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**NIPE WP 6 / 2007**

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# A Panel Analysis of the FDI Impact on International Trade

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**Abstract**

This paper examines the relationship between Foreign Direct Investment (FDI) and international trade. Specifically, the relationship between the stock of outward FDI, and inward FDI and Imports and Exports in the Portuguese economy. This paper also studies some technical problems associated with panel data have frequently been ignored in previous studies. The problems of serial and contemporaneous correlation have not been taken into account by a panel approach and, as we know, they can have an impact on estimates and statistical inferences. The results show that there exists a country-specific effect on the corrected panel data of heteroscedasticity and correlation and a complementary relationship between trade and inward stock of FDI.

*Key words:* FDI, Trade, Gravity Analysis, Panel Data
JEL codes: F1, F4

## 1 Introduction

The traditional sectores of the Portuguese economy - textiles, apparel, shoemaking and other consumer goods - have an above average weight in production, employment and exports compared to most developed economies.

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This specificity is expected to enhance the adjustment pressures associated with greater integration within the EU – with its eastern enlargement - and greater integration in the world economy under the multilateral negotiations of WTO – Doha round. Several studies have pointed point to the crucial role that foreign direct investment (FDI) has played in changing the specialization of the Portuguese economy (Gonçalves and Guimarães, 1996). Yet, it has been noticed that, in recent years, FDI has been negative with some multinational enterprises (MNEs) moving their facilities to more advantageous locations (central and eastern European countries, or elsewhere). In these circumstances, it seems crucial to understand how FDI relates to trade in the Portuguese economy.

The theoretical literature on trade and FDI is not conclusive about the relationship of substitutability or complementarity between FDI and trade. References in the literature of trade models and in the literature of FDI demonstrate that, depending on the circumstances, FDI and trade may relate positively (e.g. complementarily) as well as, negatively meaning that they are substitute. On the other hand, the empirical literature also indicates that FDI and trade may have a positive or a negative relationship.

Foreign direct investment and trade are at the core of the globalization process and stand for the mobility of capital and goods across borders. They both build and increase the complexity of economic interdependence between distinct economies. For policy making it is very important to have a good understanding of the economic and social effects associated with FDI and trade but also of the interactions between them.

Foreign Direct Investment and Multinationals are two key elements in the dynamics of globalization, with particular impact on the mobility of factors and world trade. In recent decades, despite strong trade liberalization, FDI has grown much faster than exports. These strong dynamics also reflect the changing attitude of many governments towards FDI, moving from restrictive policies on foreign investment to active policies to attract FDI.

Sections 2 and 3 present a brief review of, respectively, theoretical models and empirical studies that examine the relationship between FDI and Trade. Section 4 illustrates our modelling strategy of a modified gravity equation in a panel data framework of Portuguese trade and FDI. The main estimated results are presented and discussed in section 5. Section 6 concludes our study.

## 2 Literature Review

Traditionally, trade theories were developed in frameworks that assumed the international immobility of production factors. Yet, the activities of multinational enterprises have been growing since the Second World War and since the Eighties multinational sales have been growing faster than trade in manufactures. These growing flows and stocks of FDI could not be ignored by trade theories and there is a stream of trade models that consider the existence of multinational enterprises besides with national enterprises. This is done within a variety of models that integrate the mode of foreign market access into the "new" trade theories. Overall, these models also show that, depending on the circumstances FDI and trade may have a complementary relationship, as well as, a substitute relationship.

Foreign Direct Investment is the process by which a national firm becomes a multinational enterprise possessing productive assets in more than one country. There are two structurally different types of FDI, depending on the way the MNE organizes its international business, namely horizontally or vertically. Horizontal FDI is normally associated with bilateral flows of investments between developed economies. In this case the parent company reproduces the whole process of production of goods and/or services in different countries. Vertical FDI means that the home company fragments the production process across different locations/countries according to their respective comparative advantages generating intra-firm trade. By this way, the parent company rationalises its production and aims to reduce costs and to obtain gains in terms of efficiency. Vertical investments are mostly present in FDI flows from developed to less developed economies and normally refer to less sophisticated stages of the production process such as assembling operations. Vertical FDI may also take place between developed economies but in more sophisticated stages of the production process.

