDI flows lead to a pro-competitive effect in some sectors and to a more concentrated market structure in other sectors in Ireland and Spain, respectively. Altomonte and Pennings (2009), using data for Romania, find that the total factor productivity (TFP) of domestic firms increases when MNEs arrive but then gets weaker and even falls when the number of MNEs passes a sector specific threshold. They derive that the threshold for Motor vehicles is rather low. Kosova (2004) takes a different perspective since her model considers exit or entry of domestic firms. She obtains that the crowding out appears at the beginning. However, in the long run the presence of MNEs is beneficial for domestic firms, particularly, in technologically advanced industries. She tests her model for firms in the Czech Republic. Note the contrasting short run impact of MNEs in the last two latter studies. In this paper, we offer a different methodology to derive the outcomes for different sectors in the short run.

3. The model and simulations

We extend the GTAP model to introduce MNEs in it[1]. Our extension duplicates the sources of production in each sector of the economy. There will be two varieties –national and foreign, produced by national firms and MNEs- for each *i* good (and sector). An important feature of the model is that it considers the shares of both types of firms in production, labour and capital demand, as well as in imported and domestic intermediates across all sectors of the host economy. Due to their differences in

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[1] GTAP stands for "Global Trade Analysis Project". It is the name of a research group constructing an ambitious database for the world economy. See below.

the imput mix, they exhibit different technologies. We, thus, break the common symmetry assumption made in CGE models, by which the combinations of capital and labour and domestic versus imported intermediates is the same for national firms and MNEs operating in the same sector. Indeed, the scarce CGE models with MNEs, tend to characterise the presence of this type of firms only by their share in the capital used in the different sectors[2].

Labour is perfectly mobile across sectors and its endowment is fixed. Capital is assumed to be sector and firm type specific, as befits the conclusion in the literature that MNEs have some "specific assets" and "ownership advantages" (e.g., Barba Navaretti and Venables, 2004). Because of the differences in cost structures and the specific capital assumption, costs, prices and quantities produced of the different (i.e., the foreign and national) variety within the same sector will differ. The entry of MNEs increases capital in the foreign part (i.e., in the capital held by MNEs) of Motor vehicles, while capital in the rest of sectors remains fixed, due to its sector-specific nature.

The interactions among firms are based on microeconomic optimisation behaviour. This is typical from the Arrow-Debreu general equilibrium model in which CGEs are based. The macroeconomic perspective is embedded in a set of equations reflecting the national accounts identities.

In the country hosting MNEs the national and foreign variety are blended into a unique composite good i − the "domestic" good −, which is the one available for final or intermediate consumption. There is a representative household, whose income stems from the remuneration of all factors of production together with fiscal revenues from several taxes. She fully spends his income in investment, government consumption, and public consumption. Because we run a static version, investment is an exogenous component of final demand. This implies that the results should be interpreted as the impact in the medium term, i.e. in two or three years. To prevent biases from government activities the real

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[2] The only exception is the analysis of Rutherford and Tarr (2008), which considers that MNEs use an extra imported intermediate (not present in national firms) in a framework of monopolistic competition. But apart from this, they do not differentiate labour intensities neither the backward or forward linkages nor scale economies between both types of firms. Further, they do not offer any firm type information in their results.

level of public consumption is kept constant. Note that the analysis of the demand side of the model will allow making consumers' welfare evaluations.

A very detailed explanation of the model can be found in Latorre (2010, chapter 3), a more succinct exposition in Latorre, Bajo-Rubio y Gómez-Plana (2009). In previous simulations, we analysed the role of profit repatriation and compared the differential impact of MNEs accruing to several sectors. In this study we focus on a very detailed microeconomic analysis, evaluating the contrasting performance of national firms and MNEs.

4. Data

We construct a 2-region, 2-factor, 20-sector CGE model of the world economy. MNEs are only present in the host region, i.e., the Czech economy. By contrast, the other region, rest of the world (ROW), has no MNEs due to the absence of data. The information to obtain the Czech economy and the Rest of the World regions disaggregated into 20 sectors is derived from the GTAP6 database[3] (Dimaranan, 2007). Once we have that, we need to split the information on production and costs for national firms and MNEs in each sector. To this aim, data from the OECD (2009) and from the Czech National Bank (2004) have been exploited. We end up with a snapshot of the situation of the Czech economy and ROW in the year 2001. This snapshot will constitute the benchmark or reference point to analyse the results.

In the next 4 Figures we present the characteristics and importance of MNEs and national firms in the Czech Republic. Figure 1 shows the weights of both types of firms across sectors over total production of the Czech economy. For the economy as a whole, the weight of MNEs on gross production is 29.1 percent, and their shares are remarkable in nearly all sectors. MNEs in Motor vehicles account for 5.3 percent of total production, being one of the biggest (sub)sectors of the Czech economy. Figure 2,

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[3] This database reflects the world economy using information from the Input-Output tables, National Accounts Statistics and world trade flows. It covers 87 regions in the world (most of them countries) at a 57 sector level disaggregation.

shows labour intensity of national firms and MNEs across sectors. As expected, national firms are in general more labour intensive than MNEs. The higher capital intensity of MNEs can be seen as a proxy for more complex strategies in MNEs (Antràs, 2003). Figure 3 presents the weight in total costs of domestic intermediates (i.e., intermediates bought within the Czech economy). National firms rely much more on domestic intermediates, while, as shown in Figure 4, MNEs tend to buy most intermediates abroad.

