DOES FDI MATTER FOR TRADE IN BRAZIL?
AN APPLICATION OF THE GRAVITY MODEL

July 2003

ABSTRACT

Foreign direct investment (FDI) in Brazil was essential for financing a persistent current account deficit since 1995; however several issues concerning its long-term impact remain unclear. One of these issues is the direct effect of FDI on trade. The first part of this article overviews the literature on multinational enterprise (MNE) and describes the theoretical relationship between FDI and trade in Brazil. A gravity equation is then applied to provide empirical evidence on the effect of FDI on exports and imports of the ten major manufactured goods. The dataset consists of trade flows between Brazil and 38 countries throughout the period of 1996-2002, as well as FDI disaggregated by industry and country of origin. The results indicate the existence of a positive relationship between FDI and imports. No relationship is detected in the case of exports. This suggests that FDI was mainly of horizontal type and resulted in more imports, as affiliates started to buy manufactured goods from their home countries. It seems that MNEs in Brazil have only been interested in supplying local markets and that exporting was not their main objective.

I – INTRODUCTION

The amount of foreign direct investment (FDI) in developing countries has grown dramatically over the course of the 1990s, from $24 billion per year in 1990 to $168 billion per year in 2001[1]. In Brazil, the implementation of the *Real*[2] plan in 1994 inaugurated a period of political stability and low inflation. Combined with the privatisation process and financial liberalization, the economic stability since then has attracted high flows of FDI to the country, reaching a total of $30 billion in 2000 – the second largest share of FDI to developing countries after China.

There is no doubt that FDI in Brazil was essential for financing a persistent current account deficit since 1995, however several issues concerning its long-term impact remain unclear. One of these issues is the direct effect of FDI on trade. This has long concerned policymakers in developing countries, given that multinational enterprise (MNE) activities may be an important instrument to leverage development, productivity and a country's export capacity[3], although they may also stimulate imports and negatively affect a country's trade balance.

As a consequence of the privatisation process, the largest share of FDI flow in Brazil has been directed to the service sector. This sector, however, is typically related to non-tradable activities. The effect of FDI on trade is more relevant in the manufacturing sector, which has represented 85% of total exports[4] throughout the period of 1995-2002. Furthermore, multinationals and enterprises with foreign capital are today responsible for more than half of this sector's exports, providing evidence of a strong link between FDI and exports. On the other hand, these same enterprises are also responsible for almost half of total Brazilian imports, revealing that FDI in the manufacturing sector is not only related to exports, but also to imports.

The manufacturing sector clearly has a high trade potential. Hence it is important to check whether FDI and international trade are substitutes or complements in this sector, i.e., whether a greater inflow of FDI in Brazil has been associated with decreases or increases of imports, and, more importantly, increases of exports, depending on the strategies of the MNEs.

This article uses the gravity model to provide empirical evidence on the effect of FDI on trade in Brazil. It consists of 7 parts. Following this introduction, Part 2 overviews the theory on

[1] Global Development Finance, World Bank (2002).
[2] This stabilization plan pursued the control of inflation and changed the previous currency to the *Real.*
[3] See Fritsch, W. and G. Franco (1991).
[4] Trade in free on board (FOB) values.

multinational enterprise and discusses the reasons why an MNE decides to locate its activities in a particular place and how this behaviour affects investment and trade. The theoretical relationship between FDI and trade is discussed in Part 3. Part 4 introduces the gravity model of bilateral trade, a methodology used for analysing the determinants of trade flows. Part 5 provides a description of the relationship between FDI and trade in the Brazilian manufacturing sector. In Part 6 a gravity equation is developed to test the direct effect of FDI on exports and imports of manufactured goods throughout the period of 1996-2002. Results of the model are analysed and compared with the theory. Finally, Part 7 offers some final comments.

Other effects of FDI, however, are not addressed in this article, such as efficiency implications, technology transfers, 'spillover' effects and profits repatriation. Similarly, the discussion of policy implications of the findings is not an aim of this article.

II – THE MULTINATIONAL ENTERPRISE

Despite the importance of multinational enterprises in international economics, theoretical and empirical research on these firms was long conducted separately from that on international trade. During the 1960s and 1970s, international trade models were dominated by constant-return and perfect competition tradition, limiting the analysis of multinational enterprise behaviour, as Krugman points out: "…models in which firms place operation in different countries for comparative advantage reasons are unsatisfactory as a complete explanation for the actual pattern of foreign direct investment" (1995, pp.1265). Boundaries of firms may cut across boundaries of nations, but in a perfectly competitive and constant-returns model, firms are essentially invisible.

The introduction of imperfect competition, increasing returns to scale and product differentiation into the traditional international trade theory allowed other determinants of trade flows, such as intraindustry and intrafirm trade, to be addressed. Recently, there has been also a movement towards applying concepts from trade theory to the analysis of the location of population and production[5], giving birth to what is called the "new economic geography"[6]. This approach emphasizes the interaction among increasing returns, transportation costs and the movement of production factors, and can be applied to urban, regional and international economics.

Modelling multinational enterprise behaviour and trade patterns together thus became possible with these several recent theoretical developments. Trade theory is simply a location theory, and multinational enterprise activities, which are a consequence of the interaction between increasing returns and trade costs, are an extension of this theory. In practice, MNE production and behaviour have a direct effect on trade. In his recent book, *Multinational Firms and the Theory of International Trade,* Markusen provides a framework to integrate both fields. The literature review in this section draws on the several models available in Markusen's book, which depart from a simple partial equilibrium towards a full general equilibrium analysis.

As described by Markusen, "multinational enterprises are firms that engage in foreign direct investment, defined as investments in which the firm acquires a substantial controlling interest in a foreign firm or sets up a subsidiary in a foreign country" (pp.5). As a consequence, production is geographically divided between different countries. But why should we care about MNE and FDI?

Markusen answers this question by presenting some important facts: FDI inflows have grown rapidly throughout the world, mainly in the late 1980s and 1990s, reaching an annual growth rate of

[5] See Fujita, M., P. Krugman and A.J. Venables (1999).
[6] Krugman (1991) offers a straightforward introduction to the subject.

31.9% between 1996 and 1999. Sales of foreign affiliates have grown more then 10% a year since the mid-1980s. The most surprising fact is that 30% of world trade is now intrafirm trade.

A typical point of departure to analyse the behaviour of multinational enterprises is the logical premise that firms incur costs of conducting business abroad relative to the domestic country. Dunning (1977) proposed three necessary conditions for firms to become multinational through foreign direct investment: ownership, location and internalisation advantages. As described by Markusen, ownership advantages arise when a firm is intensive in research and development (R&D) and in the use of knowledge capital, which includes human capital of employees, patents, procedures, trademarks and reputation. These can be easily transferred internally to another country, giving the firm market power advantages. Location advantages arise when there are reasons to locate the production in a different country, such as market and factor considerations. Finally, internalisation advantage arises when a firm has a reason to exploit its ownership advantage internally, rather then sell its product to a foreign firm or incur costs of monitoring licenses.