Complementarity between trade and FDI, is normally found in trade models that incorporate vertical foreign investment, meaning that the MNE fragments/splits the production process across countries in order to reduce costs. In these types of models, Helpman (1984), and Grossman and Helpman (1991), differences in relative factor endowments between countries and differences in factor intensities and specialization between sectors are determinants of both trade and the formation of multinationals. They are particularly useful to explain FDI from developed countries into developing economies.

Markusen (1984) shows that complementarity between FDI and trade is still possible when countries have identical endowments, preferences and technology, and multinationalisation occurs in the context of multi-plant economies of scale. His basic idea is the existence of firm/headquarter-specific activities

which are distinct from plant-specific activities. Firm-specific activities are produced centrally at the headquarters, have a public good nature and generate firm-specific fixed costs.Iit includes activities such as R&D, distribution, administration services, marketing. Plant-specific activities are associated with the production process and generate plant-specific fixed costs. One possible solution for the model is a multinational monopoly, in which headquarter activities concentrate in the home country and the production plant goes to the host country, originating bilateral trade – headquarter services in exchange for final goods.

Substitution between FDI and trade is found in models that assume horizontal investments, meaning that the MNE produces the same goods and services in different countries. This is the most common type of FDI and refers to bilateral investments between developed economies. Some trade models assume similarity between countries – in size, endowments and technology – plus economies of scale at the firm and plant-levels incorporating an endogenous formation of multiplant multinationals. This is the case of models by Hortsman and Markusen (1992), Brainard (1993) and Markusen and Venables (1998) and they admit alternative solutions depending, on one hand, on the relative size of the firm and plant scale economies, and on the other on trade costs – transport costs plus barriers to trade and investment. In other words, the equilibrium – exporting or investing - depends on the trade-off between proximity to the market which reduces trade costs and the concentration of production which allows for a better exploitation of economies of scale. High transport costs and plant-scale economies favour horizontal FDI that may be associated with distinct equilibriums.

On the other hand, Markusen and Venables (1998, 2000), Egger and Pfaffermayer (2002) explore another avenue, i.e., they research the convergence hypothesis to demonstrate that FDI and trade are substitutes. Starting with the assumption of asymmetry between countries they demonstrate that the convergence in terms of size, endowments and income increases the activities of MNEs. As multinational enterprises displace national enterprises the volume of trade decreases, meaning that FDI substitutes trade. Finally, trade models by Markusen (1997, 2000) and Carr et al. (2001) admit both vertical and horizontal FDI and consequently find solutions that admit both complementarity as well as substitution between FDI and trade.

The international business literature typically looks at FDI and trade as alternative modes of entry in foreign markets. The internalization theory, developed by Buckley and Casson (1976), says that a firm will enter a foreign market through FDI when alternative entry modes, namely exports, have associated higher transaction costs. Dunning (1979) uses the OLI paradigm to explain that a firm may choose FDI instead of exports when it possesses ownership advantages, when the foreign market has location advantages – access to a big

domestic market or production resources – and when there are advantages of internalizing market access operations. In this case, FDI and trade can be substitutes, as well as complementary, depending on which of those advantages was determinant for the investment decision.

## 3 Empirical Studies

The particular question on whether FDI and trade are substitutes or complementary has produced some empirical research without a definite result. Despite the strong theoretical foundations for a substitute relation between FDI and trade this result has been found in few empirical studies - Frank and Freeman (1978), Cushman (1988) and Blonigen (2001) - while complementarity has been the most common result.

Most empirical research on this topic has looked for how changes in FDI correlate to changes in trade and vice versa. In other words, they have questioned whether systematic changes in FDI are related to systematic changes in trade, in particular if trade and FDI are substitutes (negative correlation) or complementary (positive correlation). These studies have not questioned or studied the direction of causality between FDI and trade and this seems to be a general limitation. As we will see contrasting results are associated with the diversity of interactions that exist between FDI and trade, but also, with different perspectives of analysis: country, industry and firm among others.