Cost structures in Motor vehicles look a bit peculiar. Contrasting with the general pattern, national firms in that sector use very few domestic intermediates (Figure 3) and rely very intensively on imported ones (Figure 4). This suggests that their operations consist mainly in rather marginal operations over the imported intermediates. On the other hand, MNEs of Motor vehicles rely to an important extent on domestic intermediates (Figure 3). Although the following information does not appear in the Figures, it is relevant that the domestic intermediates coming from Motor vehicles account for 19% on total costs, and those coming from "Machinery and equipment" and "Basic and fabricated metals" account for 16% and 8,6%, respectively. In addition, the production of motor vehicles is not an important intermediate to be used in other sectors, i.e. the forward linkages of MNEs in that sector would be rather weak.

5. Results

5.1. Aggregate results

Figure 5 presents the aggregate results from the impact of the arrival of new MNEs on: the real rental rate of capital and the real wage; the real GDP measured at factor costs; welfare, proxied by the change in real private consumption, which given the mathematical properties of the model is the same as the variation in real income of the representative household; and the real value of aggregate imports and exports, both measured at international prices. We analyse the effect (i.e., percentage changes with respect to the 2001 benchmark) for the successively greater increases in the capital stock of foreign

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MNEs *really* experienced in Motor vehicles from 2001-2 and 2001-2003. The exact percentage increase of capital accumulated in the foreign part of that sector is detailed in the labels of the corresponding period.

The entry of MNEs brings about strong decreases in the aggregate rental rate of capital, which is a weighted average of its remuneration in all sectors. The theory of international trade under the assumption of specific capital (i.e., Jones, 2002) predicts this fall in capital remuneration. Dycker (2006) who has also analysed the entry of FDI flows in Motor vehicles of CEE countries, offers evidence for these short-run initial losses manifested in the fall in the rental rate of capital. Conversely, the wage of the economy, which is the same for all sectors due to the assumption of full mobility, experiences meagre increases.

GDP and welfare increase slightly for small levels of capital accumulation. Note that even though the rental rate of capital falls there are bigger amounts of capital to be remunerated and thus a small increase in GDP and welfare appear. Finally, foreign trade increases as more MNEs come into Motor vehicles. Imports increase because more imported intermediates are used for production in Motor vehicles[4]. Aggregate exports also go up following a higher level of production in Motor vehicles coupled with a decrease in its price, as will be seen bellow.

The tiny increases in GDP and welfare transmit the idea that the activities undertaken by MNEs in Motor vehicles are of a low value added (Pavlínek, 2003). It is well documented that foreign-owned suppliers have supplied almost all high-value added components (Dycker, 2006; Pavlínek and Janâk, 2007; Pavlínek et al., 2009). Furthermore, Haiss, Mahlberg and Mohling (2009) offer econometric evidence on the low impact in terms of GDP growth of FDI inflows going to the automotive industry in Central and Eastern Europe.

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[4] Generally the bulk of imports consists of intermediates. In the Czech Republic they account for an outstanding 82.8% of total aggregate imports, whereas private consumption and government consumption account for 15.5% and 1.6%, respectively. Thus, the evolution of imports will tend to be more related to the path of production than to that of consumption.

To give further insight to the GDP and welfare increases obtained after the arrival of MNEs to Motor vehicles, we have also estimated how these two aggregate variables would change after the entry of all MNEs accruing to manufacturing sectors of the Czech Republic in the period 2001-3. The increase in the FDI position amounts to 86.4% for manufactures as a whole, although its redistribution varies considerably across sectors. This change implies a 14.7% increase in the total capital stock of the Czech economy. The increase in the capital held by MNEs in Motor vehicles that we have been analysing accounts for 25% (i.e., 3.67% of the increase in the total capital stock). GDP and welfare experience an 8% and 14% rise, respectively, after all MNEs accruing to manufactures. The impact of profit repatriation must be substantial and considerably reduce the percentage increases (as we have analysed elsewhere, Latorre et al. 2009, Latorre and Gómez Plana, 2010). However, it seems clear that MNEs operating in other manufacturing sectors, are more beneficial for the Czech economy than the ones from Motor vehicles. But what type of microeconomic adjustment underlies this macroeconomic evolution? We turn now to the analysis of market performance.

5.2. Sectoral results

Tables 1, 2, 3 and 4 show, respectively, the evolution of production, prices, factor costs and intermediate costs for national firms and MNEs operating in the 20 sectors of the Czech Economy. As with aggregate variables, all the tables present the effect (i.e., percentage changes with respect to the benchmark) of the successively greater increases in the capital stock of foreign MNEs *really* experienced in Motor vehicles from 2001-3.

The entry of MNEs, logically, brings about an important increase in the production of the foreign part of Motor vehicles. Table 1 shows that the arrival of more capital to be used by MNEs considerable increases their output. The price of Motor vehicles sold by MNEs diminishes (Table 2). This is because the increase in capital strongly lowers its rental rate, driving factor costs of production (Table 3) and prices down in the foreign part of that sector. These results of lower rental rate of capital and prices when more MNEs come to Motor vehicles suggest an increase in competition in that sector. The slight

increase of production in its national part, implies that MNEs are not crowding out domestic firms, but also that the backward linkages are limited.

Table 1 also shows that after the entry of MNEs there is a general mild upward tendency in production of national firms and MNEs across all sectors. Some stronger effects take place in two upstream sectors of MNEs from Motor vehicles. These are: "Machinery and equipment" and to a lesser extent, of "Basic and fabricated metals", particularly in their national part. For the rest of sectors, backward and forward linkages seem rather weak, as their responses generally exhibit very low percentage changes. Note that for those sectors which are not receiving MNEs (i.e., there is no entry of foreign capital), the evolution of production reflects the evolution of labour demand. Since capital is sector and type of firm specific, i.e., it remains fixed and cannot move across or within sectors, so that increases in production take place through increases in labour demand.

