Trade costs and the pattern of Foreign Direct Investment: evidence from five EU countries

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Summary

Abstract According to the theoretical models of the multinational enterprise, trade costs play a fundamental role in determining the pattern of foreign direct investment (FDI). The aim of this paper is to assess the impact of trade policies on the outward stocks of FDI of the EU. We estimate a model based on the knowledge-capital theory of the multinational enterprise over the period 1995-2008 by using a sample of five EU countries and 26 partner countries. We consider, first, manufacturing sector as a whole and, then, six manufacturing industries, among which the food industry, defined at the two-digit level of the NACE classification. Explanatory variables include an index of applied bilateral tariffs and a dummy to capture the presence of Bilateral Investment Treaties (BITs). From an econometric point of view, a dynamic panel model is estimated through the generalized method of moments (GMM) estimator, taking also into account the heterogeneity bias and the endogeneity of regressors. The results show that that the pattern of the outward FDI is a mix of vertical and horizontal FDI. BITs in force have a significant and positive impact on the outward FDI. The impact of tariffs varies across industries, suggesting the predominance of horizontal in some industries, such as the food industry and the existence of vertical FDI in others.

Keywords: FDI, trade protection, knowledge-capital model
JEL Classification codes: F15, F21, F23, C33

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1. INTRODUCTION

Growing attention has been given in recent international trade literature to the important role of trade costs as a determinant of Foreign Direct Investments (FDI). Theoretical models of the multinational enterprise, such as the knowledge-capital model (Markusen, 2002; Bergstrand, Egger 2007), suggest that trade costs may have different impacts depending upon the nature of FDI. They are expected to positively affect horizontal FDI, while they should exert a negative impact on vertical FDI. More recent international trade models with heterogeneous firms show that trade costs may affect the number of firms involved in FDI and the number of affiliates established in the foreign country (e.g. Antràs, Foley, 2009). The importance of trade costs in determining the pattern of FDI suggested by theoretical models is confirmed, among others, by the observed surge of FDI in customs unions and free trade areas.

In the empirical literature, the importance of trade costs has been considered by including among the explanatory variables the usual gravity ones (Blonigen and Piger, 2011): geographical and cultural distances are used as a proxy for the transportation costs and the additional costs faced by firms when operating in a foreign country. As for the trade policies, dummies are used to capture the impact of regional agreements, while an index of the openness to trade has often been included to measure the degree of protection of the host country. However, these indirect measures of trade protection may be inappropriate; dummies implicitly assume that tariffs granted under different preferential schemes are all the same. Moreover, we frequently observe wide differences in the degree of openness in countries sharing a common trade policy; this is the case, for example, of the EU member states. A direct measure of trade protection might be more appropriate to capture the impact of the trade policy on FDI.

The aim of this paper is to assess the impact of trade costs, and more specifically of trade policies, on the pattern of FDI of EU countries. For this purpose an empirical model based on the knowledge-capital theory of the multinational enterprise (Markusen, 2002; Bergstrand, Egger, 2007) is estimated over the period 1995-2008. Our contribution to the literature is threefold. First, besides the trade costs variables usually considered in the literature, we introduce in our empirical specification a direct measure of trade protection, that is, the value of the bilateral applied tariffs. Second, the focus of this paper is the pattern of FDI of European countries with countries outside the EU. While there is a considerable amount of work

examining the impact of trade costs on the pattern of the US FDI, studies focusing on the EU are few and focus mainly on the intra-European FDI (e.g. Baltagi et al 2008). We focus on the extra-EU FDI by considering several extra-EU countries including developed, developing and transition economies. As will be shown, by analysing the pattern of extra-EU FDI with 26 extra-EU countries, a considerable variability in the applied bilateral tariffs can be found, while this would not be the case with only EU members, candidate countries and/or other European countries that have signed free trade areas with the EU. The final contribution is that we focus on the manufacturing sector, with a disaggregation into six manufacturing industries. Very few studies have used FDI data disaggregated at the industry level, because of the limited availability of data at the cross-country and industry level; indeed, these data are very often unobtainable being considered confidential. As for the EU, we are not aware of studies considering FDI disaggregated at the cross- country and industry level. As trade policies show a considerable variability across industries, in this paper we assess the impact of the bilateral applied tariffs at the industry level, by using the FDI database provided by Eurostat which reports FDI data disaggregated both at the industry and cross-country level.

From an econometric point of view, a dynamic panel model is estimated through the generalized method of moments (GMM). Overall, the results show that the pattern of the outward FDI is a mix of the vertical and the horizontal. BITs in force have a significant and positive impact on the outward FDI, while the impact of tariffs varies across industries.

The paper is organised as follows. The next section offers an overview of the main facts about EU FDI and trade policy from a preliminary look at the data here used. The third section illustrates the empirical specification used, while the fourth deals with the data and the econometric issues. The fifth section discusses the results while the final one offers some concluding remarks.

2. THE PATTERN OF FDI AND TARIFFS: A PRELIMINARY LOOK AT THE DATA

Given our interest in analysing bilateral FDI data at industry level, we have restricted our data set to five EU countries (France, Germany, Netherlands, Italy and United Kingdom) for which FDI stocks data disaggregated at the industry level during the considered period, that is 1995-2008, are available. Outward stocks of FDI come from the Eurostat database, which reports data on bilateral FDI from the balance of payments statistics disaggregated both at the country and industry level. Our sample includes 26 partner countries,[1] which have been selected following two main criteria: first, the availability of data. As mentioned before, FDI data at the cross-country and industry level for the period 1995-2008 are often not available, especially for small developing countries, possibly because they are considered confidential. Second, we have taken also into account the variability of the EU trade policies and, hence, of the applied tariffs. Indeed, our sample includes partners who face the MFN tariffs, as well as countries that benefit from different level

[1] More specifically, our sample includes the following countries: Algeria, Australia, Argentina, Brazil, Bulgaria, Canada, Chile, Czech Republic, Egypt, Estonia, Hungary, Israel, Japan, Latvia, Lithuania, Mexico, Morocco, Norway, Poland, Romania, Slovakia, Slovenia, South Africa, Switzerland, United States and Uruguay.

of preferences in the considered period within the various preferential schemes. Our database also includes non-OECD countries that are not considered in other studies using the EU FDI stock as the dependent variable (e.g. Egger and Merlo, 2007; Baltagi et al 2008).

As regards the industry disaggregation, we have first considered the manufacturing sector as a whole, and then six manufacturing industries - obtained by aggregating industries defined at the two-digit level of the NACE classification - have been selected on the basis of the availability of the FDI stock data. Overall, these six industries account for 79% of the outward FDI of the manufacturing industry.

