Export Level, Diversification and Foreign Direct Investments

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Abstract

This master thesis attempts to investigate the consequences of bilateral inward FDI on the domestic export level and export diversification using an extensive panel sample of 80 countries for the period 2001-2012. Employing models that include the level of technology in the host and in the partner country and the degree of economic integration, the empirical analysis concludes that inward FDI has generally a positive effect on the domestic exports and export diversification. However, this effect decreases when the domestic country is R&D intensive and partners operate under restricted trade barriers. The empirical work also examines the FDI impact in country pairs distinguished by their income level. The results conclude that inward FDI effect on exports is maximized in middle-middle income groups while middle-high groups benefit the most from inward FDI in terms of export diversification. Another part of the analysis tests for the effect of inward FDI when the technological gap is considered and suggests a U-shape relation between FDI impact and export level and a linear connection between FDI impact and export diversification. The analysis of export diversification extends further to industrial sectors, where the results reveal that spillovers are larger in innovative sectors and lower in low-skilled sectors.

JEL Classification: F11, F12, F14, F21, O31, O50

Keywords: Exports, Export diversification, Foreign Direct Investments, Gravity model, Technology, World Economy.

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1.INTRODUCTION

"In 1985, a national linkage programme established by the Irish government had a target to raise the raw material components and services sourced by the local manufacturing industry. Since then a large number of Irish companies have been upgraded, expanded outside of their borders gaining new export markets and become suppliers to TNCs such as IBM, Apple, and Dell (UNCTAD, 2006, pp. 6-7). *Ten years later, the Malaysian government introduced a linkage industrial plan to link local small-medium enterprises (SMEs) to foreign-owned firms in order to promote value-added activities in the agriculture sectors. Once again, the results were positive as in 2009 Tesco company's records showed that 70% of its food suppliers were Malaysian firms. Moreover, Tesco has guided Malaysian SMEs to meet global standards by improving the quality of their products and helped them to broaden their markets into Europe and USA* (UNCTAD, 2011, pp. 25-27)*".*

Attracting foreign direct investments (FDI) is a key element of governments' policies to create business opportunities for the indigenous firms and to stimulate economic growth. Not only is a stable source of capital compared to other capital flows but it is also proven that multinationals have the ability to contribute additively to the performance of the local entrepreneurs by transferring advanced technologies and valuable knowledge not available in the recipient country. The potential implications that can arise from inward FDI have induced researchers to investigate the effects of these investments deeper since benefits are not granted but occur under some conditions. Real examples of Malaysia and Ireland mentioned above justify that, regardless whether a country is a high-income or low-income country, desirable outcomes may occur if appropriate measures are taken – with different weights and volumes for each case – to prepare an appealing environment for foreign investments. The Malaysian government succeeded to drive the FDI inflows-to-GDP ratio from 21% to 60% after spending a substantial amount to improve infrastructure, organize skills development programmes and relax restrictions in credit and trade markets. Likewise, Ireland become one of the most high-value FDI attracting destination, a fact that smoothed the harmful consequences of the recent recession (*The Economist*, 2014). That would not result if the Irish government did not provide both tax and non-tax incentive packages for foreign investors such as a lower corporation tax, interest subsidies, well-educated workforce and R&D acquisition targeting specifically advanced sectors (Delloite, 2013, pp. 20-22).

However, the goal of this paper is to underline the role of inward FDI in the export activities of the domestic firms, which is still under debate. The question concerns whether foreign investors are capable to influence the level of domestic exports and more importantly whether their actions induce local firms to diversify their export basket in terms of products. Directly, multinationals can increase the export capacity of the host country by setting an export platform to serve third markets (Kokko, Zejan & Tansini, 2001), while operating in a non-traditional industrial sector would lead to export diversification (Banga, 2006). In addition, multinationals using their international business connections and providing local firms with assets they lack may help them to connect with clients abroad (Zhang & Song ,2001). The indirect effect refers to the fact that foreign firms' performance can increase competition in the domestic market and motivate indigenous firms to search for more efficient production techniques which

consequently will improve their export profile (Kneller & Pisu, 2007). Furthermore, infrastructure and services set by multinationals may facilitate local entrepreneurs to reach outside markets while collaboration with their foreign counterparts is likely to enhance their managerial and technical skills and thus upgrade the quality of their export products. On the other hand, competition from foreigners may harm domestic firms if foreigners dominate in the domestic market stealing market share from the locals and/or cause an increase in factor prices (Aitken & Harrison, 1999). The available evidence though seems to point out that the magnitude of the FDI impact depends on the technological gap between the exporter and the importer.

The motivation to capture the export impact of inward FDI comes from the obvious advantages that trade offers to an economy. Export growth is vital for any economy as firms can expand their sales abroad and gain market power in other countries raising simultaneously the level of their national product. What is more, revenues from products sold abroad can generate foreign exchange earnings, cover the cost of imports and reduce unemployment in the home country. However, an argument claimed by Prebisch (1950) and Singer (1950) supports that an economy might face deteriorating terms of trade and income volatility if exports are concentrated in a limited range of products because of the risk of export instability. In contrast, a theory by David Ricardo reports that countries should export the goods in which they have a comparative advantage.

The last two decades the level of world merchandise exports followed a remarkable upward path increasing to 18.3 trillion dollars by the end of 2013 with a sudden drop during the period of the recent economic crisis (WTO, 2014, p. 24).Conversely, export diversity had decreased. For the same period, the global amount of FDI inflows had also soared reaching 1.23 trillion dollars in 2014 (UNCTAD, 2015,p.2). Hence, it is noteworthy to investigate the complementarity between inward FDI and the amount of exports along with the effect of inward FDI on export diversification.

Utilizing a dataset consisted of 80 countries for the period 2001-2012 this thesis attempts to estimate the above relationships using the latest bilateral inward FDI stock statistics from UNCTAD. Firstly, real inward FDI stock is embodied in a gravity trade model that contains the technological level of the host and the origin country to explain the variation in the real amount of exports. Afterwards, a similar model is introduced to describe the bilateral export diversification in general and in several industrial sectors. Finally, the impact of inward FDI in both equations is tested when the exporter and the importer differ in technologies.

The remainder of the paper is structured as follows. Section 2 provides an overview of the trends in foreign investments and export markets for the last two decades. Section 3 covers the theoretical background that supports the hypotheses made. Section 4 develops the methodology applied to deal with the research questions. Section 5 gives a description of the data used. Section 6 mentions possible econometric issues and solutions to avoid bias results. Section 7 presents the outcomes from the regressions and finally section 8 ends to conclusions.

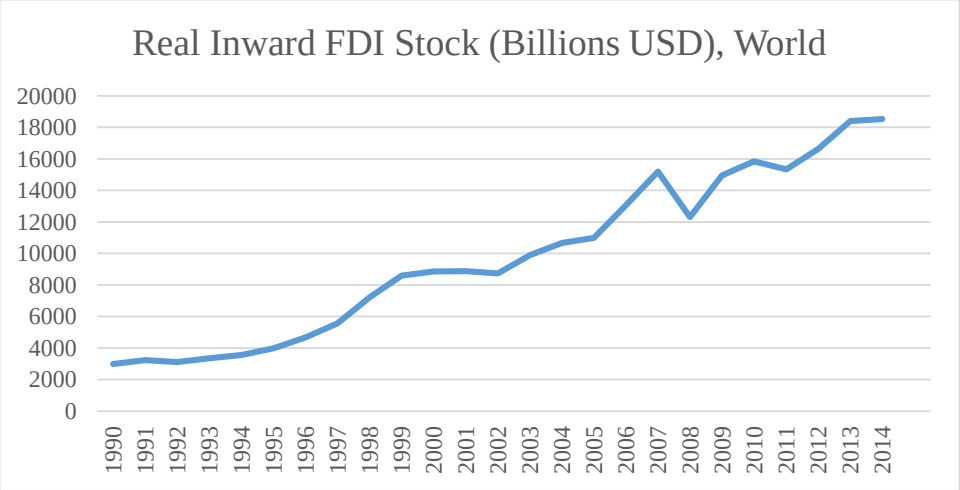
2. TRENDS IN INWARD FDI AND EXPORTS

2.1 Trends in Inward FDI

According to the Balance of Payments Manual: Fifth edition (BPM5) (IMF, 1993), Foreign Direct Investments are defined as a form of cross-border investments that include equity capital, reinvested earnings and intra-company loans between parent and affiliate enterprises. This relationship has a degree of influence over the foreign direct enterprise[1] involved if the direct investor owns 10% or more of the voting stock or shares of this company. In the early 1990s FDI flows have risen dramatically for three main reasons. Firstly, technological improvements in communication, transportation, and information processing have sped the transactions. Secondly, due to changes in patterns of international competition, capital flows between developed countries have been liberalized and integration in Europe has moved forward. Thirdly, developing countries have broken barriers that restricted FDI inflows to their countries and today they continue forming regulations to encourage investments from abroad (Fontagné, 1999, p. 9). Then after the recession between 1998-2003, where FDI flows slowed down, foreign investments elevated again. This time higher commodity prices attracted FDI in countries that are rich in natural resources, lower interest rates and corporate income taxes expanded mergers and acquisitions (M&A) in developed countries and investment agreements with Asian countries facilitated FDI flows between the members (UNCTAD, 2007, pp.3-7).

The recent "*World Investment report*" of UNCTAD (2015, pp.2-4), informs that global FDI inflows have more than tripled since the early 1990s to a record of 1.23 trillion dollars in 2014. In Figure 2.1, it is also obvious that escalations in FDI inflows have led to an even greater inflation-adjusted amount of inward FDI stock that amounted to 1.85 trillion dollars by the end of 2014. However, the current amount of inward FDI inflows is 16% lower than in 2013 because of the fragility of the global economy, the uncertainty in the Eurozone, and the geopolitical risks. Also, the number remained 30% below the pre-crisis level of 2007.

Figure 2.1

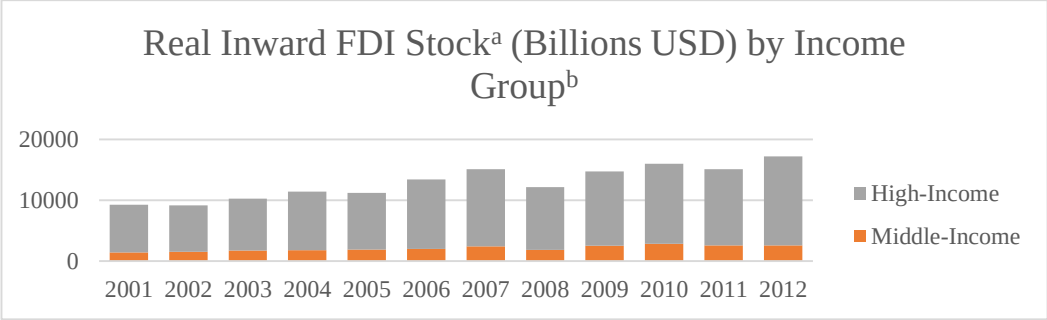


Note: World Inward FDI Stock is deflated by GDP deflator (Base year 2005).
Source: Author, UNCTAD Statistics, Foreign Direct Investment.

[1] Foreign Direct enterprise is defined as a resident institution that has 10% of its voting power held by a non-resident direct investor (IMF, 2015).

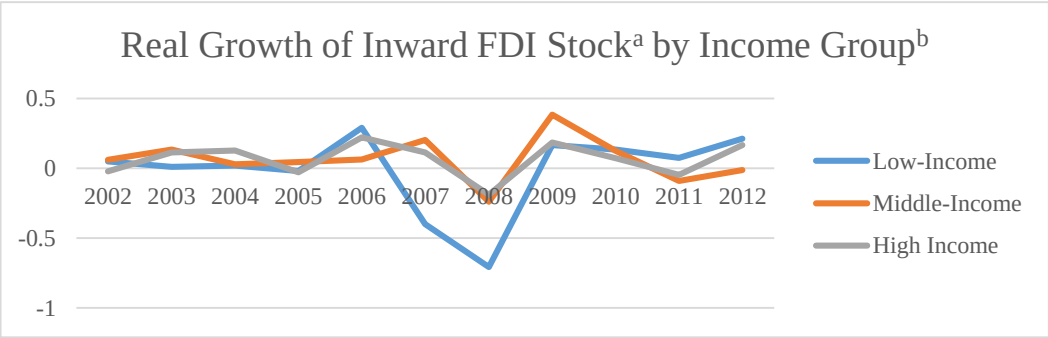
From Figure 2.2, it is clear that during the period of investigation 2001-2012, high-income economies were the major hosts of foreign stock with a share exceeding 80%. Middle-Income economies were the second best destination (15%) while low-income countries (not shown in the Figure because of values lower than 100) during these years accumulated a minor size of inward FDI and lost 78% of their initial value by 2012 (0.23%). The proportions of high and middle-income countries remained stable. Conversely, inward FDI growth rates in Figure 2.3 prove that developing economies except their plummeted rates in the years 2007-2009 witnessed the highest growth numbers in years before 2007 and after 2010. Furthermore, from Figure 2.4, seems that a substantial part of those transactions moved from high to high-income countries and from middle to high-income countries. In contrast, inward FDI rates from and towards low-income regions, that are absent in Figure 2.4, did not shift beyond 1%.[2]

Figure 2.2



Notes: [a] *Inward FDI Stock is deflated by GDP deflator (base year 2005).*
[b] *Income groups are determined by the GNI per capita thresholds, where GNI per capita is calculated based on the Atlas method suggested by World Bank.*
Source: Author, UNCTAD Statistics, Foreign Direct Investments.

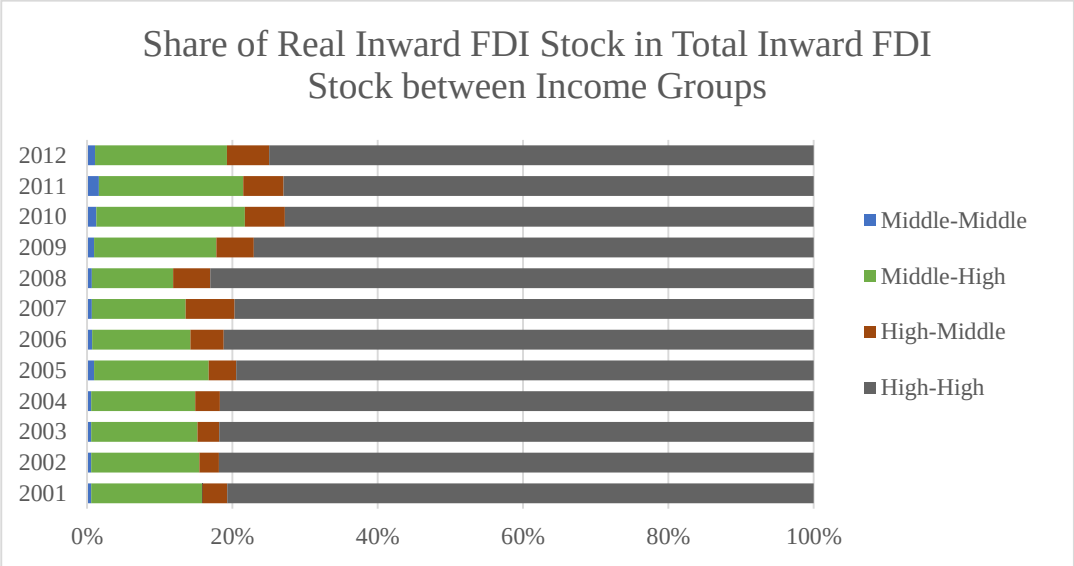
Figure 2.3



Notes: [a] *Inward FDI Stock is deflated by GDP deflator (base year 2005).*
[b] *Income groups are determined by GNI per capita thresholds, where GNI per capita is calculated based on the Atlas method suggested by World Bank*
Source: Author, UNCTAD Statistics, Foreign Direct Investment.

[2] Income groups are classified based on the Atlas method developed by World Bank. World Bank divides countries in four income groups using GNI per capita; Low, Lower-Middle, Upper-Middle and High-income countries. Atlas method converts GNI for each country to US dollars and adjusts for inflation by using the ratio of local difference in GDP deflator over the weighted difference in GDP deflators of Japan, the United Kingdom, the United States and the euro area. To generalize countries into three groups, lower-middle and upper-middle countries are considered as middle-income countries in this paper.