National firms tend to increase production and labour demand more strongly than MNEs. This effect is particularly clear in the upstream sectors of Motor vehicles, i.e., "Machinery and equipment" and "Basic and fabricated metals", where the increases in production are more substantial. The reason for this is that after the entry of MNEs a process of labour reallocation takes place throughout the economy. Labour goes to the part of the sectors which is more labour intensive (i.e., to national firms). Additionally, the entry of more MNEs brings about more activity for domestic firms than for MNEs, because the former tend to respond more intensively to the shocks experienced in the host economy, while the latter have stronger foreign links. Recall how our description of cost structures reported the relatively higher reliance of national firms on domestic intermediates (Figure 3) and of MNEs on imported intermediates (Figure 4).

Only in three sectors Finance, Petroleum and the Public Sector, i.e., Other services is the percentage increase in production higher in MNEs than in national firms (in Petroleum only in the second period). These should not be viewed as exceptions, however. The evolution in Finance is reflecting that in this sector MNEs are exceptionally more labour intensive than national firms (Figure 2). Therefore, the

tendency is the one that has been described above: the more labour intensive firms attract more labour. Regarding the evolution of Petroleum and the Public Sector, the relatively higher increase in production in MNEs seems to be due to the fact that, on the one hand, labour intensities are the same in the national and foreign part of those sectors. And, on the other hand, MNEs account for a tiny part of those sectors. Indeed, they are among the smallest weights of MNEs across sectors (Figure 1), making their relatively small increase in production more apparent in percentage terms.

Regarding prices (Table 2) there is an important fall in the price of products sold by MNEs in Motor vehicles and by national firms in Machinery and equipment, following their considerable increases in output. We also find a slightly differential pattern in prices between both types of firms. National firms tend to charge slightly higher prices than MNEs in most sectors. When this pattern appears, the evolution of factor costs (Table 3) prevails over the evolution of intermediate costs (Table 4). Due to the important fall in the rental rate of capital and to the slightly rising wages (analysed in the aggregate results) and to the fact that MNEs are more capital intensive, factor costs tend to be lower in MNEs than in national firms. Note that, somehow, the less advanced (labour-intensive) technology of national firms results in higher factor costs for them.

By contrast, if we look at the evolution of intermediates costs (Table 4), their percentage increases tend to be higher in MNEs than in national firms. Recall that national firms tend to rely more on domestic intermediates, while MNEs rely more on imported intermediates. It makes sense that imported intermediates will tend to be more expensive than domestic goods. This is what we obtain. According to Table 4, intermediate costs are higher in MNEs than in domestic firms.

On the whole, there are two opposite forces interacting simultaneously on prices. We have that factor costs push more strongly the prices of national firms up than the one of MNEs. The tendency in intermediate costs is the reverse, but it is less intense in many sectors and, therefore, does not prevail. The resulting main tendency is that national firms charge only slightly higher prices than MNEs.

The higher prices of MNEs in Finance and Other services should not be viewed as an exception. We had seen that, contrary to the general tendency, production was higher in MNEs than in national firms in these two sectors. This implies that more labour is being hired in that foreign part of those sectors. This pushes up the factor costs of MNEs compared to the ones of national firms and with them prices. Further, intermediate costs, which are generally higher in MNEs also strengthen this tendency of higher prices in MNEs of Finance and Other services.

Production of MNEs was also higher than the one of national firms in Petroleum (as in Finance and Other services). Why aren't prices of MNEs also higher in Petroleum? Note that the differences in production between national firms and MNEs in Petroleum are less pronounced than in the case of Finance and Other services. Although they still yield slightly higher factor costs in MNEs than in national firms in that sector. However, contrary to the general evolution (and to the one present in Finance and Other services), intermediate costs of MNEs are lower in Petroleum. This tendency prevails with respect to factor costs, resulting in higher prices of national firms in Petroleum.

We find exceptions to the general tendency of higher prices in national firms in Mining, Other transport equipment, Machinery n.e.c. and Transport and communication. For these sectors, there seems to be more pronounced differences between national firms and MNEs in the use of intermediates (Figures 3 and 4). Therefore, the evolution of intermediate costs exhibits a higher contrast between both types of firms and will determine the evolution of prices, making them increase by more in MNEs. In these exceptional sectors, national firms take advantage more intensively of cheaper domestic intermediates, whereas MNEs suffer more from the relatively more expensive imported intermediates. This process is also taking place in the rest of sectors, but it is more intense in these latter ones, due to their particular cost structures. Thus, the tendency of intermediate costs prevails over the adjustment in factor costs which was determinant for the outcome in prices in the rest of sectors.

6. Sensitivity analysis

We perform the so called Conditional Systematic Sensitivity Analysis (Harrison et al., 1993) to look at results with different elasticities' specifications. We use double and half values of the standard elasticities with which our previous results have been obtained. Due to space constraints, we concentrate on the impact on MNEs and national firms in Motor vehicles, which is the center of the shock and determines the rest of outcomes. We offer the analysis for the whole period 2001-2003, which conveys the entry of MNEs with the greatest possible impact (Table 5). It seems that with the new values for the elasticities, results follow the trends described above and only their magnitude measured in percentage terms varies slightly.

For the case of the elasticity of substitution between labour and capital, production of MNEs in Motor vehicles would be lower if labour were more substitutable with capital (i.e., with the double value of the elasticity). Indeed, less labour would be employed also in the national part of Motor vehicles than with the standard elasticity. With this elasticity we find some scope for a tiny crowding out effect in the national part of Motor vehicles as other studies have found in the short run (Kosová, 2004). This result for national firms does, however, not imply that the pattern of higher production in national firms has changed. Looking at the impact in the rest of sectors (available upon request) it can be seen that the pattern holds. On the other hand, despite the somewhat differentiated outcome for production in national firms and MNEs with the "double" value of this elasticity, intermediate costs and prices would be, however, pretty similar to the standard case.