The pattern of FDI of the five EU countries considered in this paper differs considerably across countries and industries. Figure 1 reports the outward stocks of FDI in the total manufacturing sector by group of third countries in the year 2005. The group "Developed countries" – which here includes seven extra-EU advanced countries (Australia, Canada, Israel, Japan, Norway, Switzerland and the US) – accounts for around the 75% of the total FDI of the five EU countries, but with important differences between them. While for the United Kingdom, France and Netherlands the share of FDI hosted by these advanced countries is higher than 80%, this is not the case for Italy and Germany. A major part of the German stock of FDI is hosted by the countries which joined the EU in 2004 and 2007 and by other extra-EU countries.

The industrial pattern of the outward FDI is even more differentiated, as shown by Figure 2. The vehicle industry has a major role for Germany and France, but a negligible one for the United Kingdom and the Netherlands. On the contrary, the "Petroleum chemicals and plastics industry" is important especially in the Netherlands and United Kingdom, but not for Germany and France. The "Metal and mechanicals" industry is especially important for the outward stock of Italy (over the 50%) but it is less important for France, Germany and the Netherlands. The food industry accounts for a considerable share of the outward FDI in the Netherlands, United Kingdom and, even to a lesser extent, Italy. Figure 3 shows the industrial pattern by group of partner countries of the outward FDI of the five EU countries. The vehicles industry has a major role especially for the EU FDI hosted by developing countries, while the "Petroleum, chemical, rubber" and "Food" industries account each for about one third of the outward FDI hosted by developed countries.

Figures 4 and 5 report the values of the average tariffs applied by the EU and by the host countries in 1995 and 2005.[2] Our main interest is to understand if and how these tariffs have affected the pattern of FDI in the manufacturing sector as a whole, and in the six industries here considered. Tariffs applied by the EU are considerably lower than the tariffs faced on average by the European firms in the host countries here considered; in addition, tariffs have, by and large, decreased during the period 1995-2005. Overall, as regards differences in EU and host countries' tariffs, we find a similar pattern. Industries where tariffs are higher – both the EU and the host countries - are the food, textiles and the vehicle sectors, while tariffs are particularly low in the computer industry, both in the EU and in the host countries.

[2] Details on the data and the methodology used to compute the average tariffs are provided in section 4.

3. THE MODEL

Preliminary exploration of the data suggests that the pattern of FDI varies significantly across the five EU countries, both from a geographical and an industrial point of view; some countries (France, Germany and UK) show a prevalence of a one-way FDI in the six industries here considered, while for others the data suggest the existence of a two-way pattern of FDI (Italy and, to a lesser extent, the Netherlands). This evidence calls for a careful consideration in our empirical model of the possible determinants of FDI which may explain such variability across the countries and industries.

The empirical literature on the determinants of FDI has used a wide variety of model specifications to explain the pattern of FDI. Blonigen and Piger (2011) have shown that 47 different independent variables have been included in eight recent empirical studies on the pattern of FDI, most of which are included in just one study only. Using Bayesian statistical techniques they found that among all the considered variables, only a small number is likely to be determinants of FDI; these include the traditional gravity variables, distance, parent and host country GDP variables, relative labour endowments and trade agreements. Their findings support the view that any explanation of FDI needs three key sets of explanatory variables: market size of parent and host country, relative labour endowments and trade costs. These determinants are, by and large, those used in the empirical specification of the knowledge-capital theory of the multinational enterprise (Carr et al. 2001; Markusen and Maskus, 2002), originally developed by Markusen (2002) and further expanded by Bergstrand and Egger (2007) to the three-factor and three-country case. The knowledge-capital model explains both the choice of replicating the same activities in many locations (horizontal FDI) and that of fragmenting production stages geographically (vertical FDI). According to the model, horizontal FDI is likely to prevail if countries are similar in size and in relative endowments and trade costs are high, while vertical FDI could occur when countries differ in factor endowments, especially if the country abundant in skilled-labour is small, and trade costs are low.

As in other recent empirical papers based on the knowledge-capital theory of the multinational firm (e.g. Braconier et al, 2005; Baltagi et al 2007), our specification includes market size and relative labour endowments variables as control variables, together with trade costs which is our main variable of interest. [3] As regards trade costs, previous studies have used the degree of openness (Blonigen et al., 2007) or an index of the overall trade costs perceived by firms (Carr et al., 2001; Markusen, Maskus, 2002; Braconier et al, 2005; Ekholm et al., 2007) and dummies to capture the impact of regional trade agreements (Baltagi et al., 2008; Stein, Daude, 2007). As our interest is the impact of trade policies on FDI, in this paper we explicitly use the tariffs, measured by the weighted average of bilateral applied tariffs. Distance has been also included in several studies and found to be among the most important determinants of FDI (Blonigen and Pigger,

[3] The empirical model used in this paper is more parsimonious than the one originally proposed by Carr et al. (2001) and used by Markusen and Maskus (2002) to test the knowledge-capital theory. The reason is that the basic cross-section specification for the knowledge-capital model generally includes interaction terms between skilled labour relative endowments and other explanatory variables, such as the differences in GDP and trade costs. However, the inclusion of these variables leads to the multicollinearity of regressors in the time dimension of panel data (Egger, Merlo, 2007).

2011). Other factors affecting trade costs are likely to be captured by the distance variable and by the fixed effects. A further policy variable is here considered, that is, the presence of bilateral investment treaties (BITs); as shown by previous studies, BITs may exert a positive effect on FDI (Egger, Pfaffermayer, 2004; Egger, Merlo, 2007; Busse et al., 2010). The dependent variable used in this model is the stock of FDI, which is among the most used measure of FDI in the literature.[4] More accurate measures of FDI, such as the affiliate sales, are less available for the EU countries at the cross-country/industry level.

The basic specification we use is thus the following:

$$\ln(FDI_{ijkt}) = \beta_0 + \beta_1 \ln(sumGDP_{ijt}) + \beta_2 \ln(relGDP_{ijt}) + \beta_3 \ln(relSKILL_{ijt}) + \beta_4 \ln(dist_{ij}) + \\ + \beta_5 \ln(host\ tariff_{ijkt}) + \beta_6 \ln(home\ \ tariff_{ijkt}) + \beta_7 BIT_{ijt} + \delta_0 trend_t + u_{ijkt} \quad [1]$$

where subscripts i (i=1,…,5) and j (j=1,…,26) refer to the home and the host country, respectively, k is the industry and t indicates the year (t = 1995, ..., 2008), u_{ijkt} is the error term and trend indicates a trend variable. FDI indicates the stocks of FDI, sumGDP is the sum of GDPs of the home and host country and measures the market size of countries; market similarity is taken into account through the variable relGDP which is the home-to-host relative GDP; relSKILL is the home-to-host relative skilled-labour endowment. The latter two variables are given by the ratio between GDP or skilled-labour endowments of the home and those of the host country.[5] Dist is the distance between the home and the host country capitals, host tariff indicates the tariff applied to the home exports by the host country, while home tariff indicates the tariff applied by the home country to imports from the host country. BIT is a dummy variable equal to one if a bilateral investment treaty is in force and zero otherwise.