In practice, there are two ways a firm can divide its productions and become multinational. The first way is to simply duplicate some of its activities, building a plant in a foreign country (the "host" economy) in addition to the one installed in the country where the multinational firm is based (the "home" economy). The idea is that if final consumers are dispersed across different countries, a firm faces a trade-off between the loss of economies of scale associated with multiplants and the reduction of transport costs it can achieve by producing locally a similar product for each market. Thus, firms exhibiting multiplant economies of scale in production become multinational to avoid costs associated with cross-border trade, dispersing the production and supplying the market directly through an affiliate. Investments associated with this behaviour are called "horizontal" and are driven by market considerations.[7]

The second way is to split a firm's activities by function and stages in order to take advantages of differences in factor prices, breaking down the production's value-added chain. Investments into this type of activity are called "vertical" and are driven by factor considerations. Firms typically engage in this behaviour when they have a multi-stage production process with different factor intensities, as well as low transaction costs associated with cross-border trade, resulting in a production process geographically distributed across many countries.

There is, however, an interesting difference between the two behaviours described above. High levels of trading costs in host economies attract horizontal FDI due to the stronger protective effect on local markets, which creates an incentive for local production and sales. On the other hand, there is a negative relationship between trade costs and vertical FDI, as the costs of importing intermediate inputs depend directly on trade costs and affect the affiliate's supply competitiveness in the world market.

The role of distance is also important and has many implications for a decision to become multinational. Large distances might discourage a firm from setting up a foreign plant due to informational costs about local markets, as well as its lower importance relative to closer markets. On the other hand, trade costs increase with distance and a firm will have a greater incentive to supply a foreign market directly through an affiliate, instead of exporting to this country.

In a simple model of perfect competition and constant returns, Markusen manages to demonstrate how technology and country characteristics affect a firm's behaviour, revealing the equilibrium market structure. The optimal choice for a firm depends on the relationship between the market size

[7] In such cases, barriers to trade will promote horizontal investments.

at home and abroad, home and foreign production costs and the existence of technology transfer costs.

The model shows that a firm will choose to have a two-plant structure when the total world demand (representing the home and host market) and trade costs are high. If firm-specific fixed costs, such as R&D and initial costs, are large relative to plant-specific fixed costs (costs of an additional plant), there will also be an incentive to split production, reducing the average firm-specific fixed costs per plant. Finally, the model shows that a firm will split production when technology transfers costs are low.

Using a duopoly model of international competition and increasing returns, Markusen shows that trade costs have a large positive impact on the number of plants per firm. An extension of the model shows that incumbent multinationals with a first-move advantage will have the incentive to install plants in foreign markets due to lower production costs, as it has already sunk its firm-specific costs.

These previous models have several limitations, largely because they are developed in a partial equilibrium framework. Markusen transposes these limitations, deriving a general-equilibrium oligopoly model of horizontal multinationals. The main result is that multinationals tend to be found in equilibrium when firm-level economies of scale are high relative to plant-level economies of scale, i.e., when fixed-specific costs are more important than plant-specific costs. High tariffs and transport costs also create an incentive for multinational activities. It is shown in the model that, due to transport costs, an increase in the world income raises a multinational's markup revenues more than it raises the revenue of national firms. This suggests that multinational activities relative to trade become more important when world income grows.

Markusen has also developed a model to explain internalisation advantages. A firm's reputation is the result of consumers' imperfect information about quality. Like any knowledge-based asset, reputation can easily be transferred to a new market, but a moral hazard problem arises when the firm cannot monitor a licensee and guarantees the quality of production. Another problem arises if a local agent, after technology is transferred through licensing, builds a rival firm. These facts create an incentive for direct investment in the new market.

Trade and its relationship to affiliate production are addressed in Markusen's "knowledge-capital" model, built around the key idea that firms have high knowledge-based assets and fixed-costs, creating firm-level economies of scale. As described above, the reduction of trade costs tends to reduce affiliate production when it is of horizontal type, but increase it when it is of vertical type. One result of the model is that vertical production arises when one country is small and skilled labour abundant relative to the other country, creating and incentive for firms with several stages and different factor intensities to separate production. On the other hand horizontal production arises when two countries are similar in size, creating and incentive to attend both markets with different plants. The type of production – horizontal or vertical – will determinate the effect of multinational activities on trade.

FDI is a substitute for trade when a horizontal affiliate is built in a host country to directly supply this market. The idea is that products that had previously been imported from the home nation are now produced in the host economy, replacing imports. However, if the host nation's affiliate is vertically linked to the multinational's home operations, its production is going to complement trade because there will be an increased exchange of intermediate and final goods between the home and host economies. It is important to notice that, because the pattern of production is determined by the difference between the two countries, trade and affiliate production will tend to be substitutes for similar countries and complements for dissimilar countries.

In an extension of the previous models, Markusen includes the possibility for produced and traded intermediate goods, focusing on the idea that intermediate goods are shipped to a foreign country for final production, then shipped back to the parent country. The motivation for this approach comes from the fact that affiliates in developing countries export a large share of production back to the multinational's parent country. The model may explain why larger and higher income developing countries, such as Brazil and China, receive large amounts of FDI. This is in part related to direct cost and factor requirements. Multinational enterprises need local skilled labour as well as reasonable infrastructure to build a final product, and these requirements are only found in high-income developing countries. A country's size matters because not all the final production has to be shipped back to the parent country and is instead consumed by the local market. The number of multinational firms in developing countries is predicted to have an inverted U-shaped relationship to the endowment differences between them and the parent country.

Turning to the empirical analysis of the models derived by Markusen, many hypotheses regarding multinational enterprise activities are tested and most of the results fit well with the theory. These models illustrate well the forces affecting a firm's decision to become multinational and reveal the strong links between multinational activities and trade. In short, the models help to understand MNE behaviour. The next section will address the direct relationship between FDI and trade.

III – FDI AND TRADE

As shown in the previous section, trade and affiliate production are substitutes or complements depending on whether the affiliate production is for local sale or for export. If firms become multinational in order to take advantage of cost differences, then by so doing, vertical FDI will tend to create international trade. However, if firms become multinational in order to gain a better access to local markets, horizontal FDI will replace conventional international trade.