7. Concluding comments

The results obtained with our CGE model should be viewed as a short run impact (i.e., in two or three years). Maybe surprisingly, they suggest that the backward and forward linkages of MNEs in Motor vehicles of the Czech Republic are very limited. Production of MNEs itself increases strongly with the increase in foreign capital, while the price of the good they sale goes down. By contrast, the production

of national firms in Motor vehicles experiences a tiny increase and could even fall slightly. Some backward linkages appear with "Machinery and equipment" and to a lesser extent with "Basic and fabricated metals". But for the rest of the economy there is only a mild upward tendency in production after the arrival of more MNEs to Motor vehicles.

Interestingly, national firms participate more intensively from this upward trend in output than MNEs. This is due to their relative labour intensive technology, which makes them attract more labour from the one reallocated throughout the economy. There is also a tendency for a contrasting pattern in prices between national firms and MNEs, although the difference between both types of firms is less clear than for output. National firms tend to charge slightly higher prices than MNEs but some exceptions arise. The latter can be traced by looking at the interplay of firms' respective factor and intermediate costs.

Our analysis entails an effort to differentiate national firms and MNEs' technologies. This aspect tends to be neglected in the scarce CGEs dealing with MNEs. There is much work ahead, though, since a finer characterisation of the climate of imperfect competition would be in order. But the analysis shown here helps to disentangle what imperfect competition and economies of scale can add to explain the contrasting performance of national firms and MNEs.

At the aggregate level, the entry of MNEs brings about important increases in foreign trade but a small positive impact in GDP and welfare. These results are in accordance with the literature available, in which there is evidence of a rather limited (and even unfavourable) impact for the arrival of MNEs from motor vehicles in the Czech Republic and in other CEECs countries. By comparing the effect of MNEs from Motor vehicles with the one from the arrival experienced across all manufacturing sectors one can see that there is much scope for MNEs to be beneficial for that economy. Indeed, the large impact of MNEs accruing to Czech manufactures makes sense in this context of a small size economy. Some part of these positive aggregate outcomes should be discounted due to profit repatriation, as we have analysed elsewhere (Latorre et al. 2009; Latorre and Gómez Plana, 2010). However, we believe,

MNEs' effects must be an important factor accounting for the substantial GDP increases experienced from 2004 till 2007 (the percentages being 4.5 in 2004, 6.3 in 2005, 6.8 in 2006 and 6.1 in 2007 according to the OECD) in the Czech economy.

References

Aitken, B. and Harrison, A. E. (1999) "Do domestic firms benefit from direct foreign investment? Evidence from Venezuela", *American Economic Review*, vol. 89, pp. 605-618.

Altomonte, C. and Pennings, E. (2009) "Domestic Plant Productivity and Incremental Spillovers from Foreign Direct Investment", *Journal of International Business Studies*, vol. 40, pp. 1131-1148.

Antràs, P. (2003) "Firms, Contracts and Trade Structure", *The Quarterly Journal of Economics*, vol. 118, pp. 375-1418.

Barba Navaretti, Giorgio and Venables, Anthony J. (2004) *Multinational firms in the world economy,* Princeton University Press, Princeton.

Barrios, S., Görg, H. and Strobl, E. (2005) "Foreign direct investment, competition and industrial development in the host country", *European Economic Review*, vol. 49, pp. 1761-1784.

Co, C. Y. (2001) "Trade, foreign direct investment and industry performance", *International Journal of Industrial Organization,* vol. 19, pp. 163–183.

Czech National Bank (several years) *Foreign Direct Investment. Annual Reports*. Available at http://www.cnb.cz/www.cnb.cz/en/statistics/bop_stat/bop_publications/pzi_books/index.html.

Dimaranan, B. V. (ed.) (2007) *Global trade, Assistance, and Production: The GTAP 6 Data Base*, Center for Global Trade Analysis, Purdue University, West Lafayette, IN.

Dycker, D. A. (2006) "Contrasting Patterns in the Internationalisation of Supply Networks in the Motor Industries of Emerging Economies", *Post-Communist Economies*, vol. 18, pp. 289-204.

Haiss, P., Mahlberg, B. and Molling, M. (2009) "The Automotive Industry in Central and Eastern Europe – Engine of Growth or Free Rider?" in *Oxford Business and Economics Conference (OBEC),* Oxford, June 24-26, Oxford University, U.K.

Harrison, G. W., Jones, R., Kimbell, L. J. and Wigle, R. (1993) "How robust is applied general equilibrium analysis?", *Journal of Policy Modeling*, vol. 15, pp. 99-115.

Jones, R. W. (2002) "Trade theory and factor intensities: An interpretative essay", *Review of International Economics*, vol. 10, pp. 581-603.

Kosova, R. (2004) "Do Foreign Firms Crowd Out Domestic Firms? Evidence from the Czech Republic", School of Business and Public Management, The George Washington University, mimeo.

Latorre, M. (2009) "The economic analysis of multinationals and foreign direct investment: A review", *Hacienda Pública Española*, vol. 191, pp. 97-126.

Latorre, M. (2010) *The impact of foreign-owned companies on host economies: A Computable General Equilibrium approach*, New York: Nova Science.

Latorre, C. and Gómez-Plana, A. G. (2010) "Multinationals in the Motor vehicles industry: A general equilibrium analysis for a Transition Economy", working paper, FUNDACIÓN DE LAS CAJAS DE AHORROS, Nº 546/2010.

Latorre, M., Bajo-Rubio, O. and Gómez-Plana, A. G. (2009) "The effects of MNES on host economies: A CGE approach", *Economic Modelling*, vol. 26, pp. 851-864.

Markusen, J. R. and Venables, A. J. (1998) "Multinational firms and the new trade theory", *Journal of International Economics*, vol. 46, pp. 183-203.

Markusen, J. R. and Venables, A. J. (2000) "The theory of endowment, intra-industry trade and multinational trade", *Journal of International Economics*, vol. 52, pp. 209-234.