At the country level, as suggested by Fontagné (1999), the links between trade and FDI can be seen from three different perspectives: the investing or home country, the recipient or host country and third countries. For the investing country FDI can be a substitute for trade to the extent that exports are replaced by local sales by the affiliates in foreign markets. On the other hand, FDI may also be complementary to trade to the extent that induces intra-firm trade in intermediate and final goods (e.g. headquarter services). In the former case investing abroad will have a negative impact on production, employment and trade balance in the home country, while in the latter case will have a positive impact.

In the case of the host country the argument is symmetrical to that of the investor and therefore inward FDI may have a complementary or substitute relation with trade. Again the effects on domestic production, employment and the balance of trade (current account) can be diverse. Third economies may also affect, and be affected by, the relationship between FDI and trade, to the extent that foreign affiliates in these countries develop new trade relations with the affiliates in the host country and vice-versa.

At country level studies by Grubert and Mutti (1991), Blomstrom and Kokko (1994), Eaton and Tamura (1994), Brenton et al. (1999), Clausing (2000), and Hejazi and Safarian (2001) have found that FDI and trade are complementary. Several studies use the gravity model with success, Grubert and Mutti (1991) research how FDI relates to exports and imports for the United States, using trade flows with 33 counties in 1982. The study finds complementarity between FDI and both imports and exports on a bilateral basis. However the authors suggest that a clear cut conclusion needs a multilateral study. Clausing (2000) uses a panel data approach and studies the interaction between outward FDI and exports in the United States in her relation with 29 countries; and he also studies the relationship between inward FDI into the US and American imports. He uses gravity equations to find complementarity between trade and FDI.

At the micro-level a different perspective is possible with firm-level studies, as this is better suited for an effective understanding of FDI and trade relationships. However, this approach faces severe data limitations and studies are limited to the few countries that have comprehensive firm data bases with investments decisions.

## 4 The Econometric Model

Our objective is to estimate the relationship between trade and FDI in the Portuguese economy. The empirical analysis applies a modified gravity equation to a panel of annual observations of Portuguese exports to and imports from 27 countries over a period of 6 years (1995 – 2000). Two different equations are estimated one for exports and the other for imports.

The gravity equation estimated is the following:

$$T_{it} = \beta_0 + \beta_1 GDP_{it} + \beta_1 Dist_i + \beta_2 Lang_i + \beta_3 Bord_i + \beta_4 TFDIin_{it} + \beta_5 TFDIout_{it} + \mu_i + v_{it}, \quad (1)$$

for $i = 1, ...N$, $t = 1, ...T$, where $T_i$ indicates the imports/exports between Portugal and country $i, GDP_i$ denotes the Gross Domestic Product of the country $i$. $Dist_i$ is the great circle distance between capital of country $i$ and capital of Portugal (Lisbon). $Lang_i$ and $Bord_i$ are dummy variables and take the value one when the country $i$ has the same language or has a common border with Portugal. $TFDIin_i$ and $TFDIout_i$ are the transformed variables of the FDI stock of country $i$ in Portugal ($TFDIin$) and the FDI stock of Portugal in country $i$ ($TFDIout_i$).

In our specification, we have only two indexes, one associated with time ($t$) and other with the country ($i$) from where Portugal imports or exports. In other words, we apply a two-way model, that incorporates a time-specific effect ($\theta_t$) and a specific country effect ($\mu_i$). $v_{it}$ are called the idiosyncratic errors or idiosyncratic disturbances because they change across $t$ as well as $i$.

All variables, except dummy variables, are in logs. As the model is log-linearised the problem appears with zero or negative values. To avoid this problem we transform the FDI stock variable.[3] This study uses the stock of FDI as an explanatory variable of trade flows which has several advantages in relation to the alternative inclusion of FDI. First, the stock variable avoids problems of multicollinearity between trade and investment flows, given that such flows are simultaneously affected by the same economic variables. Second, this approach is more correct because FDI flows do have an impact on trade with a time lag. Therefore, the use stocks is able to capture these lagged effects which is not possible with flows. Third, the stock of FDI gives a more accurate measure of foreign investment in the economy and as such the extent to which it facilitates or obstructs trade flows.