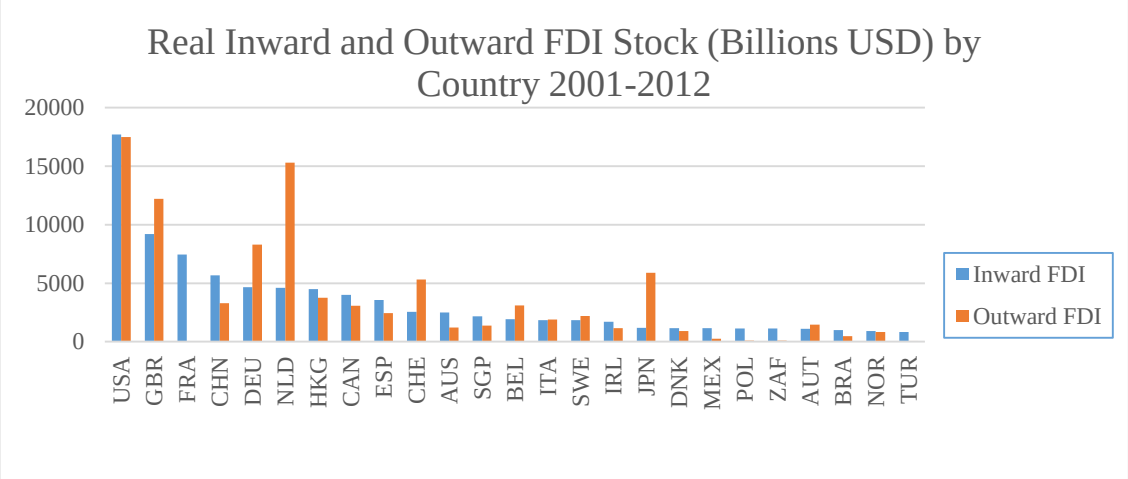
Figure 2.4



Notes: [a] Inward FDI Stock is deflated by the GDP deflator (base year 2005).
[b] Income groups are determined by the GNI per capita thresholds, where GNI per capita is calculated based on the Atlas method suggested by World Bank.
Source: Author, UNCTAD'S Bilateral FDI statistics report 2014.

The question that now arises is which countries are more attractive to foreign investors and which industries do they choose to settle. Figure 2.5 shows that among all countries during the given timeline United States deviated significantly hosting the largest amount of Inward FDI that reached a value of approximately 17.7 trillion dollars. United Kingdom, France, and China followed with less than 10 trillion dollars each. In the same graph, United States outperformed

Figure 2.5



Notes: Inward and Outward FDI Stock are accumulated over the given years and deflated by the GDP deflator (base year 2005).
Source: Author, UNCTAD's Bilateral FDI Statistics report 2014.

as a source of foreign investments while the Netherlands ranked second as the most frequent foreign partner.

Focusing now on the industries that welcome FDI flows, foreign entrepreneurs choose to invest mostly in service sectors. In the period, 2002-2012 service industry participation increased to 63% while manufacturing share reduced from 41% to 26% and the share of the primary sectors remained steady at 7%. One reason given by UNCTAD (2015, pp.12-13) could be the increasing liberalization in service sectors such as financial services and telecommunications that assisted the operation of foreign companies.

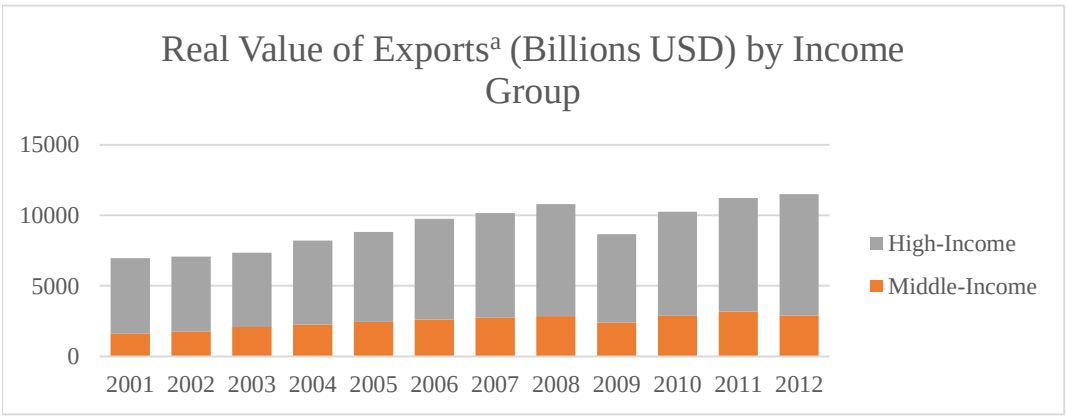
2.2 Trends in Export Markets

The invention of World Wide Web by Tim Berners-Lee (1989), the establishment of bilateral and regional trade agreements (NAFTA-1994, WTO-1995, etc.), the adoption of Euro (1999) and the enlargement of European Union were some of the determinants that not only drove to FDI expansion but also accelerated the growth of Exports in the 1990s (WTO, 2008, pp. 20-22). World exports represented by the sales of goods rather than services abroad, have responded to these facts reaching a level of 14 trillion dollars in real terms in 2013. Approximately a triple increase in two decades as Figure 2.6 shows. After the sudden but deep fall in 2009, exports of goods and services did not take long to recover as they started growing furiously again the next year. However, the growth rates recorded in the past two years were weaker because of the debt crisis in the European Union, the high unemployment and the uncertainty in the euro areas as well as the risks generated by the civil conflicts in the Middle East, Asia and Eastern Europe (UNCTAD/TDR, 2014, pp. 1-8) Figure 2.7 indicates that once again high-income economies were the best performers with their value of goods exported threefold a value of exports from middle and low-income countries (not shown because values are less than 100) during the period 2001-2012. Particularly export proportions for each group were found around 70%, 20%, and 1% respectively. Yet, export growth rates of high and middle economies in Figure 2.8 fluctuated moderately while low economies experienced a larger volatility in their export growth rates especially from the period 2006 and onward, where deep negative export growths were realised reaching a maximum level of 67% in 2008 and again a percentage of 57% in 2012. At the same time, export flows occurred more intensively between high-income countries (Figure 2.9). Economies in the top-levels were the United States, Germany, and China with the United States and Germany outranking exceedingly their counterparts (Figure 2.10).

Figure 2.6

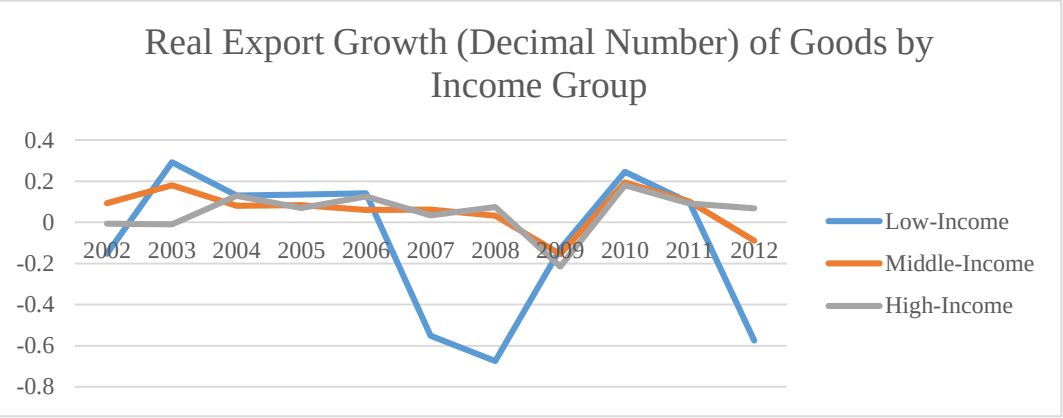
Notes: Nominal values of global exports are deflated by the GDP deflator (base year 2005).
Source: Author, UNCTAD Statistics, Economic Trends.

Figure 2.7



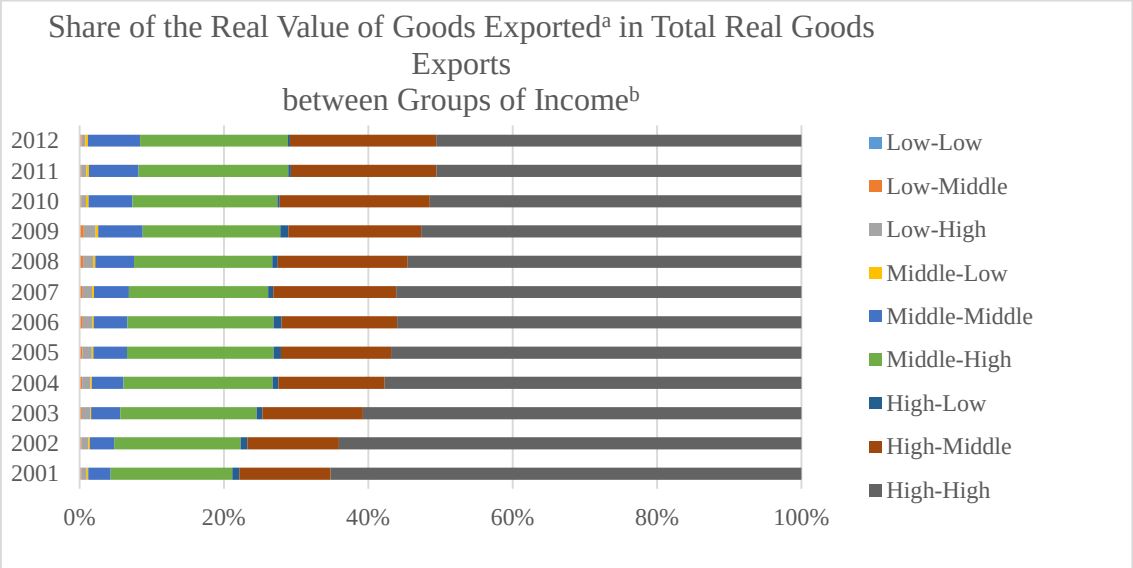
Notes: [a] *Values of exports are deflated by the GDP deflator (base year 2005).*
[b] *Income groups are determined by the GNI per capita thresholds, where GNI per capita is calculated based on the Atlas method suggested by World Bank.*
Source: Author, UNCTAD Statistics, Economic Trends.

Figure 2.8



Notes: Export Values are deflated by the GDP deflator (base year 2005).
Source: Author, UNCTAD Statistics, Economic Trends.

Figure 2.9



Notes: [a] Values of exports are deflated by the GDP deflator (base year 2005).
[b] Income groups are determined by the GNI per capita thresholds, where GNI per capita is calculated based on the Atlas method suggested by World Bank
Source: Author, UNCOMTRADE Database.

Figure 2.10

Notes: Export values are accumulated over the given years and deflated by the GDP deflator
Source: Author, UNCTAD Statistics, Economic Trends.

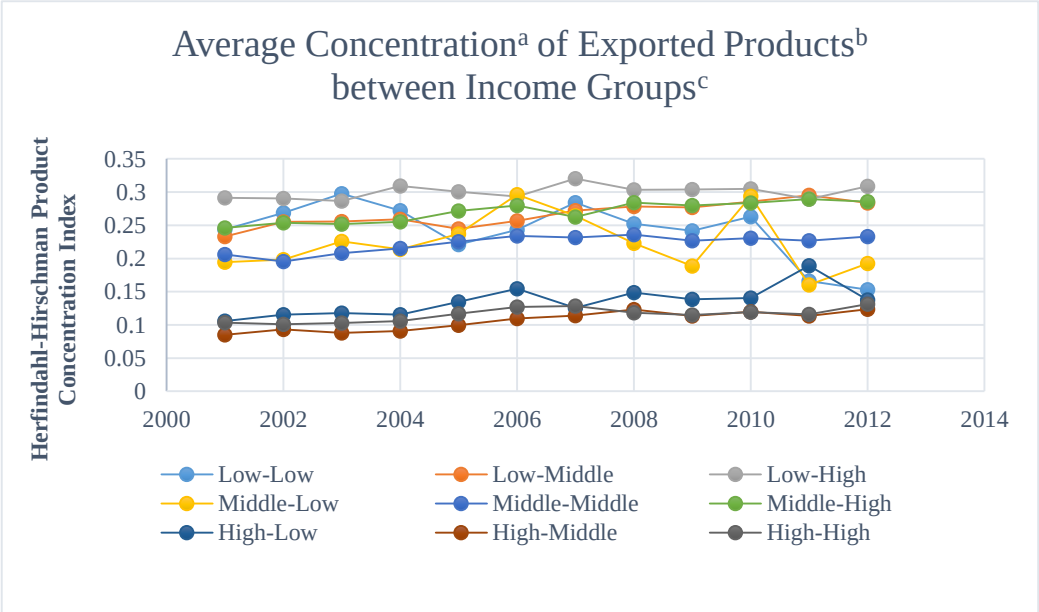
High-income countries have the economic power to invest more in technology and human capital, an ability that gives them the comparative advantage to produce products that are more sophisticated at lower marginal cost and hence magnetize foreign demand for those goods. On the other hand, low-income countries rely more on what nature can provide to them since they lack financial resources and education. Therefore, it is not surprising that developed regions remain dominant suppliers of vehicle products (75%), chemicals (70%,), and machinery (65%). While energy products (80%), apparel (65%) and textiles (60%) are predominantly sourced from developing countries. However, it is important to mention that nowadays exporters in high-income countries experience a downward trend in the agricultural and manufacturing industries (UNCTAD, 2014, pp. 10-13).

Another crucial aspect regarding export markets refers to the governments' strategy to dissuade volatility in export earnings, which may cause economic growth slowdowns. A possible scheme to mitigate the degree of exposure to external shocks is the adjustment of the export basket. That is, governments can change the mix of exports in terms of products or destinations to smooth losses in export revenues (UNDP, 2014, pp. 25-27). Notwithstanding, the latest published statistics show that as of 2008 the export concentration rate of developing countries increased by 68% from 0.09 to 0.15 in the period 1995-2008, compared to a 14% rise in developed ones. In Figure 2.11, the export concentration numbers generated by the Herfindahl-Hirschman index from 2001-2012 reveal that high-income countries exported a more diversified bundle than middle and low economies. However, they sold a greater variety of products to middle partners than to high and low partners which could be an evidence that exporters not only are seeking large markets to serve but they also choose places were the type of their products is not experienced. Also, it can be noticed that the average product bundle sold from middle to low countries followed a more volatile path than other income groups. From countries 'ranking in Figure 2.12, it is apparent that Germany was the most export-

diversified country with an index just above 0.02. The next two places were taken by China and the United Kingdom respectively.

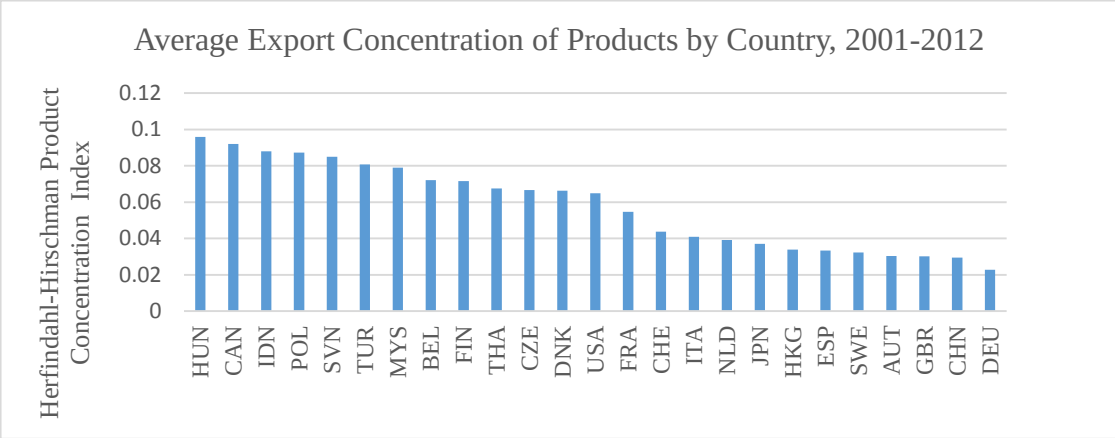
Although accelerating exports are translated as a sign of economic growth, exports do not add a meaningful value to the economy when they are heavily composed by imported intermediates. Still, firms decide to order intermediate products from foreign markets to minimize their cost of production, as the availability of the input in the country of operation is limited or non-existent. Besides that, firms prefer to use inputs with high quality to produce long-lasting products. OECD Statistics displayed in Figure 2.13 compare the percentage of the import content of exports over total exports for several countries for the years 2000 and 2009. The records show that usually small countries such as Luxembourg, Singapore, Philippines, and Malaysia – that have a lower variety of locally sourced inputs – are those who rely mostly on foreign intermediate goods.