On the basis of the theoretical and empirical literature we expect horizontal FDI to be positively correlated with market size, as the latter is crucial in determining whether to exploit plant economies of scale; the larger the size of the markets, the easier it is to cover the plant costs. Horizontal FDI is also expected to be positively influenced by market similarity; therefore, we expect a negative sign for the coefficient of the variable relGDP. Differences in factor endowments explain vertical FDI, while they are unlikely to affect horizontal FDI. Distance is expected to influence horizontal FDI positively and vertical FDI negatively. Tariffs may have a different impact depending upon the nature of FDI. Host country tariffs positively affect horizontal FDI, while they should have no effect on vertical FDI, or a negative impact if subsidiaries in the host country use intermediate goods imported from the home country. Conversely, home country tariffs are expected to negatively influence vertical FDI, especially if goods produced in the low cost partner country are shipped back to the home country.

[4] Many papers use the outward stocks of FDI (e.g. Baltagi et al 2007 and 2008; Stein and Daude, 2007), while others pool inward and outward stocks of FDI (e.g. Head and Ries, 2008, Blonigen and Piger, 2011).

[5] The specification proposed by Carr et al. (2001) considers the difference between skills or GDP of host and partner countries, rather than the ratio. However, Carr et al. (2001) adopt a specification in levels. Studies which consider a specification expressed in logarithm generally use the logarithm of the ratio, i.e. the difference between the logarithms (Egger, Winner, 2006; Baltagi et al., 2007; Egger, Merlo, 2007; Egger, 2001 and 2008).

BITs are expected, in general terms, to have a positive impact, although the empirical evidence to date is rather ambiguous, with different findings depending upon the nature and number of countries considered. Evidence of a significant positive impact of BITs on FDI has been found for the OECD countries (Egger and Merlo, 2007), while for developing countries Hallward-Driemeier (2003) found little evidence of any positive influence; however, Neumayer and Spess (2005) and Busse et al (2010), by using a larger sample of host and source countries, found that BITs do support FDI toward developing countries.

The dependent variable used in this model is the stock of FDI, which is among the most used measure of FDI in the literature. More accurate measures of FDI, such as the affiliate sales, are less available for the EU countries at the cross-country/industry level. Many papers use the outward stocks of FDI (e.g. Baltagi et al 2007 and 2008; Stein and Daude, 2007), while others pool inward and outward stocks of FDI (e.g. Head and Ries, 2008, Blonigen and Piger, 2011).

4. DATA AND ECONOMETRIC ISSUES

Our sample should include 1620 observations for each two-digit industry. However, with bilateral data of FDI stock at industry level there is a considerable number of missing values. If we consider the total manufacturing sector as a whole, we count 1003 missing values in the outward FDI vector. The share of missing values at the cross-country and industry level is, as expected, rather high. However, a preliminary exploration of the data suggests that the probability to find missing values is unlikely to be systematic and correlated with the FDI.[6]

Data on FDI stock are from Eurostat, while those on GDP are from the World Development Indicators (WDI). The skilled labour endowment of each country is measured by the tertiary school enrolment provided by the WDI, while the distances are those provided by CEPII.

Bilateral applied tariffs are from WITS. WITS provides data on bilateral tariffs disaggregated at the ISIC-four digit level for each pair of countries. In aggregating tariffs the use of import value shares as weights leads to an "endogeneity bias" due to the fact that if tariffs are very high, imports are likely to be very low or nil. A weighted average has thus been computed following the MacMap procedure (Bouët et al., 2005). Countries have been split into five groups on the basis of their level of development. Then, the weighted average of tariffs has been obtained by using as weights the share of imports of each country from the group the exporter belongs to. In this way, the endogeneity bias due to the use of bilateral imports in the weighting procedure is reduced (Cipollina and Salvatici, 2008).

In order to overcome the problem due to the presence of a considerable number of zeros in the tariff vectors, we include tariffs in equation [1] both in level and by computing ln(1+tariff).

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[6] As suggested by Wooldridge (2002), we have performed the Verbeek and Nijman (1992) test for attrition bias. Test results reject the hypothesis of attrition bias for the manufacturing sector as a whole, but not when considering the six industries. However, if we run estimations for the six industries dropping year 1995 observations , we reject the hypothesis of attrition bias also when considering disaggregated data and results are substantially similar to those obtained when considering all available years. Results obtained with this reduced sample are available upon request.

Table 1 provides information on the variables included in the model. Following the classification by the IMF (2010), we have split our sample in two different groups of countries: on one hand, we have 10 developed and/or high-income partner countries (Australia, Canada, Czech Republic, Israel, Japan, Norway, Slovakia, Slovenia, Switzerland and United States), while the others are transition and developing countries.

As already mentioned, the EU FDI directed to advanced countries are, on average, much higher than those directed toward developing countries. While differences in the skilled labour endowment between EU and host countries do not turn out to be significant even when developing countries are considered, differences in GDP between EU and host countries are very high if we consider developing host countries. Furthermore, developing countries apply, on average, higher tariffs on EU exports than the developed countries, while EU tariffs are on average higher for the advanced countries.

Estimating equation [1] by OLS could raise the problem of heterogeneity bias due to observable and non-observable factors specific to each industry-country-pair. From an econometric perspective, the omission of such factors may lead to a mis-specification of the regression model, and produces biased and inconsistent estimates. To take individual industry-country-pair effects into account, industry-country-pair specific dummies are included in equation [1], that is the error term of equations [1] is decomposed as $u_{ijkt} = \alpha_{ijk} + \varepsilon_{ijkt}$, where α_{ijk} indicates time invariant industry-country-pair and ε_{ijkt} is the idiosyncratic error term.