OECD, (2009) "Globalisation: Activities of multinationals", Available at: http://stats.oecd.org/index.aspx?r=983789

Pavlínek, P. (2003) "Transformation of the Czech Automotive Components Industry through Foreign Direct Investment", *Eurasian Geography and Economics*, vol. 44, pp. 184-209.

Pavlínek, P. and Janâk, L. (2007) "Regional Restructuring of the Škoda Auto Supplier Network in the Czech Republic", *European Urban and Regional Studies*, vol. 14, pp. 133-155.

Pavlínek, P., Domanski, B. and Guzik, R. (2009) "Industrial Upgrading Through Foreign Direct Investment in Central European Automotive Manufacturing", *European Urban and Regional Studies*, vol. 16, pp. 43-63.

Rutherford, T. F. and Tarr, D. G. (2008) "Poverty effects of Russia's WTO accession: "Modeling real" households with endogenous productivity effects", *Journal of International Economics*, vol. 75, pp. 131-150.

Sembenelli, A. and Siotis, G. (2005) "Foreign direct investment, competitive pressure and spillovers. An empirical analysis of Spanish firm-level data", Discussion Paper no. 4903, Centre for Economic Policy Research.

UNCTAD (several years) *World Investment Report*, United Nations, New York and Geneva.

Figure 1. Percentage on production of national firms and MNEs in the Czech economy
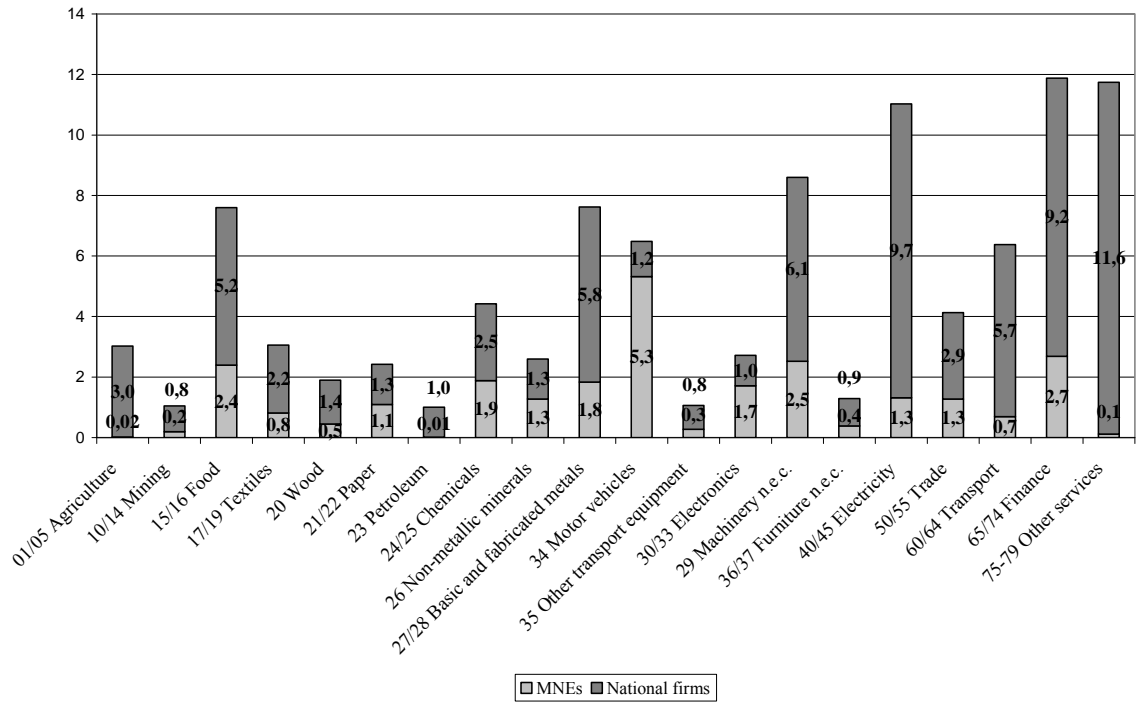
Notes: Author's own elaboration from Dimaranan (2007), OECD (2009) and Czech National Bank (2004). The definitions of the sectors follow the ISIC Rev 3 Classification.

Figure 2. Labour intensity (Labour costs/capital costs) of national firms and MNEs
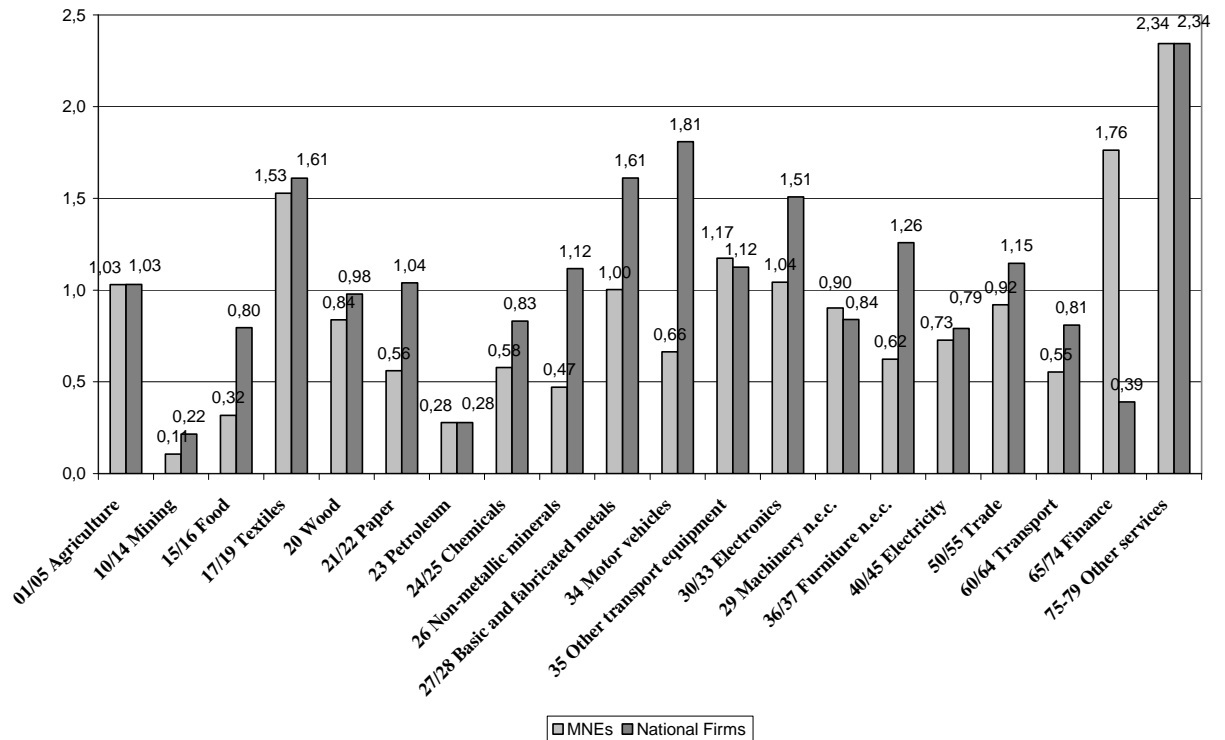
Note: see note in Figure 1.