Markusen points out that most FDI flow seems to be horizontal, but surprisingly, there is no theoretical and empirical consensus on the link between trade and FDI. From a theoretical point of view, both flows were traditionally considered as substitutes. This can be explained within the framework of the Hecksher-Ohlin theory, where trade is caused by differences in factor endowments and can be replaced by capital movements.

On the other hand, empirical results[8] often show the existence of complementarities, where FDI is associated with more, rather then less, exports from the home country. Within a framework where production technologies differ across countries, Markusen et al (1995) show that capital mobility and volume of trade in goods can be complements, providing a possible theoretical explanation for the results. Brainard (1998) explores alternative reasons for complementarity. She notes that multinational firms typically hold intellectual property advantages, and this might enable them to have larger shares of foreign markets, increasing both trade and investment where the firms operate.

What are the implications of these facts for a host economy? The relationship between FDI and trade in a host country can be seen to be symmetrical to that of the home country. More efficient affiliate production in host economies discourages import not only from the home country, but also from other countries from which it was importing the good that is now produced locally. This is the effect of substitution between FDI and trade flows. At the same time, a host country may increase its import of intermediate inputs to serve the newly created affiliate production, and export the final good not only back to the home country, but also to other countries that demand this good. In such

[8] See Fontagné, L. (1999) and Fontagné, L. and M. Pajot (1997).

cases, FDI and trade are complements. However, it is also possible that they turn into substitutes in the long run, as affiliate production becomes more efficient in the production for local markets, displacing imports from the home country.

Therefore, complementarity and substitutability between FDI and trade may exist simultaneously. The combination of the two may lead to a positive or a negative net impact of FDI on export and import volumes. Whether it is positive or not depends on the kind of effect that predominates in the particular situation. Since the effect is theoretically indeterminate, the issue becomes an empirical problem. The gravity model, a well-established methodology used to analyse the determinants of bilateral trade, is therefore presented in the next section.

IV – THE GRAVITY MODEL

Newton's gravitational model says that the attraction between two bodies is proportional to the product of their masses and inversely related to the square of the distance between them. By analogy, the gravity model of bilateral trade states that trade between two countries is proportional to their GDPs and inversely related to the distance between them. Other variables can also represent a country's "mass", such as population, land area and per capita GDP. The gravity equation typically looks as follows:

$$\text{Log}\,(T_{ij}) = \log\,(\alpha Y_i^{\beta 1} Y_j^{\beta 2} D_{ij}^{\beta 3} X^{\beta 4}),$$

where T_{ij} represents the trade flow between country i and j and is a log linear function of the countries' GDPs (Y_i and Y_j), the distance between them (D_{ij}) and of other variables explaining trade flows (X).

Linnemann (1966) was the first one to provide an econometric study on international trade using a gravity equation. He classified the determinants of trade flows in three different categories of variables: supply potential of the exporting country and demand potential of the importing country, both represented by domestic output and population, and "resistance" to trade between the two countries, represented by trade costs. Following Linnemann, Anderson (1979) presented a theoretical foundation for the gravity model, using a framework of constant elasticity of substitution (CES) preferences and product differentiation by country.

The best-known theoretical foundation of the idea that bilateral trade between two countries depends positively on their size, however, comes from the work of Krugman (1980). His model shows that under monopolistic competition and product differentiation, increasing returns generate trade between two countries, even if the economies have identical preferences, technology and factor endowments[9]. In addition, gains from trade occur because the world economy offers a wider variety of goods to consumers.

More recently, Deadorff (1998) managed to derive the gravity model from the classic Hecksher-Ohlin theory of comparative advantages, showing that it is possible to apply the model for any leading theory, enriching its foundation. His purpose was to show that the empirical success of the gravity model does not necessarily support the imperfect competition model relative to the Hecksher-Ohlin model.

[9] The model is derived from the Dixit and Stiglitz (1977) model. Equilibrium takes the form of a Chamberlinian monopolistic competition. Each differentiated good is produced in only one country, which becomes a net exporter in the industry for those goods for which it has a larger domestic demand. The argument is based on the existence of transport costs and economies of scale, which create an incentive to concentrate production close to large markets.

Trade costs explain the negative relationship between bilateral trade and distance. Greater distance implies higher trade costs, increasing the price of a good in the importing country and reducing its demand. Surprisingly, the role of geography and distance was long ignored by international economists. It was the introduction of imperfect competition and increasing returns that made it possible to model location and trade theory together. Distance is important because it leads to agglomeration, as firms will have the tendency to locate themselves close to their markets, either of suppliers or consumers, to avoid trade costs. Many different elements affect these trade costs; some of them observable ones such as transport cost, but many others non-observable, such as different languages, uncertainty about delivery, psychological and cultural barriers.

A problem arises when transport costs are high, breaking down the apparent idea behind a simple gravity equation (Krugman 1995, pp.1273). Trade between two economies should depend not only on the size and distance between them, but also on the sizes and distances of other countries, i.e., distance to other countries affects the bilateral trade. There are also problems when we consider many sectors, differing in importance of scale of economies and in the level of transport costs, i.e., market effects may influence the pattern of trade.

Today, there is no generally accepted analysis of the pattern of multilateral trade when transport costs matter. The fact is that the gravity model is a well-established methodology to analyse trade flows. As pointed out by Anderson, "our findings suggest the desirability of basing gravity equation estimation on the theory, both in terms of estimation and interpretation" (2001, pp.25).

Early studies that have used this approach reported that income levels and distance explain around two-thirds of the cross-country trade variation. That is an impressive result, but the interesting aspect of the gravity model is the possibility to test the effect, through the use of dummy variables, of geographical and cultural measures, such as common border[10], language, currency[11] and, very importantly, membership in trading arrangements[12]. This article presents a gravity equation that controls for these measures and introduces FDI as an additional covariate[13]. The next section describes the case of Brazil, for which the gravity model is applied to test the relationship between FDI and trade.

V – THE CASE OF BRAZIL

Between 1995 and 2002, Brazil was one of the major recipients of FDI among developing countries. The result was an increase in the number of multinational enterprises or firms with foreign capital acting in the country, from 6,322 in 1995 to a total of 11,404 enterprises in 2000[14]. The service sector received approximate 80% of total FDI in the period 1996-2000 due to the privatisation process (see Table 1 in Appendix A). In 2001, however, the total flow to this sector fell to one half of its value in the previous year, falling further in 2002. This was mainly due to the exhaustion of the privatisation process. On the other hand, total FDI to the manufacturing sector has consistently grown since 1996, reaching 40% of total inflow in 2002. In addition, the ten major manufacturing industries received around 95% of total FDI to the sector. Among them, the food and beverage, automobile and chemical industries received the largest share, around 70%.