Since individual effects are included in the model, we have to decide wethers they are treated as fixed or random. If $\mu_i$ is treated as a random variable we have the called random effect model. In this case $\mu_i \tilde{} IID(0, \sigma_u^2)$, $v_{it} \tilde{} IID(0, \sigma_v^2)$ and $\mu_i$ are independent of the $v_{it}$. In addition, the explanatory variables are independent of $\mu_i$ and $v_{it}$ for all $i$ and $t$, Baltagi (1995). Otherwise, if $\mu_i$ are assumed to be fixed parameters to be estimated and the remainder disturbances stochastic with $v_{it}$ independent and identically distributed $IID(0, \sigma_v^2)$, then, explanatory variables are assumed independent of the $v_{it}$ for all $i$ and $t$. In this case, FEM[4] is applied.

We estimate a two-way FEM and a two-way REM, where all variables, except dummy variables, are logarithmised. After, we determine Hausman's $\chi^2$ statistic for testing random versus fixed effects. Whether the REM or the

[3] The larger desinvestment in our sample is - 680. So, we divided all observation of FDI stock by 690 (ratio: fdi/690). Therefore, all values of transformed FDI stock are grater than -1. After we add one to the ratio and log-linearised it:
$TFDIin_{it} = \ln(1 + FDIin_{it}/690)$
$TFDIout_{it} = \ln(1 + FDIout_{it}/690)$

This transformation of FDI stock does not change its values. If:
$FDI < 0 => (1 + \frac{FDI}{690}) < 1 => \ln((1 + \frac{FDI}{690}) < 0$;
$FDI = 0 => (1 + \frac{FDI}{690}) = 1 => \ln((1 + \frac{FDI}{690}) = 0$ and
$FDI > 0 => (1 + \frac{FDI}{690}) > 1 => \ln((1 + \frac{FDI}{690}) > 0$.

[4] However, the FEM does not allow directly to estimate variables that do not change over time, time invariant variables, because the inherent transformation eliminates such variables.

FEM is the econometrically more appropriate depends on the correlation of the individual effects with the regressors. REM assumes that there is no such correlation.

The application of OLS to data characterised by nonspherical errors produces inefficient coefficient estimates and the corresponding errors estimates are biased. The application of GLS produces coefficient and standard errors estimates that are efficient and unbiased, respectively, assuming that the errors covariance structure is correctly specified, and its elements are known.

Becky and Katz (1995) have studied an error covariance structure characterised by groupwise heteroscedasticity, first-order serial correlation and cross-sectional, or spatial correlation and they have used the Monte Carlo analysis to compare FGLS with OLS, where OLS standard errors are corrected for the three categories of nonspherical disturbances. They have called their estimator OLS with panel corrected standard errors (PCSE). Their study shows that FGLS consistently underestimates standard errors, concluding that OLS with PCSE is superior to FGLS, and recommend its use.

## 5 Results

In this section the estimation procedures follow two sequential stages. First, we start with a robust pooled data estimation (ROLS), a fixed effects model (FEM) and a random effects model (REM) estimation. Given the nature of panel data, we test the hypothesis of groupwise heteroscedasticity and correlation (serial or contemporaneous) in both. As the null hypothesis is rejected, in the second stage we correct the panel for heteroscedasticity and correlation. This is done with PCSE and feasible GLS and in order to deal with unobservable fixed effects, the first differences are estimated by PCSE, FGLS and robust OLS. This procedure is followed separately for exports and imports.

### *5.1 Exports*

The OLS[5] estimation does not take into account that the error structure may not conform to OLS assumptions, and to overcome this we use the White estimator of variance (Table 1, first column). The OLS model explains a large part of the variance of Portuguese exports ($R^2 = 0.862$). All variables, except outward FDI are statistically significant, although the border and language

[5] The missing values of the inward and outward FDI were removed and we have used a transformed variable of FDI to avoid problems with the logarithm of null and negative values.

variables have an unexpected negative sign. These results suggest that Portuguese exports to Spain are negatively affected by their common border which is in contrast with the most common results in other studies. Yet, Portugal has a shorter period of market integration with Spain - only since 1986 when both become EU members. In contrast, with other EU economies strong trade relations exist since the earlier 1960s when Portugal become an EFTA member. As for the FDI-trade hypothesis, the result suggests a strong complementary relation between inward FDI and Portuguese exports while outward FDI has no impact.