Furthermore, when dealing with the stocks of FDI it is quite plausible that past bilateral FDI affects current bilateral FDI (Egger, 2001). Thus, a dynamic specification would be more appropriate. Since OLS and fixed effect estimators yield biased and inconsistent estimates with a dynamic panel specification, the Arellano and Bond (1991) estimator could be employed. Blundell and Bond (1998) proposed a system-GMM approach which combines first-differenced model (with lagged levels of FDI as instruments) and level model (with lagged differences of FDI as instruments). As Egger and Merlo (2007) have argued, such an approach is not appropriate in this context. Indeed, system-GMM requires that initial levels of the series of the bilateral FDI among countries do not deviate systematically from their long-run value. In order to use also lagged differences of the dependent variable as instruments in the level equation for the system-GMM, initial levels of the dependent variable should be mean stationary; however, this assumption is not plausible when the stocks of FDI are the dependent variable (Egger and Merlo, 2007). This is why we do not employ the system GMM estimator here. In order to maximize sample size (Roodman, 2006), forward orthogonal deviations are used (Arellano and Bover, 1995).

Econometric studies assessing the impact of trade agreements have found evidence of endogeneity for the trade agreement variables (Lederman and Özden , 2004; Baier and Bergstrand, 2007; Caporale et al. 2009). Intuitively, simultaneity between FDI and tariffs may arise if closer relations also in terms of investments between the two countries affect the level of bilateral tariffs. We tested the hypothesis of endogeneity of host and home tariffs by using the Davidson-Mackinnon exogeneity test. The resulting p-value is lower than 0.06 and, thus, we reject the null hypothesis of exogeneity at the 6% level of significance.

The endogeneity of regressors has been taken into account by employing the lagged values of host and home tariffs as instrumental variables in the GMM procedure.

5. RESULTS

Table 2 presents the results obtained by estimating equation [1] through fixed effects and dynamic GMM, as discussed in the previous section. We also report estimates obtained through OLS for comparison.

As for the OLS estimates, the coefficients of the control variables have the expected sign, except for the differences in the skilled-labour endowments variable (skillrel), which shows a coefficient that is negative but not significant. The joint size of the home and host country markets (sumGDP) has a considerable positive, albeit not significant, effect on outward FDI. Conversely, relative GDP, as expected, has a negative and significant effect. Distance has also a negative and significant effect on FDI, while as regards tariffs, only the home tariff has a significant effect with an unexpected positive sign. This coefficient becomes not significant if we consider tariffs in level, while the other coefficients do not change.

The results change somewhat when we take into account the heterogeneity bias by considering a fixed effect model. [7] The fixed effect estimates highlight the relevance of market size; differences in market size have also a positive effect on FDI. The coefficients of the tariffs and BITs are never significant, except for EU tariffs which have a weakly negative impact on FDI if we consider tariffs in level.

Table 2 also reports the results obtained for the dynamic model using the dynamic GMM estimator.[8] The dynamic specification seems to work well, as indicated by the serial correlation tests and the Hansen test. Serial correlation tests show, as expected, a first-order autocorrelation, but also the absence of second-order autocorrelation. Furthermore, the Hansen test does not reject the null hypothesis that instruments are exogenous. As the results show, past FDI significantly and positively affects current FDI. Thus, the dynamic model estimated through the GMM estimator should be considered as the most appropriate.

The results for the dynamic model also confirm the considerable positive impact of market size, and that FDI is larger the greater the differences in skilled-labour endowment. The coefficient of the skilled-labour differences is considerably higher than in the fixed effect estimation and significant. Thus, the estimations seem to provide a rather strong and robust evidence of the coexistence of factor endowment based FDI (i.e. vertical FDI) together with market-oriented FDI (i.e. horizontal FDI).

As regards the policy variables, BITs affect outward FDI positively, even though the coefficient is not significant.

[7] The distance variable has been dropped here, as it is absorbed by fixed effects, which capture the effects of all time invariant country-pair specific variables.

[8] In estimating the equations through the GMM estimator we also take into account the fixed effects; hence, the distance variable has been dropped in this estimation as well.

The tariffs applied by the EU countries have a positive impact on the outward FDI, although with a low level of significance. This result is not in line with common expectations, as home tariffs are expected either to exert no influence when outward FDI is horizontal, or to exert a negative effect with vertical FDI.

The coefficient of the host country tariff is negative and significant; this may be explained by the predominance of vertical FDI.

The results obtained by considering the six industries are reported in Table 3. OLS estimates show that market size and similarities in both market size and skilled-labour endowment have a positive effect on FDI, as well as geographic proximity. Moreover, the host tariff has a positive effect on FDI, while BITs have an unexpected negative effect. By taking into account heterogeneity bias through FE estimations, it can be observed that only joint market size and differences in market size have a significant and positive effect on FDI. Policy variables seem not to affect FDI in this estimation: only when we consider tariffs in level does the host tariff have a significant and positive impact on FDI, while the coefficients of BITs and home tariffs are never significant.

The results change considerably if we take into account the dynamic pattern of FDI through the GMM estimator; market size and differences in skilled-labour endowment have a significant and positive effect as well as BITs. As for the tariffs, the results of the GMM estimation are less straightforward: as in the case of the manufacturing sector taken as whole, we find evidence of a (unexpected) positive effect of home tariffs but only if they are included in the model by logarithmic transformation.[9] Conversely, unlike the results obtained for the manufacturing sector overall, for the six industries here considered the host tariff never exerts an influence on the outward FDI. It can be noted that the estimates obtained when considering tariffs in level are not substantially different from those obtained when considering tariffs in logarithm.

In order to gather further insights on the impact of tariffs on FDI at industry level, we have estimated the model by splitting the home and host tariffs in six groups, according to the aggregations previously used. Table 4 reports the results of these estimations. The significance of the lagged dependent variable shows that the dynamic GMM estimator is again the most appropriate. Hence, the results of the OLS and fixed effects estimation are not reported in this case. The results confirm the importance of the differences in skilled-labour, which significantly and positively affect outward FDI in almost all estimations. As for the tariffs, the coefficients of the host tariffs are significant and positive for the "Food" industry only. This suggests that, at least for this industry, tariffs in the host countries stimulate horizontal FDI. As for the home tariffs, the picture is more complex. In two industries - "Total textiles and wood activities" and " Petroleum, chemical, rubber" - home tariffs have a positive impact on outward FDI, in line with the results obtained in the estimations of the overall manufacturing industry; however, for one industry - "Total office machinery, computers, RTV and communication equipments" – there is evidence of a significant negative effect of

[9] As robustness check, we have also run Table 3 estimations by considering EU preferential tariffs instead of EU applied tariffs and the simple average of the EU tariffs provided by WITS instead of the weighted average of EU tariffs computed as described in section 4. The results, which are available upon request, do not substantially change with respect to those reported in Table 3.

home tariffs on FDI. This finding suggests that, at least for these products, FDI is likely to be of the export-platform type, that is, firms from European countries invest abroad but re-import the final product into the home country; this may explain why the home tariff affects outward FDI negatively.