Figure 2.11



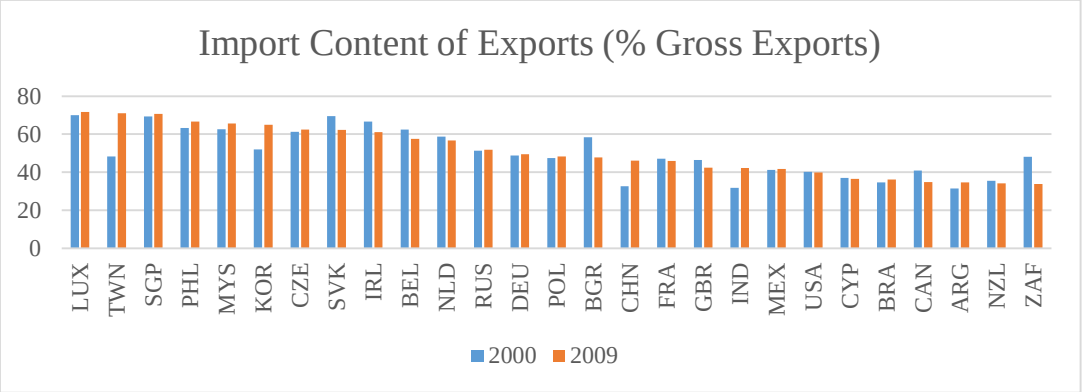
Notes: [a]Export concentration rate is measured by the Herfindahl-Hirschman Product concentration index, which gives higher values (0,1) to more concentrated export baskets.
The index is the normalized summation of the export shares of k products in total exports.
[b] Harmonized Classification of 6-digid k products, k € [1, 4.426]
[c] Income groups are determined by the GNI per capita thresholds, where GNI per capita is calculated based on the Atlas method suggested by World Bank.
Source: Author, World Integrated Trade Statistics(WITS), Trade Indicators.

Figure 2.12



Notes: Higher values of the Index (0,1) represent more concentrated export baskets
Source. World Integrated Trade Statistics (WITS), Trade Indicators.

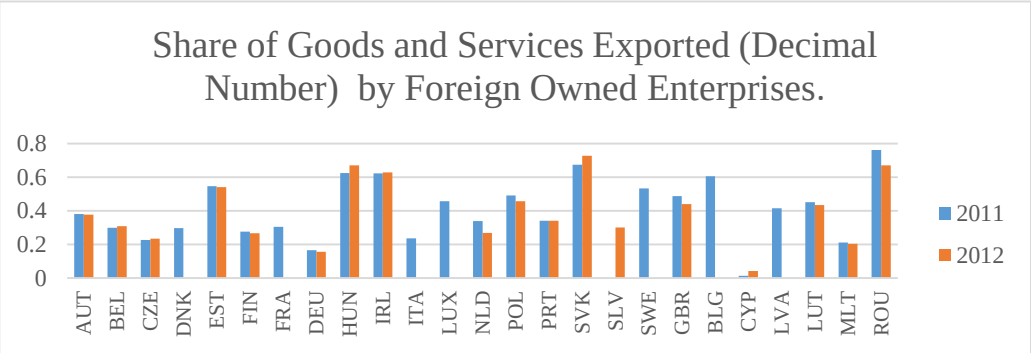
Figure 2.13



Notes: The percentage measures the share of Imported inputs used in the production of exported goods and the share of exported inputs used for the production of exports of other countries. Therefore, double entry is possible
Source: Author, OECD Statistics: International Trade Indicators.

What is more, domestic exports are not generated only by local enterprises but in some countries a high proportion of goods exported belongs to foreign affiliates who supply their parent companies with intermediate or final goods or they operate as export platforms serving third countries. Looking at Figure 2.14, which shows the share of exports generated by foreign firms in 25 European countries for the years 2011 and 2012, we can notice that the majority of those areas owned a percentage higher than 30%. Also, it seems that export activities in Hungary, Ireland, Slovakia, Bulgaria, and Romania are mainly undertaken by multinationals since the share of foreign exports exceeds 50%.

Figure 2.14



Notes: The value of exports for the European countries is defined as the total export value of both intra-EU and extra-EU zone trade.
Source: Author, OECD Statistics, Trade by enterprise characteristics by ownership, SICS revision 4.

3. THEORETICAL FRAMEWORK

Every nation struggles to promote its products and become an antagonistic player in the global market. The reason behind this behaviour is that a continuous expansion in exports leads to a straightforward increase in GDP. Other reasons come from the expectation of higher employment, larger revenues that would allow the purchase of more technological intermediate goods, greater economies of scale and less binding foreign exchange constraints (Balassa, 1978; Helpman & Krugman, 1986; Afxentiou & Serletis, 1992). Although all economies have a strategical plan to improve their trade image, the difference between them can be noticed in the composition of their exports. Some countries have a concentrated export basket while others decide to have a more diversified bundle (Aghion, Bloom, Blundell, Griffith, & Howitt, 2005). A theory by David Ricardo explains that efficiency will not take place if countries produce and trade all available products in the market. Instead, the Ricardian model recommends that countries should specialize and export the goods in which they have a comparative advantage and import the remaining ones. Therefore, following this model each country should produce and export what it can do best. Conversely, Prebisch (1950) and Singer (1950) have questioned the Ricardian perspective by drawing attention to economies who dependent on raw materials' production. From their point of view, reliance on a narrower range of primary products –which is commonly observed in developing countries –will deteriorate terms of trade, increase income volatility and slow down economic growth. The interpretation of their statement is based on the features of the natural resources relative to that of the manufacturing goods. It is well known that the former is relatively characterised by minor rates of technological progress, declining world prices in the long run and low-income elasticity (Harvey, Kellard, Madsen & Wohar, 2010). Thus, as income rise, countries heavily relying on primary goods will experience lower export revenues and high import costs. What the two authors but also Herzer and Lehmann (2006), Ferreira (2009) and Haddad, Lim, Pancaro and Saborowski (2013) suggest in order to mitigate idiosyncratic shocks and foster economic growth is to diversify the export portfolio by expanding the production sectors and/or destination markets. That can take place through extensive and intensive margins, where

extensive margins depict the exportation of new products to old destinations and/or the trade of new(old) products to new destinations while improvement in intensive margins is defined as a rise in the shares of existing products.

Policymakers are aware and care about the advantages that a diversified export basket may bring to an economy. Tariff reductions, preferable trade agreements, and less severe credit constraints are mutual measures between nations and are basically applied to minimize the trade cost and inspire the development of new products. Nevertheless, their impact is weak and vanishes after a short period of time when the tariffs approach the minimal level (Martincus & Gomez, 2010). Other principal factors are found to be the investment in human capital, R&D expenditures, and infrastructure formation. Even if countries join a highly liberalized trade markets, the production and likewise the exportation of new-born products will not occur without appropriate infrastructure and educated labour. Results from Agosin, Alvarez and Bravo-Ortega. (2012) reveal that export diversification is strongly and positively correlated with human capital accumulation. The increasing presence of qualified workers –with a relatively cheaper price –will permit countries to experiment and introduce goods that did not exist before changing their specialization patterns.

To amplify the education level and promote innovation, governments offer traineeships, subsidies, and protection of intellectual property rights. Special attention, though, has been directed to the attraction of foreign investments as findings from research works emphasize and forward the advantageous characteristics that are passed from foreign investors to the host economy. Not only they are risk-free to the recipient country, but also they are complementary to domestic properties and activities since they make available assets and knowledge that previously were missing. Due to their beneficial contribution and innovative behaviour, economists suspect that, apart from indigenous markets, FDI inflows can affect the indigenous export commodities and operations as well. The following paragraphs describe the direct and indirect channels through which multinationals can adjust the domestic export potentials.

3.1 Direct Effect

The presence of multinational enterprises abroad can influence directly the export intensity of the host economy. This is perceived when foreign affiliates export products themselves either from the traditional markets or from the non-traditional markets, where in the latter case multinationals not only increase the export transactions but they also cause a change in the export structure of the country[3].In addition, export diversification is likely to emerge if multinationals export new and more sophisticated products. According to Helleiner (1973), foreign export activities are divided into three possible groups based on production characteristics: (1) Processing of Raw Materials; (2) Exports of final labour intensive products and conversion of import-substituting industry to exporting and (3) Component processing within vertically integrated international industries.

[3] Harding and Javorcik (2011) report that export specialization can occur if foreign firms export goods that are already exported intensively by indigenous firms.

In the first group, the processing of raw materials, which is mostly observed in developing countries, is usually taken over by multinationals. Local companies in the poorest countries are lacking the superior technology and knowledge to modify natural resources and engage in international trade. Thus, allowing foreign firms who have a broader experience with trade activities and the appropriate means to develop the potential market, they can improve their participation in the global markets and benefit from higher export revenues.

Multinationals can also introduce new final labour-intensive goods in places where the distribution of a business network is an expensive matter. In contrast to domestic firms, foreigners have the technical skills to estimate consumers' preferences, create an attractive image for the upcoming new product and deal with price volatilities. Moreover, their financial ability permits them to meet safety standards while their vast list of business contacts worldwide can facilitate the negotiation agreements with prospective exporters. For that reason, many governments, particularly emerging and developing economies, who apply the import-substitution industrialization policy in their effort to protect domestic companies encourage inward FDI in order to expand exporting activities in a short period of time.

Vertical FDI by definition is achieved through export transactions that flow from host facilities to home production plants. There is a widely shared view that the difference in factor intensities between countries induce foreigners to geographically fragment the production stages particularly to take advantage of a cheaper efficient labour or/and to have a better access to raw materials (Kumar, 1998). In this case multinationals manufacture intermediate goods in a country different than origin and then export them back home or to a third- country production base for further assembly or to finalise the production process. This action which is known as an intrafirm trade but can also be an arm's length transaction between local companies in the host country and multinationals contributes positively to the amount of host exports (Zhang & Song, 2001).

Another export-oriented activity comes from the export-platform establishments that foreign investors place in specific areas to approach particularly third economies outside the recipient market. Unlike the vertically integrated strategy mentioned above, Kumar (1998) states that third-country oriented production is not highly determined by factor cost saving. Instead, the location of the platforms is positively related to the quality of infrastructure and the trade liberalization and inversely related to the size of the host market. This is explained by the multinationals' target to specialize in a specific product line and access a large market territory. For instance, the Japanese vehicle manufacturer Toyota in order to entry the European markets and avoid trade costs has transferred its manufacturing and R&D operations in European countries where it mostly builds and sells its models *Auris Hybrid*(UK) *Avensis*(UK), *Yaris*(France) and *Aygo* (Czech Republic). Ekholm, Forslid and Markusen (2007) also highlighted the importance of regional integration in the setting of third-country export-platforms. They found that in a model of three countries, where two of them are located in a free trade area and the other is out of the area, the insiders will engage in home or global export platform while the outsider will select the third-country platform. Moreover, he maintained that this strategy is less harmful to the host economy since foreigners do not purpose to serve

the domestic market while he supported that small countries such as Ireland, Belgium, and Holland are ideal places in attracting this type of investments.

3.2 Indirect Effect

It is said that what governments are principally expecting from inviting foreign entrepreneurs to settle in their country is the activation of the indirect effect, which is likely to sustain long-term economic growth (Colen, Maertens & Swinnen, 2008)[4]. Carrying profitable assets that indigenous firms do not possess or are less endowed in terms of availability, multinationals have the power to create channels through which positive or negative externalities transmit to the locals. Blomström and Kokko (1998) have categorized these channels into four groups: the competition effect, the foreign linkage effect, the demonstration-imitation effect and the training effect. After the dissemination, local firms are more prepared to enter or to ameliorate their participation in international markets, which may imply a higher amount of exports and/or a diversified export bundle in terms of partners or products. The following paragraphs analyse each of these categories and highlight their essential role in the domestic export sectors. In addition, a reference to the effect on domestic production cost is included as it is a crucial determinant of exports.

Competition effect

The entrance of foreign-owned firms in the domestic market may reinforce the competition in the target industry. Due to their ownership advantages, multinationals outperform their indigenous counterparts who are not involved in any trade activity as well as those who serve international markets. Thus, their presence in the recipient industry will likely decrease the survival prospects of the local firms. An investigation by Melitz (2003), who analysed the impact of international trade on heterogeneous firms' productivity and allocation in the industry in a setting of monopolistically competition, found that a stronger competition from exposure to open markets would force the least productive firms out of the market and raise the average productivity. By way of explanation, profitable firms will have a greater chance to live on while the most efficient among them will be able to export[5]. Therefore, from the one hand, multinationals' success to attract domestic, as well as outside consumers, might induce local firms to work harder, make a better use of their existing assets or even search for new and more advanced equipment (Blomström & Kokko, 1998). Similtaneously, they might change the market structure by dissolving monopolies (Aitken & Harrison, 1999)[6]. On the other hand, things can take a reverse turn if indigenous companies do not have the funds to invest in modern

[4] Based on neoclassical growth models where the technological advances are exogenous, an investment inflow by foreign firms will cause a short run economic growth unless the increase in the level of technology is permanent (Solow, 1956). In contrast, neoclassical growth models that consider endogenous technological improvements argue that FDI through its contribution to the development of new skills and ideas – permanent investment in technology – can lead to permanent growth in output.

[5] It is crucial to note that Melitz (2003) made an assumption of symmetric economies.

[6] Haller (2009) reports that greenfield investments enhance competition since they add production capacity to the industry in contrast to M&A that might lead to market concentration unless the acquired firms that otherwise would exit are restructured by multinationals.

technologies and foreigners target particularly domestic market crowding out a significant number of exporting indigenous firms. (Blomström & Kokko, 1998; Markusen & Venables, 1999; Barrios, Görg & Strobl, 2005; Kutan & Vukšic, 2007). Specifically, negative effects can persist in case the domestic exports are not substituted by foreign exports. Ayyagari and Kosová (2010) examined the impact of inward FDI on the exit rates of Czech firms and concluded that in the short-run exit rate is higher than in the long run where the Czech firms benefit from foreign presence. Furthermore, evidence from Hong Kong, Macau, Taiwan (Anwar & Sun, 2012) and Germany (Franco & Gelübcke, 2014) showed a positive effect on exit rates.

Demonstration- Imitation Effect

The demonstration effect of Inward FDI is defined as the ability of local firms to adopt the new production methods and knowledge that multinationals have brought with them. Even though foreign-owned companies take strict measures to internalise their intangible assets such as marketing skills, innovative products, R&D etc. still they cannot completely protect them from being spilled over to their domestic counterparts without a price as these assets are characterized public goods. Instead, domestic firms are those who benefit from the knowledge diffusion as they can save the sunk cost of the investment they would have to make in order to update or build from the ground up a new production line. Usually, materializing or even coming along with an unprecedented idea is a long time process that in the early stage needs initial capital and intensive research. Except that the future outcomes of the project are far from unknown which makes the decision to proceed with the plan even riskier. But if multinationals establish a network of operations and utilize their superior assets in the country of interest then indigenous firms can decrease uncertainty and expand their creative thinking by imitating and observing foreign actions. As a result, local companies can differentiate their exporting commodities and/or start producing new attractive goods that after a period of gaining fame and profitability would be ready for international sales (Cheung & Lin, 2004; Görg & Greenaway, 2004). Nonetheless, the insufficient absorptive capacity in the host country and the technological gap between the associated economies may prevent the leakage of know-how processes through the channel of imitation effect. Crescenzi, Gagliardi and Iammarino (2015), Karpaty and Kneller (2010) and Hamida and Gogler (2009) examined for United Kingdom, Sweden, and Switzerland respectively and concluded that internationalized domestic firms have higher potentials to gain from imitation together with high-technological and R&D intensive locals as they are more capable of exploiting advanced technologies.