Figure 3. Percentage on total costs of domestic intermediates of national firms and MNEs
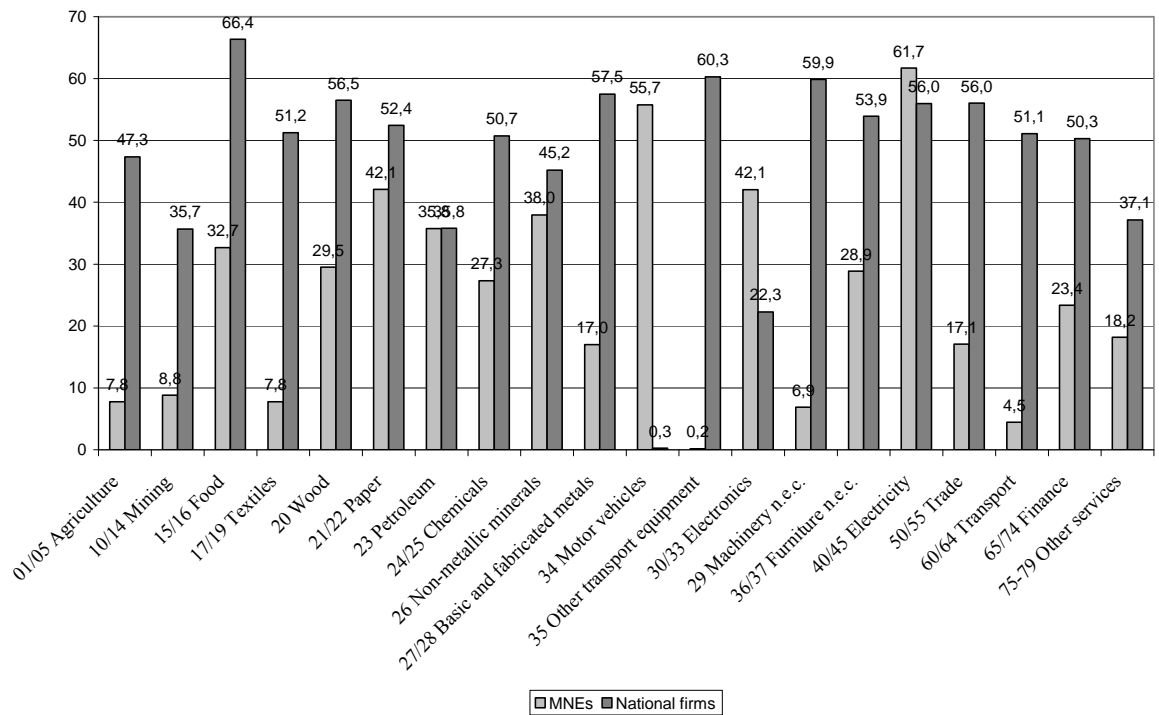
Note: see note in Figure 1.

Figure 4. Percentage on total costs of imported intermediates of national firms and MNEs

Note: see note in Figure 1.

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Figure 5. Simulation results: Effects on aggregate variables
(percentage change from benchmark)

Table 1. Simulation results: Effects on production of national firms and MNEs
(percentage change from benchmark)