Estimations have also been run by splitting the sample in advanced economies and other countries (Table 5) in order to verify if the policy variables, i.e. home and host tariffs and the BIT dummy, have a different impact on the outward FDI depending on the income level of the host country. Again for these estimates, the GMM method turns out to be the most appropriate. For both groups of countries, FDI is positively and significantly correlated with relative skilled-labour endowment which is confirmed to be a key explanatory variable; unlike the results obtained from the estimations for the whole sample of countries (Table 3), here the coefficient of relative market size is positive but not significant for both groups of countries, while the joint market size has a positive and significant effect on FDI in developing host countries. More importantly, the coefficients of the host tariff - which were not significant in Table 3 - are now positive and significant for developed countries; this result is in line with the existence of horizontal FDI; conversely, they are not significant in the case of developing countries. Table 5 also shows that home tariffs have a positive and significantly impact on the FDI hosted by developing countries, while they are not significant in the case of the developed ones. Finally, BITs have also a positive albeit not significant effect on FDI to developing countries. [10]

6. CONCLUDING REMARKS

The aim of this paper is to assess the impact of trade policy on the pattern of the extra-EU FDI in the manufacturing sector. Our sample consists of five EU countries and 26 partner countries. Unlike previous studies, our analysis is disaggregated both at the country and industry level: we first consider the manufacturing sector as a whole; then the sample is enlarged to include six manufacturing industries. An empirical specification based on the knowledge-capital model is estimated over the period 1995-2008.

Bilateral tariffs have been used to measure bilateral trade protection, instead of using dummy variables or other indirect measures of trade protection included in the previous papers. Moreover, we include a dummy to also take into account the presence of bilateral investment treaties. From an econometric point of view, heterogeneity bias, which could be due to the likely correlation between time invariant specific effects and regressors, has been taken into account by including industry-country-pair fixed effects in the model. Furthermore, we have considered the fact that past stocks of FDI are likely to affect current ones and estimated a dynamic panel model by using the GMM estimator.

[10] In the case of host developed countries, the BITs dummy variable is equal to one for 17 observations out of 825 and for only two host countries, which are the Czech Republic and Israel. Hence, it is likely that the effect of the BITs dummy is absorbed by fixed effects.

As for the control variables, our findings are generally in line with previous studies and confirm that the pattern of the EU FDI is a mix of vertical and horizontal FDI. As regards BITs, we find a significant and positive impact of these agreements on the outward FDI; hence, the results support previous (albeit scarce) empirical evidence of their effectiveness in stimulating FDI toward developing economies. The most innovative results of the paper concern the impact of the tariffs at the industry level. As expected, the impact of tariffs differs across industries: host tariffs positively affect the outward stocks of FDI in the "Food" industry, thus confirming the predominance of horizontal FDI in this industry. Conversely, tariffs applied by the EU countries have a negative effect on the outward FDI in the "Total office machinery, computers, RTV and communication equipments" industry, possibly because of the existence of vertical FDI, with products re-imported into the EU country. Tariffs of the EU countries have a positive impact on the outward FDI stocks for the "Textiles and wood activities" and "Petroleum, chemical, rubber" industries.

Our findings suggest that host country tariffs considerably influence the investments of the European firms outside the EU, especially in the more protected industries, such as the food sector. Improvements in the dataset on the extra –EU FDI of the European countries may obviously also improve the analysis, although we believe that, given the difficulties in gaining bilateral data on FDI disaggregated at industry level for the EU, our findings provide a sound basis for understanding the relationships between trade policies and the pattern of FDI.

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Table 1- Descriptive statistics, 1995-2008 (millions Euro)

	All host countries			Developed countries			Developing countries		
	Mean	*(s.d.)*	*CV*	**Mean**	*(s.d.)*	*CV*	**Mean**	*(s.d.)*	*CV*
Outward FDI - Manufacturing	4,295.60	*(11257.18)*	*2.62*	7,533.55	*(14857.54)*	*1.97*	784.18	*(1176.01)*	*1.50*
Outward FDI - six industries	940.92	*(2779.58)*	*2.95*	1,402.25	*(3435.55)*	*2.45*	187.60	*(398.62)*	*2.12*
GDP of the Host countries	957,032	*(2632469.)*	*2.75*	2,188,021	*(3924911.)*	*1.79*	183,797	*(255389.1)*	*1.39*
GDP of the EU countries	1,429,246	*(643663.5)*	*0.45*	1,430,361	*(644617.8)*	*0.45*	1,428,545	*(643386.8)*	*0.45*
Sum of GDPs home and host country	2,386,277	*(2743314.)*	*1.15*	3,618,383	*(4028907.)*	*1.11*	1,612,342	*(716731.6)*	*0.44*
GDPrel	30.67	*(52.67)*	*1.72*	12.16	*(20.01)*	*1.65*	42.29	*(62.58)*	*1.48*
SKILLrel	1.61	*(1.04)*	*0.65*	1.08	*(.44)*	*0.40*	1.96	*(1.17)*	*0.60*
Host tariff - Manufacturing	6.82	*(6.24)*	*0.91*	2.92	*(2.84)*	*0.97*	9.26	*(6.54)*	*0.71*
Host tariff - six industries	9.62	*(24.85)*	*2.58*	3.59	*(4.72)*	*1.32*	13.40	*(30.9)*	*2.31*
EU Tariff- Manufacturing	2.03	*(1.89)*	*0.93*	2.40	*(1.87)*	*0.78*	1.80	*(1.87)*	*1.04*
EU Tariff - six industries	2.79	*(3.09)*	*1.11*	3.57	*(3.34)*	*0.94*	2.29	*(2.8)*	*1.22*
Total observations - Manufacturing	1620			625			995		
Total observations - six Nace industries	9720			3750			5970		

Note: CV is the coefficient of variation; standard deviations in parenthesis.