Foreign- Linkage Effect

A plenty number of studies have concentrated their attention on the business linkages that domestic firms may have with foreign companies highlighting the importance of these relationships for information externalities. Despite the fact that multinationals are remarkably attentive to prevent their competitive advantages from spreading to domestic rivals, they have no incentive to apply their protective requirements when the latter supplies them with

intermediate inputs (backward linkage) or demands components to continue the production process (forward linkage) since they may reap benefits from the improved performance of local firms. According to Javorcik (2004) the knowledge spillovers from backward linkages are generated when multinationals share their technical skills with domestic suppliers, ask them to apply higher industrial standards and provide modern production facilities in order to ensure the quality and the on-time delivery of the inputs. Furthermore, local managers may optimize their strategic objectives by learning effective organizational and management practises from multinationals as well as expand their customer list if their foreign partners introduce them to other clients located abroad and give details about the market conditions in the country of origin and other inexperienced areas decreasing their sunk cost. Regarding the forward relations, the indigenous downstream producers may have access to low-priced materials that will reduce their production costs[7]. But apart from that, they may also upgrade their final goods and gain competitiveness in both home and international markets as foreign provisions are more sophisticated and long-lasting (Alfaro & Rodriguez, 2004). Kneller & Pisu (2007) searched for export spillovers from vertically integrated (backward and forward spillovers) multinationals in the manufacturing sector in the UK and found that downstream export-oriented and domestic- market-oriented multinationals are sources of important information that help locals to learn about foreign markets. In contrast, negative export externalities were predicted for multinationals in the upstream industries[8]. A recent paper by Görg and Seric (2015) concluded that African firms' innovative activities are correlated with supplying foreign-owned firms. Notwithstanding, foreign clients may not be a positive influence if they take advantage of their bargaining power and ask only for lower prices without any support to local producers. Also disappointing results can appear if intermediate inputs produced in the host economy are different from what actually is needed and when they are not intensively used by multinationals (Alfaro & Rodriguez, 2004).

Training Effect

Another channel that contributes to the productivity of domestic firms and particularly to the trade activities of those firms arises from labour mobility. To be more precise, multinational-employed workers are believed to acquire valuable human capital that is transferred to indigenous companies when the mentioned employee decides to switch to a local enterprise or start a new business. Then the prior-multinational worker can continue using his/ her wide international experience to maximize this time the profits of the new local firm. Therefore, skills and knowledge are not only embodied in foreign assets but also in people working for foreign companies. What is more, multinational-employees do not accumulate knowledge solely through observing what others do but sometimes training offered by employers is necessary to help them conduct complex tasks. Sousa (2001) asserts that multinationals train more and better than domestic firms. Yet, not all worker categories are sources of export spillovers. Mion and Opromolla (2014) show that among all employees,

[7] Additionally, Javorcik (2004) proves that partially foreign-owned affiliates cause greater positive spillovers than wholly-owned foreign firms because they face different conditions to supply the host economy.
[8] Non statistical significant forward linkages are reported in the paper of Girma et al. (2008).

managers that were previously employed in a transnational company are those who are likely to develop export transactions in their current national job. Indeed, managers have marketing and commercial capabilities, which make them more qualified to negotiate and build business networks with overseas clients than others (Sala & Yalcin, 2014). Even though indigenous firms' productivity is positively affected when prior-multinational workers are hired, the effect does not hold if the employee moves to a different industry indicating that probably transnationals offer specific training. Hence, labour mobility and information leakage would be larger the more general is the training (Fosfuri, Motta & Rønde, 2001; Görg & Strobl, 2005).

Wage spillovers

Except workers' performance, FDI inflows have been discussed to affect labour costs in the recipient country. Since wages are a measure of international competitiveness and affect the volume of exports it is critical to pay attention to this issue (Decramer, Fuss & Konings., 2014)[9]. Firstly, an increase in domestic wages may be a result of higher labour productivity that is induced by transnationals. Based on labour economics' theory, in a perfectly competitive labour market, employees are compensated by the value of their marginal product. Therefore, it is expected that transnational firms may give a rise to wages through knowledge spillovers, training and advanced production equipment that increase workers' marginal output (Aitken, Harrison & Lipsey, 1996). Secondly, foreign entrants might increase the demand for high-skilled workers and attract them by offering larger salaries than domestic firms offer as they are more financially empowered[10]. Then local firms will have to respond by raising the level of remuneration in order to keep the best workers. Otherwise, they will be restricted to low-skilled workers. In this case, wage spillovers are absent and human capital in domestic firms is not affected (Muñoz-Bullón & Sánchez-Bueno, 2013). Aitken et.al (1996) searched for Mexico and Venezuela, and found no and negative evidence of wage spillovers. However, foreign ownership had a positive impact on average industry wage and specifically on high-quality workers. A negative result was also estimated by Barry, Görg and Strobl (2005) who supported that Irish exporters experienced a labour crowding-out effect in the period 1990-1998 due to foreign presence. Moreover, Axarloglou and Pournarakis (2007) suggest that industry characteristics should be taken into account as they found both positive and negative results but for different industries in the USA.

[9] Decramer et al. (2014) reports in the paper of European Central Bank negative statistical significant effect of labour costs on export performance. Higher wages decrease the probability of non-exporters to start exporting and increase the likelihood of exporters to stop exporting. However, the estimated impact is negligible.

[10] Lipsey (2004) also adds that foreign firms are not able to identify white-collar workers. Consequently, they provide high salaries. In contrast, local firms are more aware and thus are not obliged to raise their labour payments.

3.3 Hypotheses

The investigation around the export effect of inward FDI is an old matter, which has displayed an ambiguous picture so far depending whether the research is a country-level, industry-level, or a firm-level analysis.

Looking first at the empirical evidence regarding total exports, Aitken, Hanson and Harrison (1997) use a database consisting of Mexican manufacturing plants for the period 1986-1990 and prove that the aggregate number of exporters has no impact on Mexicans' decision to export. Rather, the paper expresses that multinationals' activities, which release information for foreign markets and technology, are those that assist domestic firms expanding their trade horizons. The authors also notice the importance of multinationals' country of origin. Sharma (2000) tested for the Indian Economy for the years 1970-1998 and conversely his expectations foreign capital did not have any significant influence on Indian exports. Export prices and the depreciation of rupee were the determinant factors for export growth in India in the given period. Using a larger number of country participants Kutan and Vukšic (2007) limit their research to twelve Central and Eastern European economies for the years 1996-2004. They separate the FDI effect into supply-capacity increasing effect and spillover effect, which later differentiates the outcomes. All observations in the sample show higher exports due to the increasing supply capacity effect of FDI. However, only the new European members benefit from FDI externalities. Positive results were also found in the paper of Mullen and Williams (2011) for the Canadian export market. Testing for the bilateral relationship between FDI inflows and exports, they conclude that foreign firms' operations in the host economy may create intra-firm trade and hence export growth. Another study based its research in the manufacturing industry of Chile and ended up to equivocal answers. A rise in foreign investments measured by foreign stock has worsened the export likelihood of Chilean entrepreneurs because of the increased competition. Yet, Chilean export decisions seemed to be positively affected when FDI variable was measured by employment, as multinationals may enhance the Chilean human capital (Duran & Ryan, 2013). Last but not least, Zhang (2014) chose to survey China's manufacturing sectors to examine whether foreign investors improved China's export competitiveness. The results for once again indicated that FDI through its learning role had enlarged the indigenous export volume. Nevertheless, the paper could only identify a slight upgrade in technology.

On the other hand, discussions about the export diversifying impact of inward FDI have not been brought to the table a long time ago, which implies a short literature review. Despite the scant background, most of the outcomes so far are optimistic and support the power of foreign investment to alter the composition of domestic exports. Even so, negative estimations are still present and doubt this relationship. A research work by Banga (2006), which is constantly reviewed by other authors, questions the influence of American and Japanese transnational firms on the export intensity of traditional and non-traditional Indian sectors using both firm-level and industry-level data. Since export diversification is clarified as an increase in the trade of new-born goods, the author expects to find positive observations in the non-traditional sectors. Indeed, both methodological choices report that transnationals have augmented the exports in the non-traditional industries. Nonetheless, the significance holds only for FDI from

USA, while investments from Japan did not seem to contribute to the production of new commodities. Banga believes that Japanese firms compared to American firms did not connect frequently with their Indian counterparts. Bebzcuk and Berrettoni (2006) could not identify any impact from foreign operations in the Argentinian economy as well. Among other variables, domestic characteristics such as infrastructure and private access to financial institutions were the key factors for the Argentinian export diversification. Harding and Javorcik (2011) test for Central and Eastern European countries and agree that inward FDI may mutate the export basket. Furthermore, evidence from Alemu (2009) regards the East Asian and sub-Saharan African countries and search for horizontal and vertical diversification[11]. He finally states that horizontal and vertical extensions were discovered in East Asian regions and only vertical in Africa because human capital elasticity and FDI inflows were higher in the former group than in the latter. A mix of developing and developed countries were analysed by Iwamoto and Nabeshima (2012) and Tadesse and Shukralla (2013) who ended up to different conclusions. The first empirical attempt by Iwamoto and Nabeshima showed that FDI variable could not explain the variation in export diversification. However, interacting the FDI variable with the country's level of development thereafter indicated that foreign investments could change the export structure but only in low-income economies. From the Shukralla's and Tadesse's standpoint, the linkage between inward FDI and export diversification takes an inverted-U shape. Applying first a parametric econometric method, they realize that the effect of FDI depends on the existing degree of diversification. Countries that are moderately diversified receive the highest positive influence from multinationals while the impact gets weaker in low and high levels. Then to account for non-linearity they run a country-specific semi-parametric regression, which extracted both negative and positive outcomes. The crucial point in this examination was that significant results were found only in developing regions. A fact that excluded the development status from the list of determinant factors[12].

Different scenarios, either positive or negative, about the consequences from FDI inflows are collected from each part of this world. The reason, though, why the direction and the magnitude of this effect vary, is not always attributed to the nature of those investments but some responsibility stems from the recipient governments. Particularly, issues related to the capability of the host countries to absorb the modern technical skills and the advanced knowledge concern the economists. They assert that if the host countries want to benefit from foreign activities and since the introduction of new products requires innovative ideas and actions, the host governments must ensure that they possess sufficient absorptive capacity, which is usually specified as R&D expenditures, human capital, or basic infrastructure. Castellani and Zanfei (2003) tried to weigh the role of absorptive capacity and technological gap between indigenous and foreign firms in the effect of inward FDI on Spanish, French and Italian firms' productivity[13]. Even if absorptive capacity did not have any significant impact, the authors found that the technological distance, between foreigners and natives, matters. The

[11] Horizontal export diversification occurs when new products are added to the export basket of a specific sector, while vertical export diversification is translated as the transition from the primary to the manufacturing export sectors and usually is referred to the product technological transformation (Samen, 2010).
[12] Cadot et al. (2011) identifies a hump-shaped linkage between export diversification and GDP.
[13] Absorptive capacity was measured by the average total factor productivity (TFP) in an industry and technological gap as the ratio of the average foreign TFP over the TFP of a domestic firm in an industry.

larger the distance the more advantages are transferred to the nationals. Whereas, according to the paper, the non-significance of absorptive capacity emerged due to the fact that some European members had likely already reached the threshold level of absorptive capacity and any additional spillovers would not ameliorate their productivity. Girma (2005) has given an inverted-U shape to this affiliation. She supports that in low levels of absorptive capacity spillovers from foreigners speed up the domestic productivity which then starts increasing with a diminishing rate when the capacity reaches a high level. After that point, negative or non-existing externalities appear. In developing countries, it is said that technological distance between domestic and foreign firms is indeed large. Although firms in these low-income regions desire to grow in new export sectors in order to escape from the "Dutch Disease" that harass their economy, they cannot imitate foreigners because they lack basic education and equipment. Yet, they may have the opportunity to reduce the share of exported primary goods when multinationals located domestically are willing to share their fixed and intangible assets (Abiyaremye & Ziesemer, 2006).

A different perspective is expressed in the research work of Aghion et al. (2005) and Acemoglu, Gancia and Zilibotti (2012). The first paper highlights the role of competition for innovation incentives. It declares that in low-competitive conditions an increase in competition will dissuade industries with similar firms to innovate while it will persuade laggard firms in unlevelled industries to try new methods. In contrast, in a high competitive environment, a further increase in competition will have the opposite results; similar firms will innovate to escape from competition and laggard firms will avoid any R&D activity. Moreover, the paper proves that the technological gap will expand as a result of a tougher competition because inventive reactions will limit the exit rates of low-productive firms. The second article introduces the issue of standardization – the cost of standardization is assumed as an alternative measure of competition –which leads to two contradictory outcomes: the growth-enhancing impact that boosts the aggregate demand and the discouragement of creative behaviour. In other words, the process of standardization comprises the substitution of low-skilled workers for high-skilled workers, which make less important the request for scarce high-skilled workers and therefore expand the number of goods produced. Nevertheless, the easy acquisition of modern production methods by rivals, who start advertising different versions of existing products, prevents firms from engaging in R&D because it reduces the post profits of the projects. What the article recommends solving this problem is to protect the innovative rents when the supply of high-skilled workers is low and the elasticity of substitution between products is high.

The present study aims to contribute to the growing understanding of how foreign capital can affect host country's exports and whether it has the power to reallocate the export basket. Specifically, this research pays explicit attention to bilateral trade relations between the multinationals' country of origin and the recipient country. Considering the direct and indirect effects described above, the hypotheses to be testified are stated as follows:

H_1: *Real inward FDI stock has a positive impact on real exports*

H_2: *Real inward FDI stock has the power to diversify the export portfolio in terms of products.*

Additionally, conditions in the destination countries, that determine the absorptive capacity and consequently the size of the technological gap, are expected to influence the magnitude of the FDI impact. For that reason, the paper will also consider the subsequent hypotheses:

H_3: *Real inward FDI stock benefits countries in terms of exports more when their technologies are moderately less advanced than those of their partners are. This means that the impact of FDI on exports has an inverse U-shape.*

H_4: *Real inward FDI stock benefits countries in terms of export diversification more when their technologies are moderately less advanced than those of their partners are. This means that the impact of FDI on export diversification has an inverse U-shape.*

4. METHODOLOGY

To investigate the impact of inward FDI on export performance and export diversification based on a country level, two different empirical models are going to be estimated one for each case. The following parts of this section describe these methods analytically.

4.1 Export Equation

From physics to economics, Jan Tinbergen (1962) attempted to derive an equation explaining international trade from the Newton's law of gravitation, which later approved a successful technique and currently a fundamental model in the trade literature. This basic gravity model, as it is called, shows that commodity flows from country i to country j are positively related to the incomes of those regions and negatively affected by the distance between them.

$$X_{ij} = G\frac{Y_i Y_j}{D_{ij}} \qquad (4.1)$$

Even though data fitted well the model that time, the theoretical justification was missing and hence policy application was questionable. Since then researchers have made substantial efforts by incorporating different kinds of assumptions to Tinbergen's work[14], to bring the results closer to reality. What is outstanding about the further explorations is that regardless the framework implemented, all lead to an identical gravity trade model. For instance, Anderson (1979) introduced both Cobb-Douglas and constant elasticity of substitution (CES) preferences, differentiated products and same transport costs across regions. The outcome generated was a function unspecific to the type of products, positively related to countries' income and negatively dependent on the distance between i and j that is weighted by the average distance of i to all available destinations. Bergstrand (1989) tested a Heckscher-Ohlin based gravity model in a monopolistically competitive environment with industries producing unlike goods and consumers having non-homothetic tastes and found that the gravity equation

[14] Tinbergen (1962) assumed that each country produces only one good and consumers have identical Cobb-Douglas preferences everywhere.

could explain 40-80% of the trade variation. Deardorff (1998) chose Heckscher-Ohlin structure as well to examine two cases. The first case was a setting of frictionless trade with identical and homothetic preferences which led to a simple gravity model including regions' incomes. Also in the same section, Deardorff switched to arbitrary preferences ending up to results that varied around the simple gravity equation. That is if a region over-produces while the other over-consumes then the value of exports from the former to the latter will be above the value derived from the simple gravity equation. Reversely, if a country under-produces what the other over-consumes then export flows will be less than the simple gravity value. In the second case, trade barriers were added and consumers were characterized first by Cobb-Douglas preferences and later by CES preferences. Additionally, products were differentiated by country of origin. The choice of preferences did not adjust the outcome. Instead, the paper concluded that for both types of preferences export flows were inversely correlated to distance while a drop to the transport costs would enhance the trade with distant countries and lower the flows to neighbour countries.