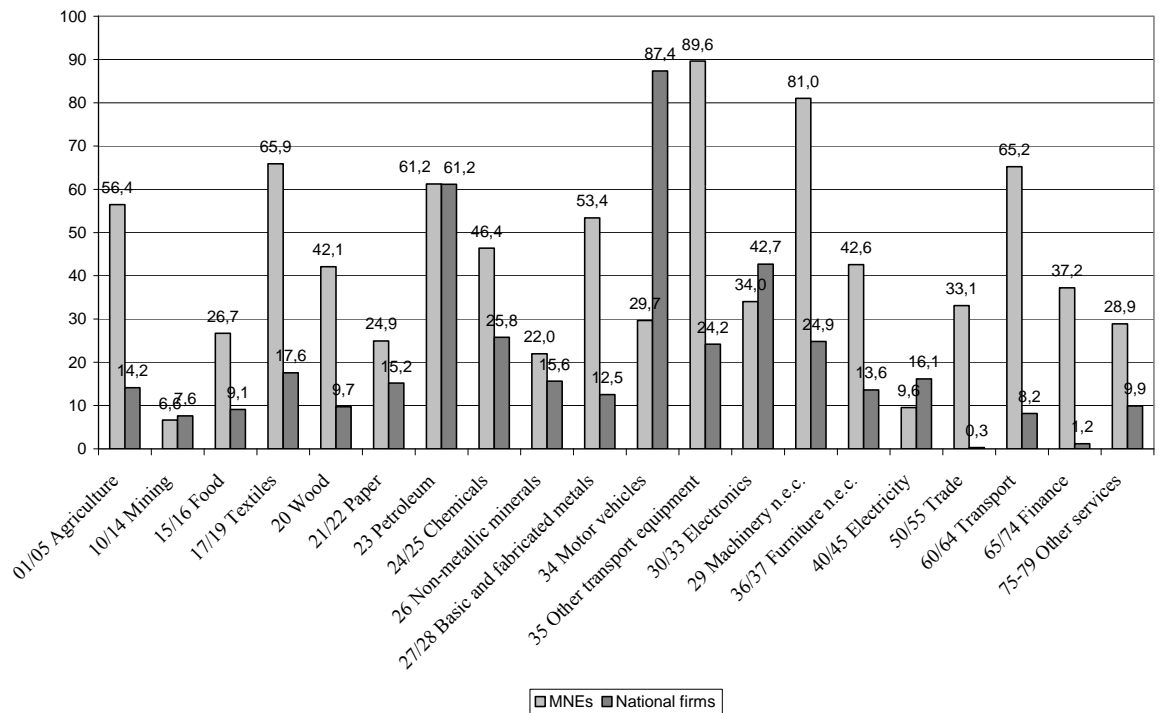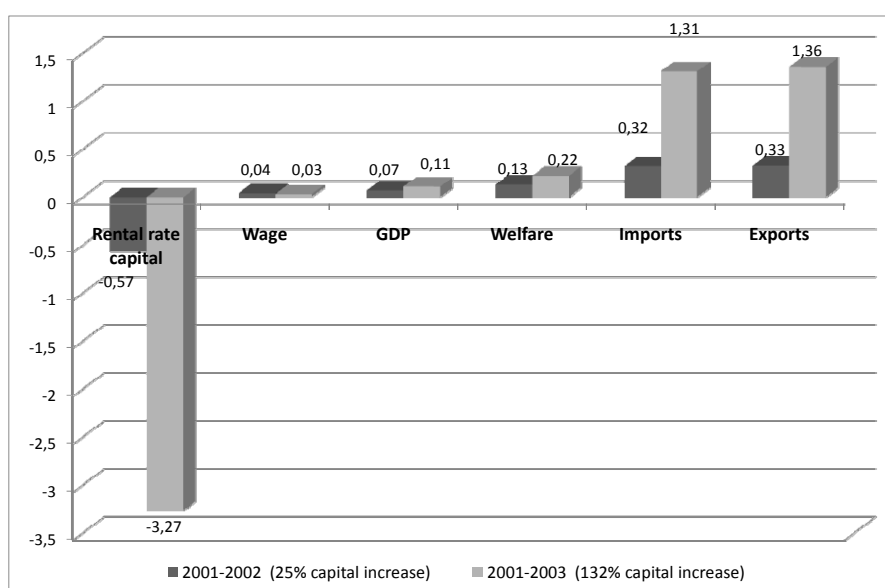|	2001-2		2001-3	
	MNEs	National firms	MNEs	National firms
01/05 Agriculture, hunting and fishing	0.00	0.02	0.03	0.08
10/14 Mining and quarrying	0.00	0.00	0.00	0.01
15/16 Food, beverages and tobacco	0.01	0.08	0.00	0.22
17/19 Textiles. wearing apparel, leather, footwear	0.00	0.04	0.08	0.35
20 Wood and wood products, except furniture	0.00	0.03	0.10	0.31
21/22 Paper; printing, publishing and recorded media	0.01	0.04	0.11	0.32
23 Petroleum	-0.01	0.03	0.07	0.06
24/25 Chemicals, rubber and plastics	0.02	0.05	0.14	0.34
26 Non-metallic mineral products	0.00	0.06	0.10	0.42
27/28 Basic and fabricated metal products	-0.04	0.05	-0.06	0.46
34 Motor vehicles	10.96	0.10	45.37	0.34
35 Other transport equipment	0.08	0.18	0.36	0.79
30/33 Electronics	0.02	0.03	0.26	0.33
29 Machinery and equipment n.e.c.	0.41	1.23	1.57	4.62
36/37 Furniture, manufacturing n.e.c.	0.01	0.05	0.11	0.31
40/45 Electricity, gas and water supply; construction	-0.01	0.05	-0.12	0.23
50/55 Trade, repair; hotels and restaurants	0.04	0.13	0.06	0.51
60/64 Transport, Storage and Communication	0.01	0.06	0.13	0.28
65/74 Finance, insurance, real estate, business activities	0.22	-0.02	0.52	0.02
75-79 Other services	0.06	0.02	0.41	0.09

Note: The percentage increases in the capital held by MNEs in Motor vehicles across periods are: 2001-2002: 25%; 2001-2003: 132%. The definitions of the sectors follow the ISIC Rev 3 Classification.