[10] See McCallum, J. (1995) for the use of gravity equations to test the effect of common border.
[11] See Frankel, J.A. and A.K. Rose (2000) for the use of gravity equations to test the effect of currency unions.
[12] See Rose, A.K. (2002) and Piani, G. and K. Honorio (2000) for the use of gravity equations to test the effect of membership in trading arrangements.
[13] See Fontagné, L., M. Freudenberg and M. Pajot (1999), Fontagné, L. and M. Pajot (1999), Liu, G.L. and E. M. Graham (1998) and Castilho, M. and S. Zignago (2002) for the use of gravity equations to test the relationship between FDI and trade.
[14] The Brazilian Central Bank conducted a Foreign Capital Census in 1995 and 2000. Data for FDI stock are only available for these two years.

Exports have grown by 30% throughout the period of 1995-2002, mostly after the devaluation of the Brazilian currency in 1999 (see Table 2 in Appendix A). The manufacturing sector was responsible for 87.5% of total exports in the period, and the ten major manufacturing industries were responsible for 80% of the exports in the manufacturing sector, or 70% of total Brazilian exports. On the other hand, imports decreased in the same period, after reaching its peak in 1997 (see Table 3 in Appendix A). 90% of total imports were manufactured goods. Interestingly, though, the ten major manufactured goods accounted not only for 70% of total imports between 1995 and 2002, but also for 70% of total exports.

What, then, is the observed relationship between FDI and trade in Brazil? Multinationals and enterprises with foreign capital acting in the manufacturing sector also engage in international trade. In 1995, these enterprises were responsible for 39.1% of total exports and 33.3% of total imports (see Table 4 in Appendix A). In 2000, however, their share of total exports and imports increased to 49.4% and 43.1%, respectively. Intrafirm trade also increased among these enterprises, and in 2000 accounted for 31.9% of total exports and 24.1% of total imports. FDI, then, seems to be strongly related to trade in the manufacturing sector.

Because Brazil is a large market and may have factor costs advantages, it seems reasonable to believe that FDI in the manufacturing sector was of both vertical and horizontal type throughout the period of 1995-2002. If vertical investments were predominant in the period, we would expect an increase in both imports and exports of manufactured goods, i.e., a complementarity relationship between FDI and trade. If horizontal investments were predominant, we would expect a decrease in imports of manufactured goods, i.e., a substitutability relationship between FDI and trade. However, it is possible that many affiliates in Brazil supply local markets and buy goods and inputs from their home countries, i.e., horizontal FDI complemented trade, resulting in larger imports. This may be the case of the electronic industry, where production for local supply may result in larger imports of electronic components. An analysis of the correlation between trade and FDI in the manufacturing sector thus requires a disaggregated approach by industry and country.

VI – AN APPLICATION OF THE GRAVITY MODEL

VI.1 – Methodology

Using a disaggregated approach by industry and country, FDI is added to the gravity equation to show empirical evidence of its effect on trade in Brazil. The dependent variable of the equation is exports and imports of the ten major manufactured goods[15], disaggregated by 38 main Brazilian trade partners[16] and covering the period 1996-2002. This sample accounts for 80% of exports and 90% of imports of manufactured goods in the period.

The gravity equation includes the standard variables GDP and per capita GDP at purchasing power parity (PPP), obtained from the *World Development Indicators,* World Bank. The reason PPP was adopted instead of nominal values is because large temporary swings in nominal exchange rate, very frequent in Latin American countries and in Brazil, could distort the comparison of incomes. The third standard variable is a measure of geodesic distance[17] between Brazil and its respective trade partner. The model has a dummy variable for every industry to allow for different intercepts,

[15] See tables in Appendix A for the ten major manufacturing industries. They were aggregated to match with the Central Bank industry classification. Data was obtained at Funcex.
[16] See Table 3 in Appendix B.
[17] This variable was calculated by the CEPII. See Table 3 in Appendix B.

as well as a dummy for the countries belonging to Mercosur[18] and for countries sharing a common language with Brazil (it only applies to Portugal).

Finally, FDI disaggregated by industry and country of origin is also included in the equation. This variable assumes zero values for some observations, but because of logarithmic transformation, one is added to every observation. It is important to notice that the effect of both FDI flows and FDI stock are tested. Unfortunately, there is no annual data available for FDI stock and a proxy had to be constructed adding FDI flows in the period 1996-2002 to the stock in 1995[19]. A temporal lag for FDI could be used, but because the data is annual, this may not be necessary. The model is run separately for exports and imports, and follows the structure:

$$\log(T^B_{ikt}) = \alpha + \beta_1 \log(Y_{it} * Y^B_t) + \beta_2 \log[(Y_{it}/N_{it}) * (Y^B_t/N^B_t)] + \beta_3 \log(Dist^B_i) + \beta_4 \log(1+FDI_{ikt}) + \beta_5 D_M + \beta_6 D_L + \sum \beta_k D_k + u$$

where:
T^B_{ikt} is Brazilian sector k's exports to country i or import from country i in year t.
Y_{it} is country i's GDP in year t
Y^B_t is Brazilian GDP in year t
N_{it} is country i's population in year t
N^B_t is the Brazilian population in year t
$Dist^B_i$ is the distance from Brazil to country i
FDI_{ikt} is sector k's FDI (flow or stock) from country i in year t
D_M is a dummy for Mercosur members
D_L is a dummy for Portugal
D_k is sector k's dummy

As discussed in section 4, a positive sign for the coefficients of GDP is expected. The variable per capita GDP was included because richer countries appear to trade more, because they liberalize more as they develop. As a consequence, the coefficient of per capita GDP is also expected to be positive. These two variables will capture mainly the effect of the foreign countries, as the Brazilian GDP is a variable with small variance.

The theory predicts a negative sign for the coefficient of distance. The coefficients of the dummies for Mercosur and common language are both expected to be positive, since trade should be larger among countries with trade agreements (lower tariffs) and common language. The effect of the dummy Mercosur is expected to reduce the effect of distance, as Brazil trades more with Argentina, Uruguay and Paraguay not only because they are geographically closer, but because Brazil has lower trade barriers with them thanks to the trading block.

The coefficient of FDI will depend on the type of activities the multinational enterprises are undertaking in Brazil. If FDI was mostly of horizontal type, a decrease in imports is expected as well as an occasional increase in exports, as affiliates can also supply foreign markets. If FDI is mostly of vertical type, an increase in both imports and exports is expected. However, as described in section 5, it is possible that horizontal investments resulted in larger imports of inputs to supply affiliate production for local markets.

[18] Brazil, Argentina, Uruguay and Paraguay formed the customs union and trading block "Mercosur".
[19] The Brazilian Central Bank conducted a Foreign Capital Census in 1995.