Source: authors' computation

Table 2 - Estimation results. Dependent variable: outward stocks of FDI – Manufacturing (in logarithm) (1995-2008)

	Ln(1+Tariff)			Tariff in level		
VARIABLES	OLS §	FE	GMM	OLS §	FE	GMM
lnFDI (t-1)			0.511***			0.495***
			(0.070)			(0.092)
lnGDPsum	0.208	5.028***	2.419**	0.252	4.867***	2.301**
	(0.216)	(1.006)	(1.112)	(0.222)	(0.981)	(1.082)
lnGDPrel	-0.643***	1.411**	-0.093	-0.648***	1.175*	0.656
	(0.118)	(0.595)	(0.605)	(0.121)	(0.598)	(0.634)
lnSKILLrel	-0.194	0.273	0.720*	-0.219	0.221	1.181*
	(0.281)	(0.219)	(0.391)	(0.283)	(0.222)	(0.606)
Host tariff (extra-EU)	0.133	-0.064	-0.530***	0.014	-0.004	-0.076*
	(0.179)	(0.079)	(0.177)	(0.029)	(0.015)	(0.041)
Home tariff (EU)	0.762**	-0.141	0.461***	0.184	-0.090*	0.165*
	(0.292)	(0.159)	(0.135)	(0.113)	(0.052)	(0.094)
BITs	-0.394	-0.197	0.157	-0.459	-0.183	0.255
	(0.386)	(0.143)	(0.995)	(0.379)	(0.165)	(1.098)
ln(dist)	-0.750***			-0.634***		
	(0.182)			(0.172)		
Trend	0.013	-0.086***	-0.061**	-0.003	-0.092***	-0.037
	(0.025)	(0.021)	(0.024)	(0.026)	(0.021)	(0.027)
Constant	9.609***	-67.618***		8.607**	-64.949***	
	(3.360)	(14.804)		(3.368)	(14.463)	
Observations	568	568	353	568	568	353
R-squared	0.598	0.956		0.586	0.957	
F	16.38	6.746	13.76	15.77	6.673	5.965
(p-value)	(.)	(.)	(.)	(.)	(.)	(.)
Hansen test			47.64			46.57
(p-value)			(.832)			(.914)
AR(1) test			-3.106			-2.330
(p-value)			(.002)			(.02)
AR(2) test			-0.512			-1.124
(p-value)			(.609)			(.261)

Notes: robust standard errors in parenthesis.
***; **, * indicate significance at 1%, 5% and 10% level, respectively.
§: standard errors are adjusted by clustering observations at country pairs level.

Table 3 - Estimation results. Dependent variable: outward stocks of FDI – Six industries (in logarithm) (1995-2008)

	Ln(1+Tariff)			Tariff in level		
VARIABLES	OLS §	FE	GMM	OLS §	FE	GMM
lnFDI (t-1)			0.451***			0.441***
			(0.085)			(0.077)
lnGDPsum	0.630***	4.118***	2.059*	0.667***	4.043***	1.833*
	(0.235)	(0.960)	(1.083)	(0.234)	(0.965)	(1.081)
lnGDPrel	-0.332***	1.528***	0.547	-0.322**	1.347**	0.469
	(0.128)	(0.575)	(0.647)	(0.128)	(0.578)	(0.607)
lnSKILLrel	-0.509*	0.055	0.601*	-0.478*	0.058	0.548*
	(0.276)	(0.205)	(0.351)	(0.263)	(0.206)	(0.295)
Host tariff (extra-EU)	0.302**	-0.026	-0.150	0.034**	0.013*	0.020
	(0.149)	(0.072)	(0.155)	(0.015)	(0.007)	(0.027)
Home tariff (EU)	-0.113	0.049	0.272***	-0.054	-0.012	-0.001
	(0.202)	(0.091)	(0.091)	(0.059)	(0.024)	(0.041)
BITs	-0.694**	0.022	0.587*	-0.710**	0.138	0.827**
	(0.333)	(0.115)	(0.349)	(0.327)	(0.123)	(0.410)
ln(dist)	-0.514***			-0.424***		
	(0.157)			(0.140)		
Trend	-0.050**	-0.067***	-0.046*	-0.060***	-0.067***	-0.036
	(0.021)	(0.024)	(0.025)	(0.022)	(0.024)	(0.025)
Constant	0.289	-56.318***		-0.647	-55.168***	
	(3.836)	(14.029)		(3.793)	(14.111)	
Observations	1,748	1,748	1,074	1,748	1,748	1,074
R-squared	0.271	0.913		0.271	0.913	
F	13.14	4.601	8.953	13.79	5.136	9.218
(p-value)	(.)	(.)	(.)	(.)	(.)	(.)
Hansen test			162.3			132.6
(p-value)			(.0959)			(.112)
AR(1) test			-3.772			-4.006
(p-value)			(.)			(.)
AR(2) test			-0.270			0.0118
(p-value)			(.787)			(.991)

Notes: robust standard errors in parenthesis.
***; **, * indicate significance at 1%, 5% and 10% level, respectively.
§: standard errors are adjusted by clustering observations at country pair-industry level.

Table 4 - Estimation results. Dependent variable: outward stocks of FDI – Six industries (in logarithm) (1995-2008), tariffs in level.

VARIABLES	GMM	GMM	GMM
lnFDI (t-1)	0.463***	0.479***	0.448***
	(0.085)	(0.076)	(0.072)
lnGDPsum	1.274	1.064	1.331
	(1.512)	(1.619)	(1.776)
lnGDPrel	0.641	-0.086	0.222
	(0.726)	(0.838)	(1.033)
lnSKILLrel	1.414***	0.436	0.892*
	(0.448)	(0.424)	(0.466)
Host Tariff (extra-EU)		0.004	
		(0.026)	
Host Tariff *NACE1	0.123***		0.058*
	(0.043)		(0.034)
Host Tariff *NACE2	0.143		0.119
	(0.116)		(0.116)
Host Tariff *NACE3	-0.028		-0.015
	(0.028)		(0.027)
Host Tariff *NACE4	0.041		0.063
	(0.062)		(0.049)
Host Tariff *NACE5	0.415		0.388
	(0.303)		(0.284)
Host Tariff *NACE6	-0.078		-0.062
	(0.070)		(0.045)
Home Tariff (EU)	0.032		
	(0.040)		
Home Tariff *NACE1		-0.009	-0.007
		(0.059)	(0.060)
Home Tariff *NACE2		0.107**	0.096***
		(0.046)	(0.037)
Home Tariff *NACE3		0.307***	0.169**
		(0.109)	(0.067)
Home Tariff *NACE4		-0.128	0.068
		(0.182)	(0.183)
Home Tariff *NACE5		-0.751*	-0.832*
		(0.440)	(0.498)
Home Tariff *NACE6		-0.477	-0.205
		(0.344)	(0.331)
BITs	0.080	0.344	0.125
	(0.426)	(0.503)	(0.367)
trend	-0.012	-0.034	-0.022
	(0.033)	(0.035)	(0.040)
Observations	1,074	1,074	1,074
F	5.669	12.67	5.351
(p-value)	(.)	(.)	(.)
Hansen test	143.5	165.6	171.1
(p-value)	(.0893)	(.23)	(.938)
AR(1) test	-4.028	-4.056	-4.217
(p-value)	(.0001)	(.)	(.)
AR(2) test	0.0529	0.281	-0.0571
(p-value)	(.958)	(.778)	(.954)