However,as mention above, the OLS model does not take into account individual effects and to test it we have used the Breusch and Pagan test ($LM_{BP} = 138,51$) that has confirmed our suspicion. Next, we have estimated the model using fixed-effects [6] and random-effects, but the Hausman test reveals that REM does not obtain consistent parameter estimates suggesting the existence of individual fixed effects.

Despite the conclusion on the existence of fixed effects, all variables in the FEM are statistically insignificant. This fact can be associated with the violation of the homocedasticity hypothesis across countries. Therefore, we have tested for groupwise likelihood ratio heteroscedasticity in fixed effect model and the result was that the null hypothesis of homocedasticity across countries is rejected ($GW : X^2(24) = 519.49$). This limitation can be overcome with the adoption of a feasible GLS estimator or a PCSE with a general variance matrix that incorporates heteroscedasticity across countries.

Finally, we have tested for serial correlation and contemporaneous correlation in our fixed effect model and have found evidence of autocorrelation. For the FEM presented in column (3) of Table 1 we reject the null hypothesis of no first-order autocorrelation ($F(1,23) = 11.887$)) generated by AR process and we conclude that there exists contemporaneous correlation. Given the results of the heteroscedasticity and autocorrelation tests, we have decided to apply the feasible GLS (FGLS) and PCSE estimator, corrected of country groupwise heteroscedasticity and contemporaneous correlation.

The FGLS is a method developed by Parks-Kmenta that uses GLS estimation and we have corrected it for first serial correlation in the residuals, contemporaneous correlation and heteroscedasticity. The PCSE method was developed by Beck-Katz and incorporates also these corrections. However, we need one process that takes into account individual effects, heteroscedasticity and correlation and that produces consistent estimates. One way to do this is by differentiating the equation 1 which allows the removal of fixed effect and

[6] The FEM only incorporates country individual effects. Time effects were introduced but these were not statistically significant. So, they were excluded and we have estimated only a one-way fixed effect model.

Table 1
Estimation Results for Exports

| Variables | ROLS | FEM | REM | FD-PCSE | FD-ROLS | FD-FGLS |
|---|---|---|---|---|---|---|
| GDP | 0.391*** | 0.391 | 0.666*** | 0.226*** | 0.226*** | 0.199*** |
| | (0.055) | (0.276) | (0.109) | (0.054) | (0.058) | (0.023) |
| Distance | -0.555*** | | -1.106*** | | | |
| | (0.114) | | (0.249) | | | |
| Language | -0.581** | | -0.197 | | | |
| | (0.259) | | (0.770) | | | |
| Border | -0.511*** | | -0.101 | | | |
| | (0.181) | | (0.875) | | | |
| Inward FDI | 1.614*** | -0.030 | 0.275* | 1.986*** | 1.986*** | 1.954*** |
| | (0.124) | (0.152) | (0.147) | (0.164) | (0.133) | (0.051) |
| Outward FDI | -0.020 | 0.006 | -0.001 | 0.0072 | 0.0072 | 0.101 |
| | (0.073) | (0.022) | (0.025) | (0.129) | (0.135) | (0.086) |
| Constant | 8.467*** | 5.000 | 8.160*** | 7.011*** | 7.011*** | 7.571*** |
| | (0.946) | -5.426 | -2.359 | (1.011) | (1.130) | (0.443) |
| R-squared | 0.862 | | | 0.7828 | 0.7828 | |
| Observations: | 131 | 131 | 131 | 102 | 102 | 102 |
| Hausman-test:$X^2(6)$ | | | 793.90*** | | | |
| F(3,103) | | 0.75 | | | | |
| Wald $X^2(k-1)$ | | | 83.14*** | 618*** | | 3312*** |
| GW test: $X^2(24)$ | | 519.49*** | | | | |
| $F(1,23)$ | | 11.887*** | | | | |
| $\text{LM}_{BP}: X^2(1)$ | | | 138.51*** | | | |

Notes:*** Significant at the 1%; ** Significant at the 5%; * Significant at the 10%.

Standard deviation in brackets. Source: Own calculations.

eliminates the autocorrelation . Therefore, we estimated the first difference model by PCSE and FGLS controlling heteroscedasticity and contemporaneous correlation and by OLS with a robust variance-covariance matrix.