VI.2 – Results

The equation is fitted to the data by means of Ordinary Least Squares (OLS) regression analysis[20]. Because the data is pooled across time, year dummies are also included in the model. Table 1 reports the results of the regressions for exports and imports, both with either FDI stock or FDI flow as explanatory variables. Year and sector controls are not reported (see Appendix C for entire results).

Table 1 – Econometric Results

	Dependent Variables (in log)			
Explanatory Variables	**Exports**		**Imports**	
Log (product of GDP)	0.998**	1.017**	1.356**	1.244**
	(0.036)	(0.039)	(0.037)	(0.041)
Log (product of per capita GDP)	0.172*	0.208*	1.730**	1.419**
	(0.078)	(0.091)	(0.087)	(0.102)
Log (Distance)	-2.439**	-2.479**	-1.367**	-1.063**
	(0.098)	(0.106)	(0.131)	(0.141)
Log (FDI flows)	0.014		0.023*	
	(0.010)		(0.011)	
Log (FDI stock)		-0.004		0.081**
		(0.010)		(0.011)
Mercosur member	-0.126	-0.142	1.519**	1.569**
	(0.135)	(0.135)	(0.219)	(0.215)
Common language	-0.065	-0.065	0.652**	0.656**
	(0.113)	(0.113)	(0.124)	(0.138)
Adjusted R2	0.51	0.51	0.55	0.56
Number of Observations	2624	2624	2496	2496
Standard Error	1.88	1.88	2.19	2.17

Notes: White-type standard errors in parentheses.
Intercept and year and sector dummies not reported.
* Significant at 5% level
** Significant at 1% level

The standard gravity variables have the expected signs in the four estimations. The coefficient of the product of the countries' GDP is positive and highly significant for both imports and exports. The results indicate that trade increases proportionally with size in the case of exports (elasticity around 1) and more than proportionally in the case of imports (elasticity larger then 1). The coefficient of the product of per capita GDP is also positive for both imports and exports, however the elasticity is much larger for imports. This may be explained by the fact that many manufacturing goods are imported from rich countries. The coefficient of distance is negative and significant for all estimates, and its effect is larger on exports than on imports.

The coefficient for Mercosur membership is only significant in the case of imports. This is maybe due to the fact that Brazil is the largest market for the other three members of Mercosur and that in turn they are small markets for Brazilian manufactured exports. As expected, imports from a member country of Mercosur are 4.5 times larger ($e^{1.5}$) than from a country outside the trade area.

The coefficient for language is only significant and positive for imports. Brazil imports 90% more ($e^{0.65}$) from Portugal because the two countries share a common language and stronger cultural and political links.

[20] For more details on the empirics of the gravity model, see Frankel, J.A. (1997).

Turning to FDI, the variable of interest, the main results of this analysis indicate the existence of a positive relationship between FDI and imports of manufactured goods. The coefficients of both stock and flow were positive and significant in the case of imports, however no relationship was detected in the case of exports. This suggests that FDI was mainly of horizontal type and resulted in more imports, as affiliates started to buy manufactured goods from their home countries. It seems that MNEs in Brazil have only been interested in supplying local markets and that exporting was not their main objective. Similar regressions were run with a temporal lag for FDI, however this variable was not significant.

Table 2 shows the coefficients obtained for both FDI stock and flow when the model is repeated for each industry separately[21]. We obtain that either FDI stock or flow resulted in an increase of imports of food and beverage, paper, machines, and electronic equipment, compatible with the overall result. However, it also had a positive impact on the export of machines and electronic equipment, indicating that these industries are vertically integrated with MNEs' home production.

FDI to the chemical, electrical and non-metallic industries affected neither the export nor the import of these goods. It did, however, have a positive effect on the export of rubber, automobiles and basic metallurgy. Furthermore, import of basic metallurgy products was negatively affected, indicating that this industry, together with the rubber and automobile industries, received horizontal investments to supply both the Brazilian and foreign markets.

Table 2 – Econometric results for each industry

	Exports		Imports	
Industry	**FDI flow**	**FDI stock**	**FDI flow**	**FDI stock**
Automobile and vehicle parts	0.016	0.041*	0.013	0.046
	(0.027)	(0.025)	(0.026)	(0.029)
Basic metalurgy and metal products	0.079***	0.069**	-0.066***	-0.020
	(0.026)	(0.031)	(0.025)	(0.027)
Chemical products	0.027	-0.012	-0.039	0.027
	(0.023)	(0.026)	(0.034)	(0.046)
Electrical machines	-0.014	-0.021	-0.046	-0.061
	(0.027)	(0.027)	(0.036)	(0.041)
Electronic and communication equipment	0.036	0.097**	0.033	0.168***
	(0.038)	(0.039)	(0.032)	(0.040)
Food and beverage	0.032	-0.013	0.042**	0.065**
	(0.023)	(0.033)	(0.020)	(0.027)
Machines and equipments	0.059**	-0.047	0.031	0.166***
	(0.024)	(0.029)	(0.036)	(0.039)
Non-metallic mineral products	-0.046	-0.031	-0.027	0.000
	(0.039)	(0.032)	(0.025)	(0.021)
Paper and paper products	-0.011	-0.049	0.012	0.105***
	(0.060)	(0.051)	(0.047)	(0.038)
Rubber and plastic materials	0.056**	0.068**	-0.034	0.038
	(0.025)	(0.027)	(0.033)	(0.031)

Notes: White-type standard errors in parentheses.
* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

These last results must be analysed with caution, since the sample for each of the industries is small and because a temporal lag for FDI was not considered. However, the overall result is clear:

[21] The complete results of these estimations are not reported in this article.

throughout the period of 1996-2002, FDI had a positive impact on imports and no effect on exports of manufactured goods, i.e., FDI and trade seem to be partial complements. A final exercise[22] shows that FDI flow accumulated every year in the period of 1996-2002 (e.g., a different proxy for FDI stock) seemed to have had a positive impact on exports. This may indicate a recent change in the strategies of MNEs in Brazil towards exporting. However, further research on this issue is necessary.

VII – CONCLUSION

The main objective of this article was to provide empirical evidence on the effect of foreign direct investment (FDI) on trade in Brazil. After an overview of the theory on multinational enterprise (MNE), the theoretical relationship between FDI and trade in the manufacturing sector was discussed. A gravity equation was then applied to estimate the effect of FDI on exports and imports of the ten major manufactured goods throughout the period of 1996-2002.

The results suggest that FDI had a positive impact on imports and no effect on exports of manufactured goods. MNEs started to buy manufactured goods from their home countries and seem to have only been interested in supplying local markets. Moreover, exports were not their main objective. The reason this happened is because Brazil is a high-income developing country with a large domestic market, creating an incentive for production for local supply. In addition, the economic stability since 1995 attracted MNEs to supply a growing market.