Table 2. Simulation results: Effects on prices of national firms and MNEs
(percentage change from benchmark)

	2001-2		2001-3	
	MNEs	National firms	MNEs	National firms
01/05 Agriculture, hunting and fishing	0.04	0.06	0.18	0.21
10/14 Mining and quarrying	0.05	0.05	0.24	0.23
15/16 Food, beverages and tobacco	0.05	0.07	0.10	0.19
17/19 Textiles, wearing apparel, leather, footwear	0.04	0.05	0.18	0.19
20 Wood and wood products, except furniture	0.04	0.05	0.15	0.21
21/22 Paper; printing, publishing and recorded media	0.04	0.05	0.19	0.21
23 Petroleum	0.04	0.05	0.20	0.22
24/25 Chemicals, rubber and plastics	0.04	0.05	0.19	0.20
26 Non-metallic mineral products	0.04	0.05	0.18	0.22
27/28 Basic and fabricated metal products	0.03	0.05	0.14	0.20
34 Motor vehicles	-2.35	0.05	-8.10	0.20
35 Other transport equipment	0.05	0.03	0.23	0.13
30/33 Electronics	0.04	0.05	0.20	0.20
29 Machinery and equipment n.e.c.	0.09	-0.14	0.36	-0.45
36/37 Furniture, manufacturing n.e.c.	0.04	0.05	0.18	0.19
40/45 Electricity, gas and water supply; construction	0.03	0.06	0.07	0.19
50/55 Trade, repair; hotels and restaurants	0.03	0.04	0.04	0.12
60/64 Transport, Storage and Communication	0.05	0.03	0.21	0.12
65/74 Finance, insurance, real estate, business activities	0.08	0.02	0.22	0.10
75-79 Other services	0.05	0.04	0.18	0.10

Note: see Table 1.

Table 3. Simulation results: Effects on factor costs of national firms and MNEs
(percentage change from benchmark)

	2001-2		2001-3	
	MNEs	National firms	MNEs	National firms
01/05 Agriculture, hunting and fishing	0.04	0.11	0.14	0.37
10/14 Mining and quarrying	0.05	0.06	0.25	0.31
15/16 Food, beverages and tobacco	0.07	0.13	0.03	0.28
17/19 Textiles, wearing apparel, leather, footwear	0.04	0.06	0.07	0.21
20 Wood and wood products, except furniture	0.04	0.06	0.12	0.28
21/22 Paper; printing, publishing and recorded media	0.05	0.07	0.19	0.28
23 Petroleum	0.02	0.13	0.23	0.20
24/25 Chemicals, rubber and plastics	0.06	0.09	0.23	0.36
26 Non-metallic mineral products	0.04	0.08	0.20	0.33
27/28 Basic and fabricated metal products	0.00	0.06	-0.02	0.26
34 Motor vehicles	-13.64	0.08	-47.09	0.18
35 Other transport equipment	0.09	0.16	0.28	0.59
30/33 Electronics	0.05	0.06	0.23	0.20
29 Machinery and equipment n.e.c.	0.40	1.20	1.40	4.35
36/37 Furniture, manufacturing n.e.c.	0.05	0.07	0.17	0.23
40/45 Electricity, gas and water supply; construction	0.03	0.09	-0.09	0.24
50/55 Trade, repair; hotels and restaurants	0.06	0.10	0.07	0.30
60/64 Transport, Storage and Communication	0.04	0.08	0.18	0.26
65/74 Finance, insurance, real estate, business activities	0.14	0.00	0.27	0.07
75-79 Other services	0.06	0.05	0.17	0.06

Note: see Table 1.

Table 4. Simulation results: Effects on intermediate costs of national firms and MNEs
(percentage change from benchmark)

	2001-2		2001-3	
	MNEs	National firms	MNEs	National firms
01/05 Agriculture, hunting and fishing	0.04	0.03	0.21	0.11
10/14 Mining and quarrying	0.04	0.03	0.18	0.12
15/16 Food, beverages and tobacco	0.04	0.05	0.16	0.16
17/19 Textiles, wearing apparel, leather, footwear	0.05	0.05	0.22	0.19
20 Wood and wood products, except furniture	0.04	0.04	0.17	0.17
21/22 Paper; printing, publishing and recorded media	0.04	0.04	0.19	0.18
23 Petroleum	0.04	0.05	0.20	0.22
24/25 Chemicals, rubber and plastics	0.04	0.03	0.17	0.16
26 Non-metallic mineral products	0.04	0.03	0.16	0.14
27/28 Basic and fabricated metal products	0.05	0.04	0.21	0.17
34 Motor vehicles	-0.42	0.04	-1.43	0.20
35 Other transport equipment	0.05	0.00	0.23	0.04
30/33 Electronics	0.04	0.04	0.19	0.19
29 Machinery and equipment n.e.c.	0.04	-0.38	0.21	-1.32
36/37 Furniture, manufacturing n.e.c.	0.04	0.04	0.19	0.18
40/45 Electricity, gas and water supply; construction	0.03	0.04	0.14	0.17
50/55 Trade, repair; hotels and restaurants	-0.01	-0.01	0.00	-0.02
60/64 Transport, Storage and Communication	0.05	0.00	0.22	0.02
65/74 Finance, insurance, real estate, business activities	0.04	0.04	0.19	0.14
75-79 Other services	0.04	0.04	0.20	0.15

Note: see Table 1.

Table 5. Sensitivity analysis: Effects on sectoral variables of national firms and MNEs operating in Motor vehicles of the arrival of MNEs to that sector in the period 2001-2004, 150% capital increase (percentage change from benchmark)

		Production		Prices		Factor costs		Intermediate costs	
		MNEs	National firms	MNEs	National firms	MNEs	National firms	MNEs	National firms
GTAP elasticities (results in previous Tables)		45.37	0.34	-8.10	0.20	-47.09	0.18	-1.43	0.20
Armington elasticity	Half	44.60	0.06	-8.17	0.19	-47.53	0.04	-1.44	0.21
	Double	46.79	0.83	-7.97	0.22	-46.27	0.43	-1.42	0.19
Elasticity of substitution between national firms and MNEs production	Half	44.98	0.35	-8.12	0.20	-47.31	0.18	-1.42	0.21
	Double	46.07	0.31	-8.06	0.19	-46.68	0.19	-1.46	0.19
Elasticity of substitution between labour and capital	Half	52.83	0.34	-9.11	0.31	-53.35	0.66	-1.55	0.26
	Double	38.42	-0.22	-7.09	0.12	-40.97	-0.12	-1.30	0.15