The results reported in columns 4, 5 and 6 in Table 1 all point to the same conclusion – Portuguese exports are positively determined by market dimension and by the stock of inward FDI. The presence of foreign affiliates in the

Portuguese economy has a positive, and a statistically significant, correlation with Portuguese exports. In other words the stock of inward FDI seems to be trade creating. This result suggests that increasing the stock of foreign investments in the Portuguese economy works as a channel through which exports expand. As seen in section 2 this can be due to the expansion of inter-industry, intra-industry or intra-firm trade. Yet to clarify this issue one needs industry and firm level research which is not the case. Finally, this result also confirms of the complementarity between FDI and Exports that was found in Africano and Magalhães.(2005) in a cross-section analysis. In turn, Portuguese investments abroad have no correlation on exports as all the estimates are close to zero and are statistically insignificant.

### *5.2 Imports*

Table 2 presents the results of the robust OLS, fixed effects and random effects estimator. Here the missing values of inward and outward FDI were also dropped and the OLS estimates were obtained using the White estimator of variance. The OLS model explains a large part of the variance of Portuguese imports ($R^2 = 0.805$) that is determined by market dimension (0.421), distance (-0.552) and inward FDI (1.552). The inward FDI stock has a positive and significant effect on Portuguese imports which places emphasis on the relationship of complementarity between imports and inward FDI when we are taking pool data into account. Portugal does not import above-"normal" from Spain and Brazil, given that language and border variables are statistically insignificant.

We have followed the same procedure as in the previous section for exports and we test for the existence of individual heterogeneity, and the existence of heteroscedasticity and autocorrelation, and contemporaneous correlation in our model of imports. The groupwise likelihood test shows on the other hand that the disturbances ($GW = 529.22$) are heteroscedastics. On the other hand, they are serially correlated ($F(1, 23) = 18.13$) and contemporaneous correlated, invalidating the statistic inference.

So, in order to have consistent estimates and consider the existence fixed effects we removed them by differentiating the model with the first differences model, which amounts to built the equation 1 defined in the variables first differenced. Thus, we estimate first difference with pooled robust OLS, PCSE and FGLS.

Columns 4, 5 and 6 in Table 2 show that Portuguese imports are positively determined by market dimension and by the stock of inward FDI. The stock of foreign investments in Portugal has a positive and statistically significant correlation with Portuguese imports. This means that there is a complemen-

Table 2
Estimation Results for Imports

| Variables | ROLS | FEM | REM | FD-PCSE | FD-ROLS | FD-FGLS |
|---|---|---|---|---|---|---|
| GDP | 0.421*** | 1.520*** | 0.691*** | 0.251*** | 0.251*** | 0.221*** |
| | (0.059) | (0.446) | (0.127) | (0.056) | (0.054) | (0.023) |
| Distance | -0.552*** | | -0.964*** | | | |
| | (0.132) | | (0.282) | | | |
| language | 0.064 | | 0.221 | | | |
| | (0.231) | | (0.853) | | | |
| Border | 0.148 | | 0.395 | | | |
| | (0.212) | | (0.684) | | | |
| Inward FDI | 1.552*** | -0.127 | 0.516** | 1.993*** | 1.993*** | 2.031*** |
| | (0.134) | (0.245) | (0.208) | (0.161) | (0.131) | (0.079) |
| Outward FDI | -0.041 | -0.010 | -0.017 | 0.0708 | 0.0708 | 0.0423 |
| | (0.050) | (0.036) | (0.038) | (0.112) | (0.065) | (0.092) |
| Constant | 8.122*** | -16.961* | 6.678** | 6.781*** | 6.781*** | 7.294*** |
| | (1.152) | (8.751) | (2.646) | (1.103) | (1.029) | (0.421) |
| R-squared | 0.805 | | | 0.7586 | 0.7586 | |
| F(3, 103) | | 4.10*** | | | | |
| Wald test: $X^2(k-1)$ | | | 80.58*** | 260*** | | 1505*** |
| $LM_{BP}$: $X^2(1)$ | | | 167.34*** | | | |
| Hausman test: $X^2(3)$ | | | 25.29*** | | | |
| GW test: $X^2(1)$ | | 529.22*** | | | | |
| $F(1, 23)$ | | 18.13*** | | | | |
| Observations: | 131 | 131 | 131 | 102 | 102 | 102 |

Notes: *** Significant at the 1%; ** Significant at the 5%;* Significant at the 10%.