A final exercise showed that an alternative proxy for FDI stock seems to have had a positive impact on exports. This may indicate a recent change in the strategies of MNEs in Brazil towards exporting, as affiliates' activity becomes more efficient. Further research on this issue is needed, as well as on the fact that FDI might be simultaneously determinate with exports and imports (i.e., it might be an endogenous variable of the model).

FDI in Brazil was essential for financing a persistent current account deficit since 1995; however the results of this article raise concerns about its long-term effects. The activity of a multinational enterprise may be an important instrument to leverage a country's export capacity; however this analysis indicates that FDI mainly stimulated imports. Several policy implications arise with these results. There might be a case, for example, for the government to negotiate export targets with MNEs, so as to avoid negative effects in the Brazilian trade balance.

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APPENDIX A

Table 1 – FDI stock and flow by sector and industry

	1995		2000		1996	1997	1998	1999	2000	2001	2002
Sectors	**Stock**	**%**	**Stock**	**%**	**Flows in US$ millions**						
Agriculture and mineral extraction	**925**	**2.2**	**2,401**	**2.3**	**111**	**456**	**142**	**423**	**649**	**1,494**	**638**
Manufactures	**27,907**	**66.9**	**34,726**	**33.7**	**1,740**	**2,036**	**2,766**	**7,002**	**5,087**	**7,001**	**7,617**
Automobile and vehicle parts	4,838	11.6	6,351	6.2	286	223	1,060	1,831	961	1,550	1,819
Basic metalurgy and metal products	3,578	8.6	3,107	3.0	94	0	158	155	272	539	229
Chemical products	5,331	12.8	6,043	5.9	222	368	355	1,272	1,118	1,546	1,573
Electrical machines	1,101	2.6	990	1.0	30	138	111	340	66	327	372
Electronic and communication equipments	785	1.9	2,169	2.1	62	186	263	520	655	1,166	544
Food and beverage	2,828	6.8	4,619	4.5	186	323	133	1,239	975	563	1,873
Machines and equipments	2,345	5.6	3,324	3.2	179	207	175	87	579	344	391
Non-metallic mineral products	854	2.0	1,170	1.1	195	208	85	289	67	130	124
Paper and paper products	1,634	3.9	1,573	1.5	22	0	0	13	10	150	54
Rubber and plastic materials	1,539	3.7	1,782	1.7	30	139	157	207	58	176	183
Others	3,076	7	3,597	3	434	246	269	1,049	327	509	456
Services	**12,864**	**30.9**	**65,888**	**64.0**	**5,815**	**12,818**	**20,362**	**20,147**	**24,139**	**12,547**	**10,498**
TOTAL	**41,696**	**100.0**	**103,015**	**100.0**	**7,665**	**15,311**	**23,271**	**27,572**	**29,876**	**21,042**	**18,753**

Source: Brazilian Central Bank

Table 2 – Exports by sector and industry

	1995	1996	1997	1998	1999	2000	2001	2002	1995-2002	
Sectors	**In US$ millions**								**Average**	**%**
Agriculture and mineral extraction	**4,458**	**4,926**	**6,510**	**6,654**	**5,548**	**6,711**	**8,154**	**9,432**	**6,549**	**12.5**
Manufactures	**42,048**	**42,821**	**46,476**	**44,466**	**42,463**	**48,375**	**50,068**	**50,930**	**45,956**	**87.5**
Automobile and vehicle parts	4,366	4,933	6,880	7,727	6,759	9,407	9,489	8,761	7,290	13.9
Basic metalurgy and metal products	4,902	4,830	4,582	4,322	3,706	4,281	3,819	4,546	4,373	8.3
Chemical products	1,842	2,174	2,292	2,279	2,158	2,230	2,244	2,558	2,222	4.2
Electrical machines	1,425	1,390	1,400	1,340	1,275	1,486	1,509	1,501	1,416	2.7
Electronic and communication equipments	716	868	1,029	1,020	1,252	2,241	2,344	2,185	1,457	2.8
Food and beverage	12,113	12,704	13,456	12,499	11,716	10,118	12,325	12,998	12,241	23.3
Machines and equipments	2,370	2,333	2,692	2,459	2,001	2,179	2,184	2,189	2,301	4.4
Non-metallic mineral products	2,777	2,755	2,751	2,255	2,482	2,891	2,411	2,650	2,621	5.0
Paper and paper products	2,732	1,957	2,021	2,013	2,176	2,572	2,216	2,085	2,221	4.2
Rubber and plastic materials	688	721	782	788	743	792	759	762	754	1.4
Others	8,118	8,157	8,591	7,766	8,196	10,178	10,768	10,696	9,059	17.3
TOTAL	**46,506**	**47,747**	**52,986**	**51,120**	**48,011**	**55,085**	**58,223**	**60,362**	**52,505**	**100.0**

Note: Industries were aggregated to match with the Central Bank sector classification for FDI inflows

Source: Funcex

Table 3 – Imports by sector and industry

Sectors	1995	1996	1997	1998	1999	2000	2001	2002	1995-2002 Average	1995-2002 %
	In US$ millions									
Agriculture and mineral extraction	5,114	6,747	5,572	4,502	4,046	5,173	4,983	5,106	5,155	9.6
Manufactures	44,858	46,599	54,270	53,212	45,165	50,611	50,599	42,127	48,430	90.4
Automobile and vehicle parts	7,139	5,878	8,224	8,821	6,619	7,004	7,053	5,343	7,010	13.1
Basic metalurgy and metal products	1,226	1,392	1,953	2,078	1,360	1,584	1,752	1,593	1,617	3.0
Chemical products	5,713	6,503	7,110	7,451	7,381	7,608	7,895	7,362	7,128	13.3
Electrical machines	1,830	2,132	2,651	2,667	2,515	2,603	3,597	3,023	2,627	4.9
Electronic and communication equipments	5,016	5,798	6,733	6,120	5,932	7,899	7,262	4,996	6,219	11.6
Food and beverage	4,056	3,659	4,091	4,206	3,037	2,905	2,558	2,564	3,384	6.3
Machines and equipments	6,253	6,877	8,296	8,017	6,351	5,703	6,381	5,345	6,653	12.4
Non-metallic mineral products	1,596	1,539	1,826	1,707	1,458	1,711	1,803	1,328	1,621	3.0
Paper and paper products	1,319	1,325	1,395	1,391	1,012	1,156	946	705	1,156	2.2
Rubber and plastic materials	915	964	1,112	1,112	891	1,026	992	968	998	1.9
Others	9,794	10,534	10,877	9,643	8,608	11,412	10,363	8,900	10,016	18.7
TOTAL	**49,972**	**53,346**	**59,842**	**57,715**	**49,210**	**55,783**	**55,582**	**47,232**	**53,585**	**100.0**