Another attempt by Eaton and Kortum (2002) conformed to Ricardian theory to emphasize the role of geography or otherwise the substance of emerged geographical barriers in international trade. In this context, countries differed in technology, markets were perfectly competitive and consumers had CES preferences. Arranging technologies, prices, wages and trade flows, the final step of the process delivered a gravity formula[15] with parameters that measured the comparative advantage. Anderson and Van Wincoop (2003) in their effort to find the influence of borders on trade activities between USA and Canada, underline the importance of multilateral resistance variables that are responsible for capturing the role of bilateral trade costs in the level of trade costs with third parties. Due to the difficulty of determining the multilateral resistance, they recommend the inclusion of country fixed effects in the regression. Their main findings are summarized as follows: (1) a rise in trade barriers will increase the multilateral resistance of small countries by more than that of the large countries because large countries can rely on their sufficient internal trade. ;(2) commodity flows between large regions decrease more rapidly compared to small regions since multilateral resistance for the latter rises faster.; (3) the ratio of region i's internal trade to the bilateral trade between i and j gets bigger the smaller is region i and the larger is region j.

A recent paper by Novy (2013) decides to depart from the CES preferences and use alternatively translog preferences[16]. Indeed, the extracted equation is a function of incomes, countries' multilateral resistance, and trade costs but the variables are not multiplicatively linked and the depended variable is a non-logarithmic share of trade flow. Furthermore, the translog preferences generated an endogenous trade cost elasticity, which is connected with the intensity of trade flows. In other words, the more regions interact with each other the less sensitive they are to bilateral trade costs and the other way around.

[15] $\log\left(\frac{X_{ni}}{X_{nn}}\right) = -\theta \log(d_{ni}) + \frac{1}{\beta}\log\left(\frac{T_i}{T_n}\right) - \theta \log(\frac{w_i}{w_n})$, $Y_{i,n} = \frac{1}{\beta}\log(T_{i,n}) - \theta \log(w_{i,n})$

[16] Consumers with translog preferences have different shapes of indifferent curves as their income rises. That is, they consume with different analogies as they become richer.

In overall, the gravity formula that appears in most of the studies has a log format – therefore, parameters indicate elasticities – and is expressed as follows:

$$log(X_{ij}) = logG + \alpha_1 log(Y_i) + \alpha_2 log(Y_j) + \varphi_{ij} + u_{ij} \quad (4.2)$$

where X_{ij} is the trade flow from country i to country j, G is the gravitational constant, Y_i and Y_j represent the exporter's capacity to supply its products and importer's purchasing power to demand those products respectively – usually these variables are assigned by exporter's and importer's GDP.

The explanatory variable φ_{ij} stands for trade costs between i and j and according to literature surveys is mainly defined by geographical distance. Yet, a number of researchers have tested for other observable arguments that have been successfully incorporated into the trade cost function. In current studies, the expression for φ_{ij} is commonly appeared and includes except from geographical distance, dummy variables such as language similarities, physical borders colonial relations and trade agreements that are proved to meliorate the fit of the model. Intuitively, the additional characteristics are believed to symbolize barriers in trade since regions with common languages, common borders and same colonial history are said to behave identically or similarly and communicate clearly and effectively in contrast to other areas whose features are not matching (Sauter, 2012; De Sousa & Lochard 2012; Groizard, Marques & Santana, 2014; UNCTAD & WTO 2012). What is more, treaties such as free trade agreements, preferential trade agreements and common currency areas undoubtedly favour exporters by dissolving impediments that previously made the transfer of goods an expensive matter (Glick & Rose, 2002; Serrano, Martinez, Rodriguez & Salazar,. 2015). Finally, u_{ij} is the identically independently distributed (i.i.d) error term that contains unobservable variables that possibly affect exports.

Since its discovery, the gravity model has been empirically extended from many aspects. Nevertheless, foreign investments have been widely used as a variable that substitutes exports and less as an explanatory variable that describes the overseas sales. A fact that gives the incentive to look deeper for the gravitational role of FDI and specifically the role of inward FDI. Following Wang, Wei and Liu (2010), who took into consideration the FDI contribution in bilateral trade flows, the gravity model to be estimated in this paper is based on a panel sample and is assumed as:

$$X_{ijt} = A_{ijt} {Y_{it}}^{a1} {Y_{jt}}^{a2} {E_{it}}^{a3} \varphi_{ijt} u_{ijt} \quad (4.3)$$

where φ_{ijt} is a function of trade costs, traditionally fragmented as:

$$\varphi_{ijt} = {D_{ij}}^{-\beta 1} e^{\{\beta 2(Lang_{ij})+\beta 3(Border_{ij})+\beta 4(Col_{ij})+\beta 5(LE_{ij})+\beta_6(TA_{ij,t})\}} \quad (4.4)$$

and comprises time-invariant dummy variables such as the geographical distance between country i and country j (D_{ij}), common official language ($Lang_{ij}$), common borders ($Border_{ij}$), a variable representing a sharing colonial history (Col_{ij}), common legal system (LE_{ij}) and a time dependent dummy variable that counts for treaties between areas (TA_{ijt}).

Back to the equation (4.4), the term A_{ijt} , which is granted as constant in the literature, is set to be a function of the exporter's and importer's R&D capital stock by Wang et al. (2010) who argue that a constant is not appropriate because countries are heterogeneous. Specifically, the authors hypothesize that exporter's R&D activities are determined by domestic technological efforts and by foreign firms' innovative actions in the local economy. This is also approved in the research work of Coe, Helpman and Hoffmaister (2009) who have shown that total factor productivity is positively related to domestic R&D as well as to foreign R&D because firms' may use advanced equipment and intermediate goods imported from their foreign partners. In addition, since successful R&D projects and inward FDI need time to influence the indigenous markets, inward FDI stock and R&D stock will be lagged. Therefore, the equation is specified as:

$$A_{ijt} = e^{\gamma o}(RD_{i,t-1})^{\gamma 1}(FDI_{ij,t-1})^{\gamma 2}(RD_{jt-1})^{\gamma 3} \quad (4.5)$$

Following variables Y_{it} , Y_{jt} denote the real GDP per capita of the exporter i and the importer j while E_{it} captures the domestic competitiveness in international markets through the fluctuations in the real effective exchange rate which compares the local currency against a bundle of foreign currencies. What is more, u_{ijt} is the i.i.d error term that measures all the unobservable issues that affect export flows. To avoid bias due to omitted variables country and time fixed effects will be included. Dummy variables for exporters and importers will control for country heterogeneity that is constant over time and according to Anderson and van Wincoop (2003) will identify multilateral resistance. Dummies for time periods will control for facts that occurred in a specific year and affected the bilateral trade such as business cycles Even though, country-pair fixed effects or time- dimensioned country pair fixed effects are intuitively more suitable for panel data, their intake would remove a large size of degrees of freedom.

Despite that foreign investments are an important source of technology, spillovers from multinationals are likely to be spread more easily when the local economy engages intensively in R&D activities. Conversely, literature also supports that spillovers are ineffective when the domestic R&D efforts do not deviate from those of partners. As a result, the FDI impact in

advanced economies is expected to be weaker. To capture this relationship an interaction between domestic R&D and inward FDI will be added to the model. Moreover, an interaction between inward FDI and trade agreements will be included as well to identify whether liberalized markets facilitate the transition of foreign knowledge.

Substituting equation (4.5) into (4.3) and applying the logarithmic rule, the gravity model that arises – after the attachment of the interaction terms – is defined as:

$$log(X_{ijt}) = \gamma_0 + \gamma_1 log(RD_{i,t-1}) + \gamma_2 log(FDI_{ij,t-1}) + \gamma_3 log(RD_{j,t-1}) + \theta_1[log(FDI_{ij,t-1}) * log(RD_{i,t-1})] + \kappa_1[log(FDI_{ij,t-1}) * TA_{ij,t}] + \alpha_1 log(Y_{i,t}) + \alpha_2 log(Y_{j,t}) + \alpha_3 \log(E_{it}) + + \beta log(\varphi_{ij,t}) + u_{ijt} \quad (4.6)$$

4.2 Export Diversification Equation.

Apart from the export equation, a second model in interest under the scope of this paper is the export diversification model, which is responsible for capturing the FDI consequences on export structure. Even so, only few of the existing empirical works, which are scant, have developed a theoretical framework to justify the factors that lead to export diversity. Some of them belong to Imbs and Wacziarg (2003) and Cadot, Carrère and Strauss-Kahn (2011), who based on nonparametric methods employed diversification indexes such as Herfindahl, Gini, and Theil but also other measures and found that export diversification has a hump-shape relationship with the level of income. Diversity enlarges when countries are flourishing, then countries start to specialize again when they have reached a sufficient level of income but they never return to their initial point of concentration[17]. Imbs and Wacziarg (2003) estimate this GDP per capita turning point to be around $ 9000 (1985 PPP in U.S dollars) compared to $25,000 (2005 PPP in U.S dollar) found in the article of Cadot et al. (2011). Furthermore, they declare that their findings are an aftermath of the interaction between improved productivities and decreasing trading costs. Specifically, if productivity rises, a broader range of goods will be produced. But if trading costs fall then economies will prefer to import some commodities and thus concentrate their production basket. The dominant effect will finally determine the outcome. From the viewpoint of Cadot et.al. (2011) export diversification appears in economies that grow from the middle to a high level of income due to the slow- dying industries. If the speed of innovation and/or invention is larger than the speed of termination of old industries, then export diversification might occur. Mau (2015) on the other hand following Eaton's and Kortum's (2002)[18] methodology and considering only extensive margins reflected by the number of disaggregated goods exported, express a disagreement about the inverted U-shape relationship between export concentration and GDP per capita. Transforming both income per capita and its squared form into logarithmic variables and excluding oil exporters and low

[17] Cadot et al. (2011) explains that in the first phase of development, economies add new commodities to their production list. Thereafter, obtaining an adequate income they cease producing a fraction of goods for which they have lost comparative advantage.

[18] Eaton and Kortum (2002) mention that trading economies that observe an upgrade in their technologies, have lower factor costs and less restrictive trade barriers tend to produce a wider list of commodities.

populated countries, estimates a continuous negatively sloped curve which rejects the re-specialization in high levels of income.

Dennis and Shepherd (2011) choose a sample of developing countries to illustrate the role of trade facilitation in the export diversification. They utilize a model that contains domestic GDP per capita, gravity core variables and import tariffs with dependent variables being the number of exported products as well as the Herfindahl index. The usage of an index did not lead to divergent outcomes, while their results concluded that distance and higher European import tariffs affected negatively the export diversification in developing countries.

What is more, numerous research papers have underlined the role of innovation in the exporters' tendency to produce and sell a larger variety of products. To sustain their comparative advantage and expand their market share not only domestically but also globally firms focus an important part of their operations in R&D. This strategy allows them to dig out new products or/and new processes that will update their existing commodities. Nevertheless, recent empirical works have also verified the bi-directional causality between R&D and export intensity which is based on the fact that firms spend on technology to progress in international markets but at the same time, their internationalization and specifically the knowledge they earn overseas boost their creativeness (Chen, 2013; Harris & Li, 2009). Simultaneously, a rise in export variety may stem from foreign technology embodied in imported intermediate inputs. Domestic exporters (foreign enterprises) may import high-tech inputs from their partners (origin country) and use them to produce better versions of the existing products or/and fresh products (Coe et al., 2009).

With regard to Agosin et al. (2012), exchange rates are linked to export diversification. The authors found that a currency appreciation is negatively associated with firms' decision to export new products because it reduces trade profitability. However, they did not find any relation between exchange rate volatility and export variety.

Typically, the number of products sold abroad measures export diversification. Lately, other measurements such as Herfindahl-Hirschman indices (HHI), Theil and Gini indices successfully were used as alternatives. While the former describes changes in the distribution of export shares, the latter indices are favoured due to their ability to identify inequalities. The ideal approach would be to employ the three indices and compare the arising estimates. Unfortunately, this is not feasible since Theil and Gini indices are not available for bilateral disaggregated trade flows yet, which leave Herfindahl-Hirschman index and the number of exports as the only measure options in this empirical work.

Therefore, considering the above determinant factors, the model of export diversification to be estimated is similar to the export equation with an ad hoc dependent variable and looks like:

(4.7)

$$\begin{aligned}(1 - HHI_{ij,t}) = \delta_0 + \delta_1 log(FDI_{ij,t-1}) + \delta_2 log(RD_{i,t-1}) + \delta_3 log(RD_{j,t-1}) + \lambda_1 \left[log(FDI_{ij,t-1}) * log(RD_{i,t-1})\right] \\ + \rho_1 \left[log(FDI_{ij,t-1}) * TA_{ij,t}\right] + \delta_4 log(Y_{i,t}) + \delta_5 log(E_{i,t}) + \delta_6 log R_{i,t} + \mu\varphi_{ij,t} + \varepsilon_{ijt}\end{aligned}$$

where the dependent variable is the normalised Herfindahl-Hirschman index (HHI_{ijt}) that measures the extent of diversification in the export basket of country i intended for country j at period t and varies in the range [0,1]. The index is calculated as follows:

$$HHI_{ijt} = \frac{\sum_{k=1}^{n_i}\left(\frac{x_{ijkt}}{X_{ijt}}\right)^2 - \frac{1}{n_{ijt}}}{1-\frac{1}{n_{ijt}}} \quad (4.8)$$

with subscripts denoting:

i= domestic country

j= destination country

t= annual time period

and:

x_{ijkt}= value of exports of product k from country i to country j in period t.

X_{ijt} = total exports' value from country i to country j in year t.

n_{ijt} = total number of products exported from country i to country j in year t.

Lower records of the Herfindahl index imply that the economy has a more diversified export basket while higher records is an evidence of concentration. To interpret the coefficients in terms of diversification rather than concentration the index is extracted from one.

Looking at the right side of the equation, $FDI_{ij,t-1}$, $RD_{i,t-1}$ and $RD_{j,t-1}$ are again the real inward FDI stock and the R&D stock of the host and partner's country respectively, which are lagged to allow spillovers and technology to take effect. The subsequent interaction term between inward FDI stock and domestic R&D stock has a key role to play in determining the FDI impact in already technological informed countries Thereby, its coefficient will give an answer to the question of whether or not multinationals are competent to diversify the export basket of skilful indigenous producers. Moreover, the interaction between inward FDI stock and trade agreements will reveal the FDI impact in regions that are free of trade restrictions. The degree of development is reflected by $Y_{i,t}$ which stands for the real GDP per capita, while $E_{i,t}$ is the real effective exchange rate and represents exporter's international competitiveness. Transport and trade costs are measured by the gravity variables ($\varphi_{ij,t}$) introduced in the previous section and R_{it} denotes the share of raw materials exported as "Dutch disease" producers of primary goods are less willing to change the composition of their traded goods. Then ε_{ijt} is the error term that contains unobserved factors that influence export diversification. Yet, to reduce the size of the error term country and time fixed effects will be added. Country fixed effects for exporters and their partners will capture factors that are related to individual countries and

affect export diversity, while time fixed effects will be responsible for explaining the variation in the dependent variable due to attributive occurrences in a particular year.

Though it is crucial to note that HHI displayed above calculates the degree of diversification over all industries. On the other hand, advanced knowledge from foreign multinationals may concern only a particular sector and thus, differentiation may occur to a greater extent in a specific industry rather than in overall. Accordingly, to restrain this drawback, Herfindahl index for several industries, described in tables A.3, will replace the general HHI.

4.3 Technological Gap

Certainly, as was mentioned in the previous section, spillovers from inward FDI are less likely to reach domestic exporters if they appear in an environment that is not prepared to absorb them. According to Cohen and Levinthal (1990), an economy can value the outside knowledge only if it can recognize, assimilate, explore it and finally apply it to its own institutions. Thereby, this statement admits that knowledge spillovers will not be activated if the technological gap between countries is wide. In contrast, aspects of the FDI effect being stronger in economies that differ in technologies but are able to filter the outside knowledge have not been dismissed yet. Therefore, to identify the effect of FDI when technological gap is taken into consideration, (4.6) and (4.7) will be re-estimated as follows:

(4.9)

$$log(X_{ijt}) = b_0 + b_1 log(TG_{ij,t}) + b_2 log(FDI_{ij,t-1}) + c_1\left[log(FDI_{ij,t-1}) * log(TG_{ij,t})\right] + m_1\left[log(FDI_{ij,t-1}) * TA_{ij,t}\right] + d_1 log(Y_{i,t}) + d_2 log(Y_{j,t}) + d_3 \log(E_{it}) + f log(\varphi_{ij,t}) + e_{ijt}$$

(4.10)

$$(1 - HHI_{ij,t}) = s_0 + s_1 log(TG_{iJ,t}) + s_2 log(FDI_{ij,t-1}) + q_1\left[log(FDI_{ij,t-1}) * log(TG_{ij,t})\right] + z_1\left[log(FDI_{ij,t-1}) * TA_{ij,t}\right] + s_3 log(Y_{i,t}) + s_4 log(E_{i,t}) + s_5 log R_{i,t-1} + h\varphi_{ij,t} + r_{ijt}$$

Where $TG_{ij,t}$ stands for the technological gap between the exporter and the importer and is calculated as follows:

$$TG_{ij,t} = \frac{rdp_{j,t}}{rdp_{i,t}} \quad (4.11)$$

Variable rdp represents R&D expenditures as a percentage of GDP. Ratio values larger than one indicate that exporters have less technology than their partners have and thus are less capable to absorb FDI spillovers. Last but not least, the interaction between technological gap and inward FDI will appraise the FDI impact when trade transactions concern pair of countries that differ in their ability to absorb foreign knowledge. To observe the non-linear relations between exports-technological gap and FDI effect-technological gap, squared terms of the

logged technological gap and its interaction with the logged FDI will be added to (4.9) and (4.10).