Standard deviation in brackets. Source: Own calculations.

tary relation between the stock of inward FDI and Portuguese imports. Yet, outward FDI is not statistically significant, which reveals that it has no impact on Portuguese imports.

For the period under analysis, foreign affiliates in the Portuguese economy act as a channel for trade favouring the expansion of both exports and imports. In contrast, Portuguese investments abroad have no impact on trade and to a

certain extent this is no surprise. These investments abroad are still relatively small in value, are highly concentrated in just two markets, Spain and Brazil, and in the latter case have been directed to the privatisation of non-tradable services.

## 6 Conclusion and Final Remarks

This paper examines the relation between FDI stock, inward and outward, and Portuguese trade flows, imports and exports. In this paper we have applied a panel data analysis, i.e., our data about Portuguese trade flows with 28 trade partners during 1995 to 2000. The gravity model was used to test the hypothesis of complementarity or substitutability on a panel analysis. Besides researching the type of relationship between FDI, inward and outward and trade flows - complementarity or substitutability - we also investigated the errors structure and applied consistent estimation methods that take into account fixed effects associated to unobserved effects of each country.

We find a complementary relation between inward FDI and trade - imports and exports, respectively - when the residuals are corrected and PCSE, FGLS and robust OLS estimation method are applied to first difference. For the period under analysis foreign affiliates in the Portuguese economy act as a trade channel that facilitates the expansion of both exports and imports. In both cases the inward stock of FDI has an estimate that is positive, significant and very similar in value. This suggests that foreign investments in the Portuguese economy have an overall neutral impact on her trade balance. Yet, this aggregate result may hide contrasting conditions at lower levels of aggregation in which positive balance of trade effects in some sectors cancel out negative balance of trade effects in other sectors. Namely, vertical FDI associated with high value added activities may have also greater impact on exports than on imports. In contrast, foreign investments in low value added activities may generate high values of intermediate imports, with a negative impact on the balance of trade.

Portuguese investments abroad, as shown in both regressions, have no impact on trade which to some extent is not a surprise. Such investments are relatively small in value and highly concentrated in just two markets - Spain and Brazil. Moreover, in the latter case investments were primarily directed to the privatisation of non tradable services.

The policy implications of these results are not fully clear. On the one hand, those policies designed to help the internationalization of Portuguese companies' through FDI did not improve the external competitiveness of the Portuguese economy as measured by trade indicators. One can suggest that the

economic rationale of these policies should be accessed carefully. On the other hand, our results do not exclude the possibility that, in some sectors, investing abroad may have a positive effect on Portuguese exports.

This question may be clarified by studying the effects of FDI on trade at sectorial level that would provide greater insights into this relationship. Morever,a sample with a longer time period is the condition to capture the impact that changes in external trade conditions have on Portuguese trade. These could be changes in the EU external trade policy on a bilateral level or at multilateral level in the WTO. Also changes in FDI policies could be assessed.

## Appendix A: Data Sources

In order to test the relationship between trade and FDI in the Portuguese economy we use a sample of OECD countries plus Brazil observed from 1995 to 2000. Values of Portuguese bilateral trade were taken from the OECD Statistical directory in current USD. These values were converted into the 1995 base year prices through the consumer price index from the International Financial Statistics. Only the trade in goods is included, meaning that trade in services is not taken into account in this study.

GDP values were obtained from the GDP per capita and population values from the Penn world table (PWT 6.1). The GDP in purchase power parity of 1996, and values for the other years were calculated with the Chain index. Inward and outward FDI are from the OECD International Direct Investment Database, in millions of Escudos, and than converted to USD with the yearly average exchange rate from the IMF, International Financial Statistics CD-ROM (June 2002). The variable distance is measured in kilometers and refers to the great circle distance between Lisbon and each capital of the countries included in the sample.

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