Note: Industries were aggregated to match with the Central Bank sector classification for FDI inflows
Source: Funcex

Table 4 – Trade Share of Enterprises with foreign capital

	Exports				Imports			
	1995		2000		1995		2000	
Multinationals and enterprises	**US$ millions**	**%**	**US$ millions**	**%**	**US$ millions**	**%**	**US$ millions**	**%**
with foreign capital	21,745	46.8	33,250	60.4	19,371	38.8	31,553	56.6
Agricultural sector	2,236	4.8	1,856	3.4	89	0.2	270	0.5
Manufacturing sector	18,199	39.1	27,199	49.4	16,636	33.3	24,021	43.1
Service sector	1,310	2.8	4,196	7.6	2,647	5.3	7,263	13.0
Intrafirm trade	9,078	19.5	21,055	38.2	8,529	17.1	18,236	32.7
Agricultural sector	422	0.9	980	1.8	8	0.0	135	0.2
Manufacturing sector	8,117	17.5	17,561	31.9	7,037	14.1	13,452	24.1
Service sector	539	1.2	2,513	4.6	1,484	3.0	4,649	8.3
Brazil	**46,506**	100.0	**55,085**	100.0	**49,972**	100.0	**55,783**	100.0

Source: Carta da Sobeet no. 24, with data from the Foreign Capital Census, Brazilian Central Bank

APPENDIX B

Table 1 – Main Markets for Brazilian Exports

In percentage (%)	1995	1996	1997	1998	1999	2000	2001	2002
NAFTA	21.0	22.0	20.4	22.3	25.9	28.4	28.9	30.9
European Union	27.8	26.9	27.4	28.8	28.6	26.8	25.5	25.0
ALADI [1]	20.4	21.5	24.1	24.1	19.6	20.1	17.6	12.3
Mercosur	13.2	15.3	17.1	17.4	14.1	14.0	10.9	5.5
Western Europe	2.1	2.2	2.5	2.3	2.4	1.8	2.9	2.9
Middle East	2.8	2.8	2.7	3.2	3.1	2.4	3.5	3.9
Asia [2]	17.6	16.4	14.6	11.0	11.9	11.5	11.9	14.6
Africa	3.4	3.2	2.9	3.2	2.8	2.4	3.4	3.9
Oceania	0.8	0.6	0.6	0.4	0.6	0.7	0.5	0.5
Others	4.2	4.5	4.9	4.7	5.0	5.8	5.8	6.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Notes: (1) Latin American Integration Association, including Mercosul; (2) Does not include Middle East

Source: Funcex

Table 2 – Main Suppliers of Brazilian Imports

In percentage (%)	1995	1996	1997	1998	1999	2000	2001	2002
NAFTA	25.2	26.4	27.6	27.7	27.3	26.6	26.4	24.9
European Union	27.7	26.5	26.5	29.2	30.4	25.2	26.7	27.7
ALADI [1]	18.3	20.0	20.0	19.7	17.9	19.5	16.8	4.3
Mercosur	13.7	15.5	15.9	16.3	13.7	14.0	12.6	11.9
Western Europe	2.1	1.8	1.4	1.4	1.4	2.1	2.0	1.9
Middle East	4.1	4.1	3.2	2.2	2.2	2.8	2.6	3.1
Asia [2]	16.5	14.2	15.1	13.7	13.2	15.4	16.1	16.9
Africa	2.4	3.2	3.3	3.2	4.5	5.2	6.0	5.7
Oceania	0.5	0.7	0.6	0.7	0.6	0.6	0.5	0.5
Others	3.1	3.0	2.3	2.4	2.4	2.6	3.0	3.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Notes: (1) Latin American Integration Association, including Mercosul; (2) Does not include Middle East

Source: Funcex

Table 3 – Sample of countries and respective distances to Brazil

Country	Distance	Country	Distance	Country	Distance	Country	Distance
Argentine	1,977	Finland	11,034	Mexico	7,645	Sweden	10,653
Austria	9,823	France	9,093	Netherlands	9,508	Syria	10,438
Belgium	9,353	Germany	9,857	Paraguay	1,475	Taiwan	18,410
Bolivia	2,700	Greece	9,667	Peru	3,767	U. Arab Emirates	11,722
Canada	8,136	Hong Kong	17,675	Portugal	7,653	United Kingdom	9,221
Chile	2,919	Iraq	11,127	Russia	13,752	United States	7,694
China	17,300	Irland	9,143	Saudi Arabia	10,983	Uruguay	1,835
Colombia	4,576	Italy	9,124	Singapore	15,699	Venezuela	4,456
Denmark	10,123	Japan	18,558	South Korea	18,118		
Ecuador	4,542	Luxembourg	9,353	Spain	8,101		

Source: CEPII (Centre d'Etudes Prospectives et d'Informations Internationales)

Note: Distances reported in km

APPENDIX C

Dependent Variable: LOG (Exports)
Method: Least Squares
Date: 03/03/03 Time: 15:45
Included observations: 2624
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-11.06081	1.285605	-8.603579	0.0000
LOG (product of GDP)	0.998097	0.035932	27.77774	0.0000
LOG (product of per capita GDP)	0.172221	0.077735	2.215497	0.0268
LOG (Distance)	-2.439317	0.098273	-24.82184	0.0000
LOG (FDI flow)	0.014491	0.009952	1.456107	0.1455
Sector 1	1.179069	0.148208	7.955515	0.0000
Sector 2	-1.511812	0.201331	-7.509087	0.0000
Sector 3	-0.648868	0.123716	-5.244829	0.0000
Sector 4	-2.143025	0.130708	-16.39548	0.0000
Sector 5	-1.212914	0.156067	-7.771746	0.0000
Sector 6	-0.036590	0.136867	-0.267342	0.7892
Sector 7	-0.881512	0.130362	-6.762029	0.0000
Sector 8	-1.245330	0.129721	-9.600068	0.0000
Sector 9	-2.590563	0.184847	-14.01463	0.0000
Year 97	-0.183110	0.142725	-1.282959	0.1996
Year 98	-0.150074	0.134033	-1.119678	0.2630
Year 99	-0.355628	0.143902	-2.471311	0.0135
Year 00	-0.325804	0.134972	-2.413865	0.0159
Year 01	-0.470698	0.142441	-3.304521	0.0010
Year 02	-0.338207	0.133061	-2.541746	0.0111
MERCOSUR	-0.126229	0.135236	-0.933396	0.3507
LANGUAGE	-0.065570	0.113362	-0.578409	0.5630