In brief, Table 4.1 illustrates the expectations about the hypotheses stated in this study.

Table 4.1.	**Expected FDI Coefficients' Sign**	
Hypothesis	**Coefficients**	**Description**
H_1:	$\gamma_2 + \theta_1 + \kappa_1 > 0$	Positive impact of real inward FDI stock on real bilateral domestic exports through positive technological spillovers.
H_2:	$\delta_1 + \lambda_1 + \rho_1 > 0$	Positive impact of real inward FDI stock on bilateral export diversification through positive technological spillovers. .
H_3:	$b_2 > 0$ $c_1 > 0$ $n_1 < 0$ $b_2 + c_1 + n_1 + m_1 > 0$	The impact of real inward FDI stock on real exports increases with diminishing returns due to domestic firms' inability to absorb spillovers.
H_4:	$s_2 > 0$ $q_1 > 0$ $w_1 < 0$ $s_2 + q_1 + w_1 + z_1 > 0$	The impact of real inward FDI stock on export diversification increases with diminishing returns due to domestic firms' inability to absorb spillovers.

Note: n_1 and w_1 are the coefficients of the interaction terms between real inward FDI stocks and squared technological gap.

5. DATA AND DESCRIPTIVE STATISTICS

5.1 Data

The empirical strategy utilizes a panel dataset that regards a list of 80 countries, specified by the UNCTAD country classification, for the annual period 2001-2012. A large dataset consisting both of developing and developed countries will eliminate the bias that occurs if the sample is limited to describe characteristics of a particular country and will bring outcomes that are more representative. Furthermore, the time period and the number of economies were selected based on the availability of the data and whether countries were involved in armed conflicts in the period of examination. Tables 5.1 and 5.2 list the names and the ISO codes of the countries by continent included and excluded from the sample respectively.

Since the models presented previously require a bilateral connection between countries, most of the variables explain the actions and the common features between an exporter and an importer. A balanced dataset would be composed of 6,320 bilateral flows for each year and in overall 69,520 observations for 11 years. Though, missing bilateral relationships and non-complete time periods give a final unbalanced sample of 32,366 observations (2,841 country-pairs). The subsequent paragraphs give details about the source and the construction of the variables.

Exports (X_{ijt}) are measured in U.S dollars and are extracted from UNCOMTRADE, where the export value flowing from country i to country j is the total amount of 6-digid products classified by the Harmonized System revised in 1996 (All subheading HS6). The Harmonized

Classification System offers information for highly disaggregate products, where the number of commodities reaches its maximum available level of 5,113 in the 1996 revision. Deflation was applied using the GDP deflator from World Bank based on 2005-dollar values. From the same source, data for exported raw materials were used to calculate the **share of exported raw materials (R_{it})**.

Herfindahl-Hirschman Product Diversification Index (HHI_{ijt}) is calculated, as it is shown in the previous section, by World Integrated Trade Solution (WITS trade indicators) using the HS6 exported products from UNCOMTRADE. The number of products are restricted to the products directed to a specific destination with a value over 10,000 USD in a point of time and range between 1 and 4,926. Herfindahl product diversification index by sector of industry regards sectors such as machinery- electronic products, footwear, textiles - clothing, food products, chemicals, metals and plastics. The HS classification and the description of the sectors are shown in Table A.3.

Inward Foreign Direct Investments (FDI_{ijt}) are sourced from Bilateral FDI statistics published by the centre of Division on Investment and Enterprise of UNCTAD in 2014[19]. FDI stock is measured in current U.S dollars and departs from an exporting country to a specific partner country. Preferably, it was chosen over FDI inflows as FDI stocks are less volatile over time and accumulation of foreign capital matters for foreign capital to take effect on domestic market. UNCTAD defines a foreign investor as an investor with 10% or more of equity ownership and FDI stock as the summation of equity capital, reinvested earnings and short and long-term intra company loans. Any negative value, which corresponds to the offsetting of these elements, is excluded from the sample as it represents outward FDI stock. Moreover, FDI stock values were deflated by GDP deflator (2005 US$), while depreciation was not necessary since UNCTAD has gathered the FDI values from national accounts were depreciation was already applied.

The gravity distance variables (D_{ij}, $lang_{ij}$, Col_{ij}, $Bord_{ij}$ CL_{ij}) are published in the CEPII database. Firstly, the geographical distance D_{ij} represents the weighted bilateral distance between two countries, which is estimated by taking the distance between the largest cities of those countries, and then weighting them with the share of population living in those cities. Common language $lang_{ij}$ is considered as the common official language; colony Col_{ij} detects whether the pair of countries were ever under the power of the same colonizer; $Bord_{ij}$ reflects whether the countries are contiguous and LE_{ij} states if the economies have similar legal policies**.** The latter is equal to one if country pairs share civil law, common law or muslim law. Zero values were assigned to country pairs that practised a mixture of laws.

GDP per capita at constant (2005) prices in U.S dollars (Y_{it} , Y_{jt}) and **real effective exchange rates (E_{it})** were found in UNCTAD's database and were corrected for inflation by GDP deflator (2005). Real effective exchange rates are calculated as the value of the domestic

[19] http://unctad.org/en/Pages/DIAE/FDI%20Statistics/FDI-Statistics-Bilateral.aspx

currency against other important foreign currencies, weighted by the share of trade value towards the issuing foreign market in the total domestic trade value.

Research and development expenditures (RD_{idt} , RD_{jt}) were provided by UNESCO Institute for Statistics (UIS) and were deflated by GDP deflator (2005). To calculate the accumulated R&D stock the perpetual inventory method was applied:

$$RD_{it} = (1 - \delta)RD_{t-1} + rd_{t-1}$$

where RD is the R&D stock, rd are the R&D expenditures in a specific year and δ is the depreciation rate which is assumed to be 20% (Bernstein & Mamouneas, 2006)[20]. To estimate the initial value of R&D stock the following expression was calculated:

$$RD_{i0} = rd_{i0}/(g_i + \delta)$$

with g_i being the average growth rate of R&D expenditures for each country over the years for which data were available.

Trade agreements (TA_{ijt}) that relax trade restrictions are inserted into the equation as a dummy variable that takes unit values if a pair of countries has signed a free trade agreement in a specific year **(FTA)**. In this way, regulations regarding the type of the agreement will be taken into account such as reduced or eliminated import tariffs and quotas, external tariffs, liberalized labour markets etc. The World Trade Organization (WTO) provides an extensive dataset on regional trade agreements.

5.2. Descriptive Statistics

Table A.4 shows the mean, the standard deviation, the minimum and the maximum value for each variable registered in period 2001-2012. Summarizing these statistics, we conclude to the following facts: An exporting economy in the sample is a middle-income country with a GDP per capita of 16,520 dollars. Spends on average an annual percentage of 1.13% of his GDP on R&D and by 2012 has accumulated a stock of R&D evaluated at 66 billion dollars. The country with the highest R&D percentage is Israel while USA own the largest R&D capital stock. The lowest percentage records are found in Gambia and Bosnia-Herzegovina and the lowest stock values are observed in Saint Vincent and the Grenadines. Despite this, the most distant countries in terms of technology are Sweden and Bosnia and Herzegovina while some of the countries that are similar in R&D spending (TG=1), in some points of time, during the given period, are Azerbaijan- Cyprus, Azerbaijan-Russia, Argentina-Costa Rica, Australia-Singapore, Australia- USA, Denmark-Germany, South Africa- India, and Ireland- China. The average gap is computed at 3.44 declaring that partner countries are relatively more innovative than home economies. Regarding the international performance in the export markets, average competitiveness on export promoting, represented by the real effective exchange rate, is equal to 134.24 with Mongolia and Moldova obtaining the minimum and the maximum rates respectively. Export flows are mostly moving from middle to high-income economies where

[20] Literature review based on country and industry levels present R&D depreciation rates to vary between 10-25%.

exporters are compensated by 2,87 trillion dollars, of which almost 0.02% belongs to revenues from raw materials. Bilateral export flows are maximized between Canada and USA whereas the largest share of raw materials is transferred from Moldova to Russia. The general HHI export diversification index classifies the average exporter as a well-diversified country with a score of 0.83. In more detail, the most diversified export basket is sold from Slovenia to New Zealand and the less diversified one is sold from Panama to Sweden. What concerns the export variety in industry sectors, the range of products in machinery and electrical sectors is more extensive than in other sectors and short in the footwear sector. Based on country scores, the mixture of machinery-electrical exports is wider when it flows from Armenia to Turkey. The number of chemical products is larger when it is exported from Estonia to Saudi Arabia. Textile and clothing diversity is maximized when it moves from Cyprus to Thailand. Food export basket send from Norway to Trinidad and Tobago is the biggest while country pairs such as Paraguay-Japan, Argentina-Bahrain and Philippines-Ireland have the greatest export variance in metals, plastics, and footwear respectively. Moreover, the mean of inward FDI stock is 2.58 billion dollars and in the top and the bottom of the ranking, country pairs such as Hong Kong - China and Armenia-India are located. Geographically, the average exporter is 5,716 km far from its partner with the most relatively remote countries being Portugal-New Zealand and the adjacent ones Netherlands-Belgium. Finally, the gravity variables' statistics indicate that not only the average country pair does not operate in free tariff areas but it also does not share a similar language, a border, a colonial history and a legal system.

6. ECONOMETRIC ISSUES

6.1 Zero Values

The gravity model introduced in section 4 requires the logarithmic transformation of the data. However, variables such as the inward FDI stock and the absorptive capacity gap are described by values that make the transformation burdensome. For instance, inward FDI stock entries are zero for some panels, which could be an evidence of prohibitive costs or more likely a measurement error. Moreover, R&D ratios that measure the technological gap are less than one when the home country is in a better position than its partner. Retaining the initial values of the variables and taking the logarithmic form would lead to inconsistent results as this decision would drop zero values and replace those below one with negative ones. To prevent this, values were increased by one before the log transformation.

6.2 Restricted Dependent Variable

The choice of linear regression models to explain bounded dependent variables that range between zero and one is inappropriate as it yields fitted values that are below or above the real interval. Biased results and inefficiency arise because the variable has no longer a normal distribution and is characterized by heteroskedastic error terms and skewness. Hence, using linear estimators to predict the movements of the Herfindahl index is an undesirable approach. Further, another difficulty is met when the dependent variable is both restricted and continuous but does not equal to the endpoints of the interval – countries' exports in the sample are not completely diversified or concentrated, therefore Herfindahl index numbers are different from

zero or one. In this case, a maximum likelihood estimator with a beta distribution is recommended. A beta regression has a privilege over other fractional regressions that assume a logit or a probit density functions since it does not require the inclusion of zero and one codes. Moreover, a beta distribution has two shape parameters that after a re-parameterization specify the location(mean) and the dispersion of the observations (variance) and thus it can accommodate different forms of asymmetric as well as symmetric distributions (Smithson & Verkuilen ,2006)[21].Selecting a logit transformation to restrict the mean of the response variable into the unit interval gives the corresponding function:

$$g(\mu_t) = \sum_{i=1}^{k} s_i x_{it}$$

$$g(\mu_t) = log\left(\frac{\mu_t}{1-\mu_t}\right) = \sum_{i=1}^{k} s_i x_{it}$$

6.3 Multicollinearity

The inclusion of variables that are highly correlated may cause the problem of multicollinearity. Some of the consequences are related to higher variances and switching coefficients' signs and hence make the selection of the model difficult. In Table A.5, a correlation matrix is presented revealing the high degree of correlation between GDP per capita and R&D stock. To correct for multicollinearity GDP per capita was dropped from the model as its impact on exports and export diversification is out of the scope of this paper. Though, outputs categorized in bilateral income groups will be later discussed to reveal how FDI impact varies when exporters and their partners differ in income levels.

6.4 Endogeneity

Gravity models are built to describe the flows of trade. Nevertheless, research articles around the topic question the causality between the regressor and the explanatory variables and therefore signalize the problem of endogeneity. For instance, FDI flows, R&D activities and trade treaties are considered endogenous variables in the literature. Multinationals may decide to locate their operations in countries that are massive exporters, R&D activities may become more drastic when firms are competing in international markets and trade agreements may be formed based on prior strong trade transactions between the countries. Other issues reflecting endogeneity are omitted variables. To solve the problem of the endogeneity in the export equation, two-stage least squares (2SLS) method is going to be used where lagged levels of inward FDI and R&D stock will instrument their endogenous current levels[22]. Before that, a robust score test and a regression robust test will examine whether the suspected endogenous variables can be treated as exogenous and a Granger causality test will declare the direction of

[21] $f(y;a,b) = \frac{\Gamma(a+b)}{\Gamma(a)\Gamma(b)} y^{a-1}(1-y)^{b-1}$, $y \in (0,1)$, $a,b > 0$ and $\Gamma(.)$ Is a Gamma function.

[22] Other instrumental variables for inward FDI and R&D stock such as corporate income tax, days/ costs to start a business in the domestic country and patents applications were used respectively. Yet, significant results occurred only with lagged FDI and R&D stock values as instruments.

causality. However, instruments for trade agreements are not easily identified and for that reason, FTA variable will not receive any treatment[23].

Endogeneity tests for beta regressions in Stata could not be detected during the period of econometric analysis. Despite this, Papke and Wooldridge (2008), who employed a quasi-MLE with a probit link function, applied 2SLS steps to test for endogeneity. Specifically, they regressed the endogenous variable on the instrumental variable and all the exogenous regressors and obtained the residuals. Then they added the residuals into the main equation and based on the t-statistic they concluded analogously. Hence, to indicate whether inward FDI and R&D stock in the host country in (4.7) are endogenous the above steps will be followed. Besides that, a granger causality test will also give a sign of endogeneity.

7. EMPIRICAL RESULTS

7.1 Export Equation

With an unbalanced panel sample of 80 developed and developing countries observed in the period 2001-2012, model (4.7) is estimated by OLS fixed effect method and robust standard errors clustered by country pairs to control for heteroskedasticity and serial correlation. Table 7.1 displays the results of the model, the Wooldridge test for autocorrelation, the Granger causality test, and the endogeneity test. Coefficients of logged variables are interpreted as elasticities.

Looking at the first column, the main variables, inward FDI stock and the home and partners' R&D stock have the expected signs and are statistical significant at 1% level. Foreign capital stock and accumulated R&D activities have a positive impact on domestic exports, while real effective exchange rate reduces the amount of exports when the relative value of the domestic currency against other foreign currencies increases driving the indigenous economy to a less competitive position.

The second column shows that the contribution of gravity core variables that capture the information and transport costs is vital to explain the export transactions as goodness of fit measure reflected by the adjusted R-squared climbs from 0.59 to 0.71. Also, all the gravity variables own the anticipated signs and are consistent with previous empirical works. Bilateral exports between countries that are adjacent and share a common border, a common language, a colonial history and a similar legal system are larger than exports flowing between countries that stand apart. Moreover, FTAs that eliminate tariff expenses and generally abolish trade barriers between the members have a substantial influence on exports.

[23] Literature suggests to insert country-pair fixed effects to solve a part of the problem that is attributed to time-invariant omitted variables. Unfortunately, due to the large size of the dataset country-pair variables exceeds maximum number of variables accepted by STATA and thus cannot be estimated. An alternative solution for endogeneity is the GMM method developed by Arellano and Bond (1991); A dynamic panel model where lagged dependent variables as well as lagged and first differenced independent variables are used as instruments. Unfortunately, GMM estimations did not permit any significance and thus are not reported in this paper.