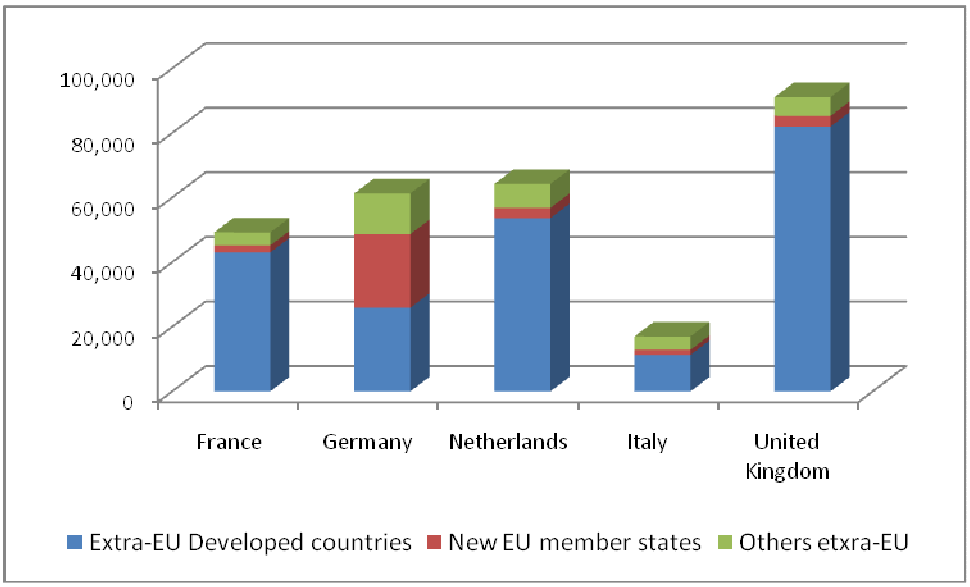
Notes: robust standard errors in parenthesis.
***; **, * indicate significance at 1%, 5% and 10% level, respectively.
NACE1: Food products, NACE2: Total textiles and wood activities; NACE3: Total petroleum, chemical, rubber, plastic products; NACE4 Total metal and mechanical products, NACE5 Total office machinery, computers, RTV, communication equipment and NACE6 Total vehicles and other transport equipment sector.

Table 5 Estimation results. Dependent variable: outward stocks of FDI – Six industries (in logarithm) (1995-2008), tariffs in level. Estimation method: GMM.

VARIABLES	DEVELOPED HOST COUNTRIES	DEVELOPING HOST COUNTRIES
lnFDI (t-1)	0.453***	0.561***
	(0.095)	(0.162)
lnGDPsum	-0.099	4.476**
	(1.630)	(1.934)
lnGDPrel	0.964	0.868
	(0.985)	(0.919)
lnSKILLrel (tertiary school)	1.797**	1.701**
	(0.731)	(0.853)
Host tariff (extra- EU)	0.081*	0.022
	(0.044)	(0.036)
Home Tariff (EU)	-0.021	0.132***
	(0.049)	(0.048)
BITs		0.613
		(0.786)
trend	-0.000	0.019
	(0.036)	(0.049)
Observations	825	249
F	13.17	7.003
(p-value)	(.)	(.)
Hansen test	108.3	40.76
(p-value)	(.316)	(.437)
AR(1) test	-3.317	-2.057
(p-value)	(.0009)	(.0397)
AR(2) test	0.130	0.293
(p-value)	(.896)	(.769)

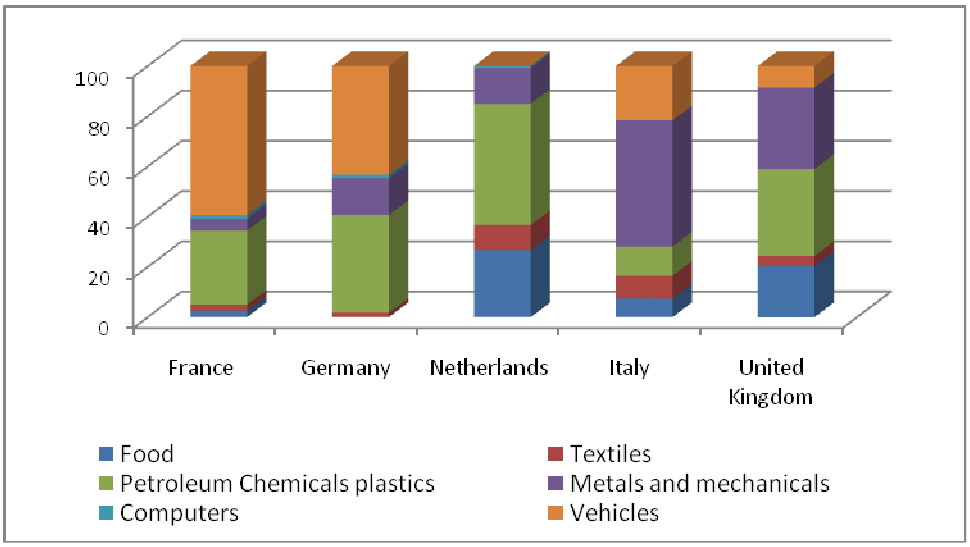
Notes: robust standard errors in parenthesis.
***; **, * indicate significance at 1%, 5% and 10% level, respectively.