R-squared	0.518150	Mean dependent var	9.288988
Adjusted R-squared	0.514261	S.D. dependent var	2.698990
S.E. of regression	1.881060	Akaike info criterion	4.109897
Sum squared resid	9206.884	Schwarz criterion	4.159133
Log likelihood	-5370.185	F-statistic	133.2390
Durbin-Watson stat	2.323301	Prob(F-statistic)	0.000000

Dependent Variable: LOG (Exports)
Method: Least Squares
Date: 03/03/03 Time: 15:55
Included observations: 2624
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-12.06816	1.684581	-7.163898	0.0000
LOG (product of GDP)	1.017031	0.039040	26.05114	0.0000
LOG (product of per capita GDP)	0.207717	0.090692	2.290345	0.0221
LOG (Distance)	-2.479418	0.106154	-23.35671	0.0000
LOG (FDI stock)	-0.003564	0.010448	-0.341131	0.7330
Sector 1	1.174106	0.147755	7.946310	0.0000
Sector 2	-1.539793	0.200141	-7.693551	0.0000
Sector 3	-0.641866	0.124138	-5.170593	0.0000
Sector 4	-2.160958	0.130685	-16.53557	0.0000
Sector 5	-1.238247	0.156308	-7.921844	0.0000
Sector 6	-0.043320	0.136991	-0.316224	0.7519
Sector 7	-0.890756	0.130283	-6.837080	0.0000
Sector 8	-1.265941	0.128974	-9.815462	0.0000
Sector 9	-2.605454	0.183960	-14.16312	0.0000
Year 97	-0.181635	0.142921	-1.270878	0.2039
Year 98	-0.145823	0.134272	-1.086029	0.2776
Year 99	-0.353082	0.144224	-2.448145	0.0144
Year 00	-0.331572	0.135596	-2.445292	0.0145
Year 01	-0.444052	0.140373	-3.163370	0.0016
Year 02	-0.327193	0.132876	-2.462400	0.0139
MERCOSUR	-0.141618	0.134788	-1.050674	0.2935
LANGUAGE	-0.065351	0.112834	-0.579176	0.5625

R-squared	0.517884	Mean dependent var	9.288988
Adjusted R-squared	0.513993	S.D. dependent var	2.698990
S.E. of regression	1.881580	Akaike info criterion	4.110449
Sum squared resid	9211.971	Schwarz criterion	4.159685
Log likelihood	-5370.909	F-statistic	133.0971
Durbin-Watson stat	2.322403	Prob(F-statistic)	0.000000

Dependent Variable: LOG (Imports)
Method: Least Squares
Date: 03/03/03 Time: 15:57
Included observations: 2496
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-64.98077	1.841655	-35.28389	0.0000
LOG (product of GDP)	1.355793	0.037222	36.42457	0.0000
LOG (product of per capita GDP)	1.730054	0.087122	19.85773	0.0000
LOG (Distance)	-1.367523	0.130912	-10.44611	0.0000
LOG (FDI flow)	0.022981	0.010923	2.103960	0.0355
Sector 1	0.243407	0.209581	1.161398	0.2456
Sector 2	-1.022004	0.214634	-4.761612	0.0000
Sector 3	0.862016	0.189350	4.552512	0.0000
Sector 4	-0.853183	0.187945	-4.539537	0.0000
Sector 5	-0.243686	0.193698	-1.258076	0.2085
Sector 6	-0.491341	0.186062	-2.640734	0.0083
Sector 7	0.312609	0.192701	1.622250	0.1049
Sector 8	-0.178397	0.203041	-0.878626	0.3797
Sector 9	-0.526437	0.234441	-2.245497	0.0248
Year 97	0.031247	0.168656	0.185272	0.8530
Year 98	0.074116	0.164570	0.450360	0.6525
Year 99	-0.432094	0.167188	-2.584481	0.0098
Year 00	-0.755073	0.173298	-4.357089	0.0000
Year 01	-0.920478	0.174833	-5.264891	0.0000
Year 02	-1.104082	0.164288	-6.720410	0.0000
MERCOSUR	1.519634	0.219403	6.926235	0.0000
LANGUAGE	0.652049	0.124301	5.245710	0.0000

R-squared	0.557166	Mean dependent var	8.951478
Adjusted R-squared	0.553407	S.D. dependent var	3.280664
S.E. of regression	2.192390	Akaike info criterion	4.416636
Sum squared resid	11891.46	Schwarz criterion	4.467956
Log likelihood	-5489.962	F-statistic	148.2258
Durbin-Watson stat	2.221849	Prob(F-statistic)	0.000000

Dependent Variable: LOG (Imports)
Method: Least Squares
Date: 03/03/03 Time: 16:05
Included observations: 2496
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-57.81406	2.191277	-26.38374	0.0000
LOG (product of GDP)	1.243501	0.041061	30.28441	0.0000
LOG (product of per capita GDP)	1.419923	0.101765	13.95292	0.0000
LOG (Distance)	-1.063217	0.140529	-7.565808	0.0000
LOG (FDI stock)	0.080766	0.010626	7.600812	0.0000
Sector 1	0.166324	0.206388	0.805879	0.4204
Sector 2	-0.982806	0.211143	-4.654690	0.0000
Sector 3	0.740849	0.187390	3.953513	0.0001
Sector 4	-0.889081	0.185308	-4.797854	0.0000
Sector 5	-0.170724	0.193929	-0.880343	0.3788
Sector 6	-0.609733	0.184744	-3.300426	0.0010
Sector 7	0.229298	0.186719	1.228042	0.2195
Sector 8	-0.157287	0.203352	-0.773473	0.4393
Sector 9	-0.557411	0.228574	-2.438645	0.0148
Year 97	0.041623	0.167405	0.248634	0.8037
Year 98	0.080260	0.162957	0.492525	0.6224
Year 99	-0.404872	0.165963	-2.439539	0.0148
Year 00	-0.687699	0.172149	-3.994787	0.0001
Year 01	-0.834967	0.168308	-4.960954	0.0000
Year 02	-1.037878	0.161977	-6.407550	0.0000
MERCOSUR	1.569722	0.214888	7.304838	0.0000
LANGUAGE	0.656202	0.137840	4.760596	0.0000

R-squared	0.565098	Mean dependent var	8.951478
Adjusted R-squared	0.561406	S.D. dependent var	3.280664
S.E. of regression	2.172666	Akaike info criterion	4.398562
Sum squared resid	11678.46	Schwarz criterion	4.449882
Log likelihood	-5467.406	F-statistic	153.0778
Durbin-Watson stat	2.195177	Prob(F-statistic)	0.000000