Columns 3 and 4 attach to the model the year and the exporter and importer dummies that control for multilateral resistance, omitted variables such as business cycles and country-specific factors that are difficult to be observed. As it seems time and country fixed effects improve the explanatory power even more, especially after the incorporation of country dummies, raising the adjusted R-squared to 0.86. The highly significant results of the complete model in column 4 support that inward FDI is complementary to trade. A 10% increase in inward FDI stock increases the amount of exports by 0.2%. The R&D activities taking place in both home and foreign economy contribute positively by 3.1% and 4% respectively to domestic exports. Even so, it is surprising that partners' innovative activities have slightly a greater impact compared to domestic ones. An appreciation of the real effective exchange rate drops overseas sales by 2.3% while this disadvantage is offset exactly if a pair of countries belongs to a free trade network. What is more, economies with common borders, language, legal system, and colonized economies experience higher exports by 5.5%, 3.6%, 5% and 17.1% respectively[24]. In contrast, the amount exported to distant partners is 12.2% lower than to nearby ones.

Finally, in column 5 interaction terms are added to distinguish whether spillovers from FDI depend on the level of R&D stock in the recipient country and the membership in free-trade zones[25]. Despite the minor improvement in the adjusted R-squared, the FDI coefficient has grown to 1.9% and that of FTA has almost doubled to 4.1%. Both interaction terms are statistically significant at 1% level but their parameters have a negligible size and are negative suggesting that FDI impact in countries that are more involved in innovative processes and in free trade networks is weaker. For example, if an exporter owns R&D capital stock valued at its mean then the FDI effect, in case he has not signed a free trade agreement with his partner, is 0.2% (0.187-0.0074*22.54) and 0.12% (0.187-0.0074*22.54 -0.0078) in case they trade in FTAs. A possible explanation behind this negative sign could be that technological spillovers from multinationals might have been already familiar to domestic firms making the competition between them more intense. Simultaneously, foreign investments in countries that have agreed to free trade benefit less. This lower effect could be due to the fact that multinationals may have been attracted by lower trade costs in free trade areas and established their operations in the domestic country not only to serve the host market but also the entire block. Therefore, their intentions may not have been translated into serving their parent economy. Subsequently, their presence may have harmed domestic exporters and finally excluded them from international markets. Another reason could be referred to the period of examination, where some economically integrated areas were put into effect before that period. For instance, some European union members had agreed to eliminate trade barriers in the early 90s. Thus, valuable spillover may have met at that time.

[24] Dummy coefficients are calculated as: $100\%(e^{\beta}-1)$

[25] Preferential trade agreements, custom unions and currency unions were examined as well. However, significant results were obtained only with free trade agreements.

In the next column, 2SLS results that control for endogeneity, are reported. Since the Granger causality test[26] permits bi-directional causality between exports and inward FDI and the Wooldridge's robust score test and robust regression based score statistics are significant, the null hypothesis of exogeneity is rejected and therefore suspected variables must be treated as endogenous. Using the first lags of the endogenous variables, all the explanatory variables are statistically significant at 1% level except the interaction between FDI and FTA. Inward FDI stock has a positive impact of 7.1%, which declines to 0.3% if the exporting country has R&D capital stock equal to its mean. Therefore, hypothesis 1 cannot be rejected. This econometric approach has also doubled the host R&D coefficient. That is 10% greater spending on research raises exports by 6.6%.

As the level of development is a critical determinant factor for the magnitude of exports and inward FDI flows, Table 7.2 presents the coefficient of the main variables and their interaction terms by pairs of income groups corrected for endogeneity[27]. Among the groups, significant results are achieved only in low-high, middle-middle, middle-high and high-high income groups. These results unexpectedly conclude that FDI has its largest positive impact when it runs from middle to middle-income economies raising the indigenous exports by 12.2% followed by the low-high income groups that benefit by 11.9% and high-high groups that experience an increase of 9.5%. Middle-high groups have the lowest impact of 5.1%. However, if R&D stock's magnitude in the host economy is taken into consideration the effects for the mentioned groups, in order, fall dramatically to 0.4%, 0.1%, 0.2%, and 0.2%. As it seems, the interaction term between FTA and FDI is significant only for middle-middle and high-high pairs. Therefore, the corresponding percentages for them are -0.02% and 0.1%. Intuitively, multinationals – that are generally known to be more productive than exporters – from middle-income economies are likely to improve the export performance of firms in other middle-countries as labor in those economies may possess sufficient technology – that still can be exploited even further – that allows them to act immediately and imitate their transnational partners. However, they may gain less from high-income multinationals rather than other middle multinationals because the former may use the sources of the country to serve third places different from the origin while the latter may be interested in providing its motherland with sources from this economy. In addition, since countries that make this group are mostly transition economies and Latin American territories, common cultural characteristics between them may stimulate FDI spillovers and thus increase export transactions. On the other hand, the FDI effect for low-income indigenous firms drops dramatically in high R&D areas, a signal that can be translated as a frailty of those companies to catch up with advanced foreign firms. The overall impact though is positive and relatively smaller than in other groups, which give a reason to suspect that the transition of spillovers is a slow process in these regions. Surprisingly, the results for high exporters show that advanced exporters may still extract valuable knowledge from high multinationals even in sophisticated economies, which proves once again the brilliance of the multinational's ownership advantages. At the same time, it is noteworthy

[26] Pedronis test for cointegration showed that real exports and real inward FDI stock are cointegrated. Thus Granger causality test could be proceeded.

[27] Bilateral inward FDI stock impact that regards low-low and middle-low income groups were not statistical significant and therefore, were not reported.

to mention that the size of the interaction coefficients for the high-high income pairs is the smallest among the other significant income groups. The interpretation behind this could be that high-income exporters in R&D intensive areas and in FTAs are capable of protecting their business from fierce competition by acting strategically and thus, exit rates may be less frequent. Additionally, R&D stock in high-income countries may have reached a maximum possible point and has less space to grow even more. A fact that may reduce the gains from foreign spillovers while stricter protection rules imposed by high-income multinationals may limit the size of these externalities.

Special attention can also be given to the importance of the technological progress conducted in the partner's country. Foreign R&D stock seems to have a larger effect on domestic exports in low-high and middle-high groups, which throws light to the fact that home economies that are inferior in terms of income compared to their partners, gain more from imported sophisticated intermediate inputs coming from the partner's origin rather than from partners' businesses executed in their land. By way of explanation, they may like better to engage in reverse engineering strategies or, for low educated countries, to use these inputs to produce more long-lasting and high-quality products rather than face foreign competition.

Table 7.1: Impact of Inward FDI Stock on Domestic Exports

Pooled Panel-Data Regression						
Dependent Variable: Log(Exports)						
	OLS (1)	**OLS (2)**	**OLS (3)**	**OLS (4)**	**OLS (5)**	**2SLS**
Log($FDI_{i,t-1}$)	0.0721***	0.0363***	0.0403***	0.0223***	0.187***	0.711***
	(0.0016)	(0.0014)	(0.0014)	(0.0012)	(0.0093)	(0.0839)
Log ($R\&D\ stock_{i,t-1}$)	0.689***	0.752***	0.754***	0.312***	0.371***	0.659***
	(0.0051)	(0.0044)	(0.0044)	(0.0441)	(0.0439)	(0.0657)
Log ($R\&D\ stock_{j,t-1}$)	0.354***	0.500***	0.500***	0.403***	0.386***	0.344***
	(0.0057)	(0.0052)	(0.0052)	(0.0439)	(0.0436)	(0.0530)
Log($FDI_{i,t-1}$)* Log ($R\&D\ stock_{j,t-1}$)	-	-	-	-	-0.00724***	-0.0302***
					(0.0004)	(0.0036)
Log($REER_{i,t}$)	-0.0595**	-0.0516**	0.0510*	-0.235***	-0.269***	-0.347***
	(0.0267)	(0.0227)	(0.0231)	(0.0650)	(0.0645)	(0.0729)
Contiguity	-	0.995***	0.981***	0.440***	0.452***	0.445***
		(0.0518)	(0.0512)	(0.0382)	(0.0379)	(0.0416)
Off. Common Language	-	0.735***	0.709***	0.313***	0.321***	0.327***
		(0.0425)	(0.0421)	(0.0363)	(0.0360)	(0.0399)
Common Colony	-	0.913***	0.965***	0.999***	1.051***	1.222***
		(0.0660)	(0.0655)	(0.0542)	(0.0539)	(0.0648)
Common Legacy	-	0.621***	0.644***	0.412***	0.451***	0.549***
		(0.0281)	(0.0278)	(0.0212)	(0.0211)	(0.0282)
Log($Distance_{ij}$)	-	-0.694***	-0.673***	-1.220***	-1.219***	-1.176***
		(0.0135)	(0.0135)	(0.0148)	(0.0147)	(0.0173)
FTA	-	0.0626**	0.148***	0.230***	0.358***	0.283***
		(0.0265)	(0.0269)	(0.0238)	(0.0407)	(0.0456)
Log($FDI_{i,t-1}$*FTA)	-	-	-	-	-0.00781***	-0.00265
					(0.0021)	(0.0024)
Constant	1.556***	2.542***	1.893***	16.18***	15.03***	9.301***
	(0.268)	(0.212)	(0.214)	(1.291)	(1.283)	(1.633)
Time Fixed Effects	No	No	Yes	Yes	Yes	Yes
Exporter Fixed Effects	No	No	No	Yes	Yes	Yes
Importer Fixed Effects	No	No	No	Yes	Yes	Yes
Observations	20,275	20,275	20,275	20,275	20,275	17,815
Adj. R-squared	0.599	0.712	0.718	0.860	0.863	0.848
Wooldridge Autocorrelation test	F-stat					
Ho: no first-order autocorrelation	9.491					P=0.0021
Granger Causality test: Lags 2	F- stat.					
Ho: FDI_LOG does not Granger Cause EXP_LOG	11.265					p=1.00E-05
Ho: EXP_LOG does not Granger Cause FDI_LOG	981.66					p=0.0000
Tests of Endogeneity						
Ho: variables are exogenous						
Robust score chi2(2):	45.765					p=0.0000
Robust regression F (2,17640):	22.967					p=0.0000
Clustered Robust Standard errors in parentheses ***** p<0.01, ** p<0.05, * p<0.1**						

Table 7.2: Impact of Inward FDI Stock on Domestic Exports by Combination of Income Groups

2SLS Regression							
Income groups: Exporter-Importer	**Low-High**	**Middle-Low**	**Middle-Middle**	**Middle-High**	**High-Low**	**High-Middle**	**High-High**
Log($FDI_{i,t-1}$)	1.194*	0.550	1.216***	0.513**	1.507	4.771	0.945***
	(0.675)	(1.641)	(0.325)	(0.204)	(2.630)	(49.70)	(0.266)
Log ($R\&D\ stock_{i,t-1}$)	3.344*	1.106	0.950***	0.734***	-0.223	2.981	1.188***
	(1.967))	(1.174)	(0.262)	(0.181)	(1.632)	(28.54)	(0.229)
Log ($R\&D\ stock_{j,t-1}$)	2.353***	0.503	0.416***	0.562***	1.269	0.082	0.167*
	(0.844)	(0.606)	(0.152)	(0.168)	(1.612)	(0.288)	(0.092)
Log($FDI_{i,t-1}$)* Log ($R\&D\ stock_{j,t-1}$)	-0.060*	-0.025	-0.055***	-0.023**	-0.062	-0.199	-0.039***
	(0.034)	(0.074)	(0.0151)	(0.009)	(0.110)	(2.080)	(0.011)
Log($FDI_{i,t-1}$* FTA)	-0.039	0.092	-0.043***	-0.004	1.401*	0.003	-0.012*
	(0.0394)	(0.787)	(0.016)	(0.009)	(0.710)	(0.113)	(0.006)
Observations	156	133	2,020	4,376	137	3,299	7,639
Adj. R-squared	0.856	0.901	0.746	0.815	0.932	0.843	0.884

Clustered Robust Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

7.2 Export Diversification Equation

Beta regression coefficients from (4.8) that are responsible for explaining the degree of export diversification in the local economy mirrored by the Herfindahl index[28] are reported in Table 7.3. Particularly, due to the non-linear characteristic of the maximum likelihood estimators, marginal effects are a function of the remaining independent variables. Hence, explanatory variables were set at their means to calculate the partial derivatives. Additionally, estimated coefficients are interpreted as quasi-elasticities. In the bottom of the table, Akaike and Bayesian information criteria[29] support that the complete model in column 5 which includes the year, country fixed effects and the interaction terms is preferred over the restricted models. Looking at the main variables in column 5, the results suggest that all variables are statistically significant at 1% level with the appropriate signs. On average a 10% increase in inward FDI stock improves Herfindahl diversification index by 0.2% while domestic and foreign R&D stock diversifies the local export basket by 0.4% and 0.1%. An appreciation in real effective exchange rate concentrates the products exported by almost 0.3%. Also, producers that export higher shares of raw materials are more concentrated by 16.3%. Common characteristics between exporters and their partners facilitate the exportation of a wider product range. For instance, exports between countries that have common borders, speak similar languages, have a common legal system and were/are controlled by each other or were/are colonies of the same conqueror are more diversified by 0.2%, 0.7%, 0.7% and 0.2% respectively. Then again, if they are geographically located far apart from each other, fewer types of products will practically reach the destination. This size of concentration is estimated to grow by 0.2% per kilometer. The second important determinant of export diversification, after domestic R&D activities, approved by the model is the FTAs. Eliminating tariffs, quotas, and other costly barriers raise the variety of exports by 0.3%. Furthermore, FDI stock interacted with domestic R&D as well as with FTA has once again a negative sign supporting that inward FDI in innovative economies and in free trade areas limits the product options purposed for sales in partner's country. Though, the size of covariates is minimal. The average FDI impact in technologically advanced economies that do not participate in FTAs is 0.02% (0.02-0.0008*22.54) and -0.02% for those who do (0.02-0.0008*22.54-0.004).

In column 6 and 7, endogeneity issues concerning inward FDI and host R&D stock are tested respectively. The columns contain residuals extracted from the regression of the endogenous variable on its lagged form and the remaining exogenous variables. Even though granger causality test[30] proves that the relationship between inward FDI and export diversification is causal from both sides, the non-significance of the FDI residual in column 6 states that causality is not problematic. Furthermore, in column 7 R&D residuals are also not significant. Because of this, 2SLS steps are not necessary and conclusions can be drawn from column 5 where Akaike and Bayesian information criteria confirm that the model is preferred over its reduced

[28] Alternatively, the number of products exported was used in place of Herfindahl-Hirschman Index in a poisson regression to measure export diversification. Even though the sign of the coefficients did not differ from the index outcomes, the size of the marginal effects was exceedingly large. Hence, poisson coefficients are not shown in this paper.

[29] The smaller are the Akaike and Bayesian statistics the better is the model explained by the variables.

[30] Pedronis cointegration test allowed for cointegration between the export diversification measure and real inward FDI stock.

forms. It follows then that, from the beta regression, inward FDI irrespective of its dimension has the ability to diversify domestic exports even in technological welfare countries where the spillovers are less inspiring. Nevertheless, in FTA blocks positive spillovers are dismissed due to the competitive pressure from larger integrated markets. As a result, hypothesis 2 is partially rejected.