Figure 1: The stock of outward FDI by countries in the manufacturing industry (2005, millions Euros)



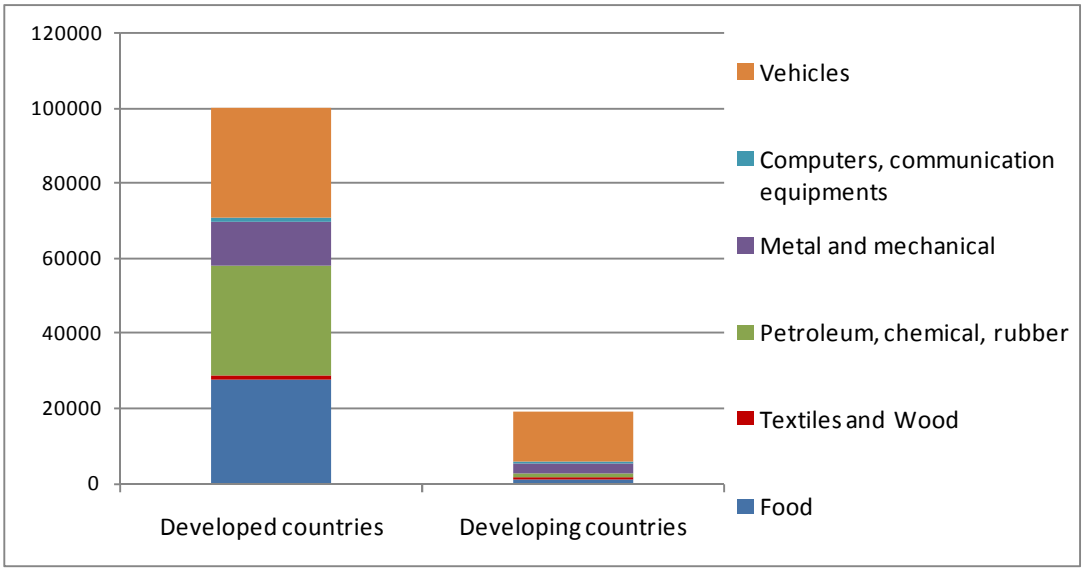
Source: authors' computations on Eurostat data.

Figure 2: The stock of outward FDI by industries (2005)



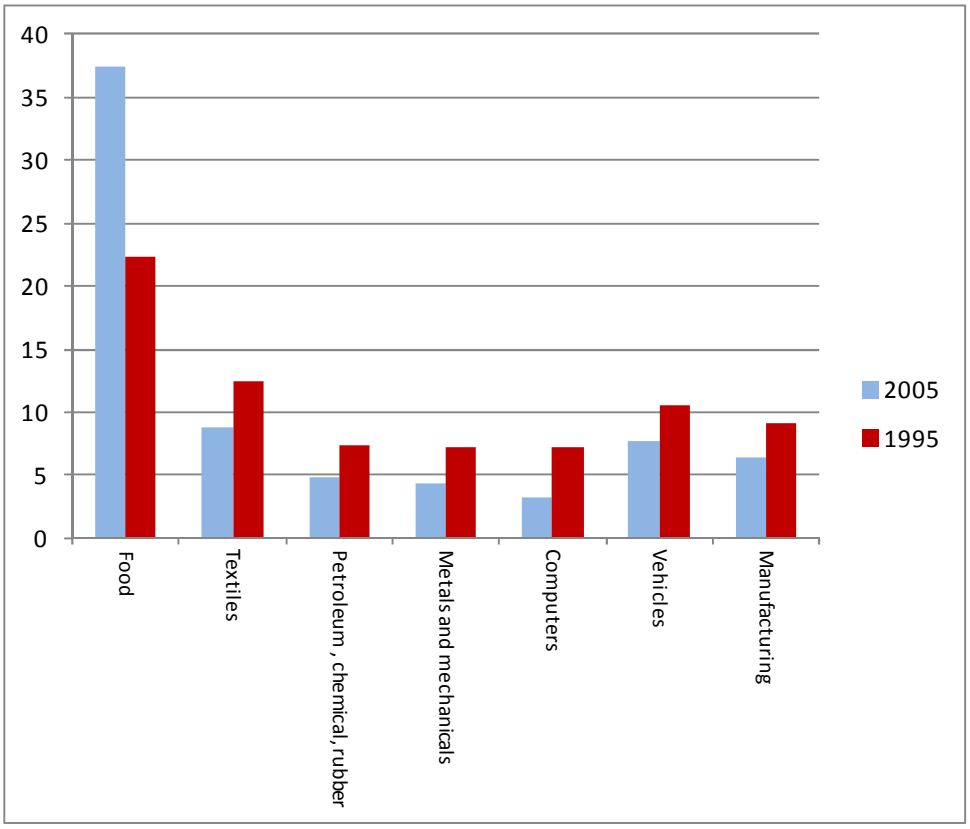
Source: authors' computations on Eurostat data.

Figure 3: The stock of outward FDI by industries and partner countries (2005)



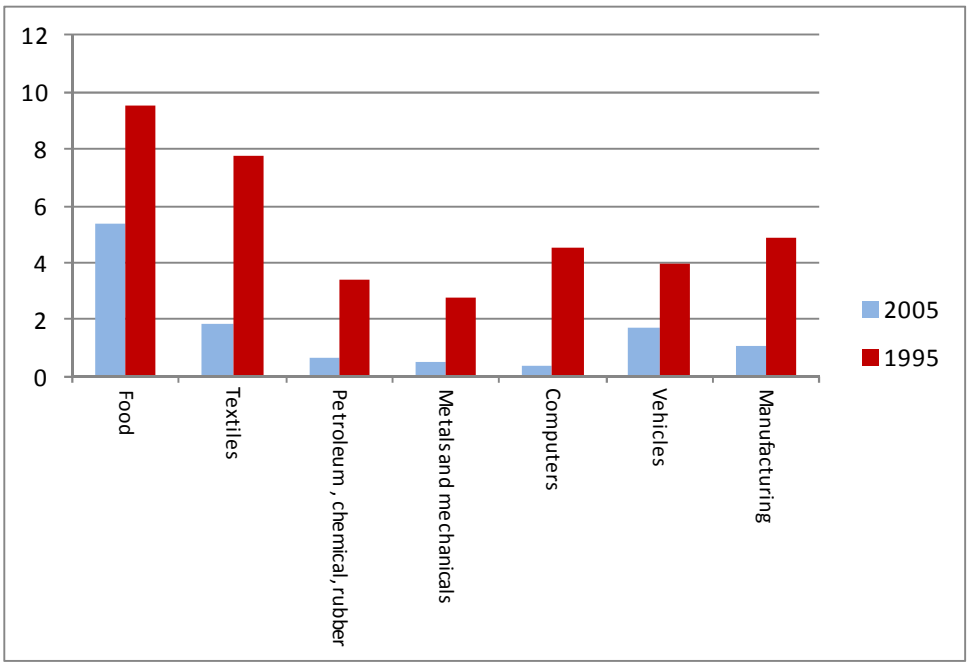
Source: authors' computations on Eurostat data

Figure 4: Average tariffs applied by host countries to EU products



Source: authors' computations on WITS data, World Bank.

Figure 5: Average tariffs applied by EU to host countries products



SOURCE: AUTHORS' COMPUTATIONS ON WITS DATA, WORLD BANK.

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