Table 7.3: Impact of Inward FDI Stock on Export Diversification

Beta Regression: Marginal Effects at means							
Link: Logistic							
Dependent Variable: Herfindahl-Hirschman Product Index							
	1	**2**	**3**	**4**	**5**	**6**	**7**
Log($FDI_{i,t-1}$)	0.0047***	-0.000049	0.0002***	0.0018***	0.0248***	0.02395***	0.02214***
	(0.0002)	(0.0002868)	(0.0002)	(0.0003)	(0.0027)	(0.0248)	(0.0252)
Log ($R\&D\ stock_{i,t-1}$)	0.0150***	0.0197***	0.0198***	0.0059	0.0365***	0.0602	0.0622
	(0.0003)	(0.0004)	(0.0004)	(0.0040)	(0.0022)	(0.0440)	(0.0448)
Log ($R\&D\ stock_{j,t-1}$))	0.0006*	0.0079***	0.0079***	-0.0018	0.0097***	-0.00311	-0.00339
	(0.0004)	(0.0004)	(0.0004)	(0.0037)	(0.0009)	(0.0434)	(0.0429)
Log($FDI_{i,t-1}$)* Log ($R\&D\ stock_{j,t-1}$)	-	-	-	-	-0.0008***	-0.0091***	-0.0083***
					(0.0001)	(0.0010)	(0.0010)
Log($REER_{i,t}$)	0.0092***	0.0098***	0.0136***	0.0003	-0.0254***	-0.0088	-0.0075***
	(0.0017)	(0.0016)	(0.0016)	(0.0058)	(0.0060)	(0.0575)	(0.0552)
Log($Raw_{ij,t}$)	-2.4168***	-2.1260***	-2.0973	-1.4771***	-1.6377***	-1.2644***	-1.3267***
	(0.056823)	(0.0590)	(0.0582)	(0.0609)	(0.0661)	(0.6121)	0.5836
Contiguity	-	0.0273***	0.0266***	0.0153***	0.0159***	0.01384***	0.01443***
		(0.0025)	(0.0025)	(0.0028)	(0.0029)	(0.0265)	(0.0263)
Off. Common language	-	0.0083***	0.0075***	0.0092***	0.0069***	0.00819***	0.00636***
		(0.0025)	(0.0025)	(0.0030)	(0.0025)	(0.0290)	(0.0284)
Common Colony	-	-0.0018	0.0004***	0.0180***	0.0069***	0.01749***	0.01720***
		(0.0046)	(0.0046)	(0.0056)	(0.0048)	(0.0534)	(0.0534)
Common Legacy	-	0.0215***	0.0224***	0.0119***	0.0242***	0.01210***	0.01316***
		(0.0018)	(0.0018)	(0.0017)	(0.0018)	(0.0170)	(0.0167)
Log(Distance)		-0.0258***	-0.0250***	-0.0319***	-0.0249***	-0.02919***	-0.02894***
		(0.0009)	(0.0009)	(0.0013)	(0.0009)	(0.0137)	(0.0131)
$FTA_{ij,t}$	-	0.0128***	0.0170***	0.0133***	0.0346***	0.02879***	0.03043***
		(0.0014)	(0.0015)	(0.0019)	(0.0029)	(0.0281)	(0.0275)
Log($FDI_{i,t-1}$* FTA)	-	-	-	-	-0.0042***	-0.0396***	-0.0415***
					(0.0004)	(0.0039)	(0.0039)
Residuals-FDI						-0.0011	-
						(0.0076)	
Residuals- $R\&D\ stock_{j,t-1}$						-	-0.1126
							0.1507
Time fixed effects	No	No	Yes	Yes	Yes	Yes	Yes
Exporter fixed effects	No	No	No	Yes	Yes	Yes	Yes
Importer fixed effects	No	No	No	Yes	Yes	Yes	Yes
Observations	19329	19329	19329	19329	19329		
Goodness of fit							
Akaike Information Criterion	-42437.76	-44053.72	-44168.2	-48742.7	-48959.3		
Bayesian Information Criterion	-42382.67	-43951.42	-43995.1	-47404.9	-47597.9		
Granger Causality Test							
Null Hypothesis	F-statistic						
FDI_LOG does not Granger Cause HHI_DIVER	84.8498					p=0.0000	
HHI_DIVER does not Granger Cause FDI_LOG	128.034					p=0.0000	
Robust Standard Errors in parentheses *** p<0.01, ** p<0.05, * p<0.1							

In Table 7.4, outcomes were distinguished by the development status of the exporter and its partner. In opposition to the results in the exports equation, FDI from middle-income countries is not a significant determinant factor for other middle economies but unexpectedly it is for high-income countries. Outward FDI from high-income economies diversifies middle-income exports by 0.21% and by 0.18% the export structure of other similar advanced areas. Also, middle multinationals affect the export heterogeneity of high exporters by 0.14%. Inspecting the R&D intensive markets, FDI from high-income foreign firms has a minor influence of 0.07% in middle economies that decrease even more to a percentage of 0.013% if the area is free of trade restrictions while the equivalent impact in high economies is 0.04% and 0.015%. The insignificance of the FDI-FTA interaction term concerning high-middle country pairs suggests that export basket in innovative high economies is compressed by 0.001% independent of whether countries are free-trade partners. Then, what can be expressed is that foreign investments from high-income economies are likely to favor more middle-income exporters than high-income exporters because the knowledge gap between them may be larger. That is foreign knowledge and techniques are more precious in places where they are less familiar. In middle countries where human capital and infrastructure is growing exponentially, exporters can improve their performance by learning from proficient foreigners. Whereas, conditions in high-income countries are similar to those in other rich economies and therefore the degree of profitability is smaller. In addition, from the same table, we can see that R&D intensity in the partner's country has a larger effect in middle-high countries than in high-high countries, which supports the above reasoning, but in contrast to the export equation, the coefficients are smaller than the inward FDI coefficients. Thus, inward FDI stock is more important than partner's R&D stock for export diversification.

Table:7.4 Impact of Inward FDI on Export Diversification by Income Group

Beta Regression: Marginal Effects at means							
Link: Logistic							
Dependent Variable: Herfindahl-Hirschman Product Index							
Exporter-Importer	**Low-High**	**Middle-Low**	**Middle-Middle**	**Middle-High**	**High-Low**	**High-Middle**	**High-High**
Log($FDI_{i,t-1}$)	0.0005	0.2158	0.0051	0.0216**	-0.0074	0.0143**	0.0180***
	(0.0741)	(0.4420)	(0.0140)	(0.0106)	(0.0349)	(0.0066)	(0.0033)
Log ($R\&D\ stock_{i,t-1}$	0.4029	0.1254	0.0573***	0.0493***	0.0387***	0.0375***	0.0298***
	(0.7740)	(0.0608)	(0.0135)	(0.0135)	(0.0052)	(0.0030)	(0.0027)
Log ($R\&D\ stock_{j,t-1}$))	-0.0567	-0.1049	-0.0077	0.0209***	-0.0552***	0.0136***	0.0021**
	(0.1147)	(0.0372)	(0.0090)	(0.0047)	(0.0115)	(0.0033)	(0.0010)
Log($FDI_{i,t-1}$)* Log ($R\&D\ stock_{j,t-1}$	-0.0002	-0.0097	-0.0002	-0.0007*	0.0004	-0.0006**	-0.0006***
	(0.0037)	(0.0201)	(0.0006)	(0.0004)	(0.0013)	(0.0002)	(0.0001)
Log($FDI_{i,t-1}$* FTA)	-0.0428	0.0121	-0.0313***	-0.0053***	-0.0498***	0.0015	-0.0023***
	(0.0495)	(0.0197)	(0.0109)	(0.0018)	(0.0170)	(0.0009)	(0.0004)
Observations	140	140	2,251	4,885	153	3,505	8,125

Robust Standard Errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The general Herfindahl product index measures the diversity of exports overall industries. However, inspecting that foreign multinationals may target particular industries or/and knowledge spillovers may be industry-specific and thus only a part of exporters may gain from FDI, Herfindahl index in Table 7.5 is limited to seven industrial sectors; machinery-electrical, chemicals, metals, plastics, clothing, footwear and food products that are analytically classified in Table A.3. Estimations show that the FDI effect is statistically significant in all sectors and has its largest export diversity power in chemical products, where a 10% increase in inward FDI stock raise Herfindahl index by 0.5%. The following sectors that have the largest FDI estimates are metals (0.47%), machinery-electrical products (0.41%), food (0.347%), plastics (0.344%), textiles-clothing (0.32%) and footwear (0.23%). Though, it is clear that R&D activities are not significant in all sectors. Host technological research is important in machinery, chemical, plastics and footwear industries while foreign experimentation affects significantly only machinery and chemical sectors. A possible answer to the latter result could be that R&D activities are mostly taking place in industries where rivals cannot easily exploit methods and techniques, confirming the opinion in the paper of Aghion et al. (2005). Calculating the FDI marginal effects in R&D intensive areas, the results that emerge for machinery products are 0.05% and for FTA connected countries is -0.006%. For chemical domestic exporters corresponding marginal effects are 0.07% and 0.03%, for plastic exporters are 0.05% and 0.03%, and for footwear, exporters are 0.04% and 0.002%. The percentages show that the export diversifying impact of FDI is lower in industries where the low-skilled labour supply is large, the elasticity of substitution is high and consequently, R&D efforts are low – such as in the footwear sectors – Indicating that multinationals might be quite protective when their techniques can freely be reproduced by domestic firms and later sold at lower prices.

Table:7.5: Impact of Inward FDI on Export Diversification by Industry

Beta Regression: Marginal Effects at means							
Link: Logistic							
Dependent Variable: Herfindahl-Hirschman Product Index by Sector of Industry							
Sector of Industry	**Machinery**	**Chemicals**	**Metals**	**Plastics**	**Clothing**	**Footwear**	**Food**
Log($FDI_{i,t-1}$)	0.0411***	0.0501***	0.0474***	0.0344***	0.0329***	0.0239***	0.0347***
	(0.0035)	(0.0058)	(0.0054)	(0.0055)	(0.0042)	(0.0075)	(0.0059)
Log ($R\&D\ stock_{i,t-1}$	0.0247***	0.0360***	0.0061	0.0335***	0.0094	0.0427***	0.0024
	(0.0064)	(0.0107)	(0.0102)	(0.0106)	(0.0076)	(0.0111)	(0.0103)
Log ($R\&D\ stock_{j,t-1}$))	0.0105***	0.0135***	-0.0024	-0.0002	0.0079	0.0040	-0.0091
	(0.0049)	(0.0075)	(0.0069)	(0.0072)	(0.0064)	(0.0105)	(0.0086)
Log($FDI_{i,t-1}$)* Log ($R\&D\ stock_{j,t-1}$)	-0.0016***	-0.0019***	-0.0017***	-0.0013***	-0.0012***	-0.0009***	-0.0014***
	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0003)	(0.0002)
Log($FDI_{i,t-1}$* FTA)	-0.0050***	-0.0045***	-0.0034***	-0.0017***	-0.0040***	-0.0034***	-0.001***
	(0.0005)	(0.0009)	(0.0011)	(0.0008)	(0.0007)	(0.0011)	(0.0009)
Robust Standard Errors in parentheses *** p<0.01, ** p<0.05, * p<0.1							

7.3 Technological Gap Equation

Table 7.6 reports the 2SLS estimates of model 4.10 and the outcomes of beta regression for model 4.11. Where the index of technological gap replaced the R&D stock variables to account for differences in absorptive capacity reflected by the deviations in R&D expenditures[31]. Technological gap covariate in export equation appeared in column 1 is statistically significant and positive indicating that the larger is the partner's absorptive capacity the more exports are directed to them (2%). This could be due to the fact that exporters are targeting sizable markets that usually are advanced regions. In column 2 technological gap is interacted with inward FDI to capture the change in FDI impact when exporters and their partners deviate in their abilities to absorb new knowledge and techniques. The interaction term is statistically significant at 1% level and has a negative sign which states that the bigger is the technological gap, or in other words, the less capable are exporters to absorb spillovers compared to their partners, the fewer advantages they will reap (-0.2%). Deriving the average marginal effect, an exporter that is twice less progressive than his partner will have an increase of 0.4% (0.0511-0.0165*log (3)) in his exports toward the partner's country and if they also operate under FTA a reduction of 0.2%(0.0511-0.0165*log (3)-0.0207). From an export diversification perspective, technological distant countries are exporting a narrower basket of products (-0.4%). Incorporating the interaction term in column 4 turns the positive FDI effect into a negative one that still remains highly significant. Nevertheless, calculating the FDI partial effect we conclude that an average exporter with poor innovative abilities that deviates twice compared to his partner experiences a negligible upward movement in HHI index by 0.0002%. Yet the effect between FTA members is not significant.

To examine the non-linear relationship between the technological gap and FDI effect on exports and export diversification, that is supported in previous empirical works; squared terms of the technological gap and its interaction with inward FDI stock are added. In column 3, squared terms are statistically significant at 1% level. Nonetheless, hypothesis 3 is rejected because the non-linear relationship does not support a diminishing increase in real exports. In contrast, the results prove that FDI impact is decreasing as the technological gap increases but with diminishing returns. That is exporting countries that differ substantially in technologies compared to their partners observe a lower FDI impact on their real exports than those that differ less, giving a U-shape to the relationship instead. For instance, an exporter that is three times less advanced than his partner will observe an increase of 0.93% in his real exports (0.1075-0.2410*log (4) +0.1085*log (16)) while an exporter that is twice less advanced will observe a 0.96% (0.1075-0.2410*log (3) +0.1085*log (9)). For countries that are equally advanced, the FDI impact is 1%. In free trade areas the percentages are 0.78%,0.81 and 0.85% respectively. On the other hand, in column 6, the squared term of the technological gap is not significant proving that inward FDI and technological gap exhibit a linear relationship in the export diversification equation. Therefore, hypothesis 4 is rejected as well.

[31] Other measures of technological gap such as differences in human capital and capital formation were estimated but without significance.

Table: 7.6: Impact of Inward FDI on Export Level and Export Diversification-Technological Gap

	2SLS	2SLS	2SLS	Beta	Beta	Beta
	Log(Exports)	Log (Exports)	Log(Exports)	HHI	HHI	HHI
Log($FDI_{i,t-1}$)	0.0309***	0.0511***	0.1075***	0.0082***	-0.00131***	0.00380***
	(0.0017)	(0.0034)	(0.0104)	(0.0002)	(0.0005)	(0.00103)
Log($TG_{it,t}$)	0.203***	0.384***	3.6876***	-0.0388***	-0.0194***	-0.0313
	(0.0441)	(0.0506)	(0.5379)	(0.0014)	(0.0044)	0(.0242)
Log($TG_{it,t}$)^2	-	-	-1.5941***			0.0038
		-	(0.2414)			(0.0102)
Log($FDI_{i,t-1}$)* Log($TG_{it,t}$)	-	-0.0165***	-0.2410***	-	0.0028***	-0.0082***
		(0.0021)	(0.0317)		(0.0004)	(0.0031)
Log($FDI_{i,t-1}$)* Log($TG_{it,t}$)^2	-	-	0.1085***	-	-	0.0048***
			(0.0146)			(0.0014)
Log($FDI_{i,t-1}$* FTA)	-	-0.0207***	-0.0148***	-	-0.0033	-0.0045***
		(0.0024)	(0.0022)		(0.005)	(0.0004)
Observations	17,042	17,042	17,042	18,342	18,342	18,342
Adj.R-squared	0.865	0.865	0.864			

Clustered robust standard errors for the export equations and robust standard errors for the export diversification equations in parentheses
*** p<0.01, ** p<0.05, * p<0.1

8. CONCLUSIONS

The present paper gave an insight into the connection between inward FDI, export level, and export diversification. Theoretical background witnesses that multinationals' decisions to establish their operations overseas not only cause adjustments in the source economies but are also said to affect markets in the recipient countries through direct and indirect relationships. Foreign companies emit positive externalities to domestic firms and therefore improve their productivity. Despite that, non-desirable outcomes are possible to occur if foreign entrepreneurs are antagonistic to local firms. This paper moved a step further by investigating whether productivity upgrade due to foreign presence dominates over competitive effect and thus enhance domestic export performance or/and create new export lines.

Utilizing a gravity trade model that assumes heterogeneous countries by specifying a gravitational constant as a function of inward FDI stock and R&D stocks in the host and foreign economy, the outcomes generated from a panel sample of 80 countries for the years 2001-2012, are optimistic. An increase of 10% in bilateral inward FDI raises the domestic exports towards multinationals' origin by 7.1%.and by 0.4% the Herfindahl index that measures the variety of exports sold in multinationals 'country of origin. Nevertheless, the paper has also demonstrated that technologically advanced countries experience a lower FDI impact on both exports (0.3%) and export diversification (0.02%). This fact is attributed to the exporters' familiarity with the knowledge and techniques used by multinationals. In addition, a negative significant impact on export diversification was estimated in free trade areas (-0.02%), where the limitation of trade barriers induced innovative countries to export the products for which they have a comparative

advantage and thus concentrate their export basket. An explanation for this was based on the competitive pressure that domestic exporters were facing from multinationals when due to the market enlargement more foreign firms were establishing their operations in the country. Next, the FDI effects were estimated in groups of countries that were detected by their level of development. The FDI spillovers favoured mostly middle-middle groups in respect of exports (12.2%) who could benefit in innovative areas as well (0.4%) Yet in FTAs, the group was negatively (-0.02) affected while high-high country pairs were able to deal with competition and enjoy positive externalities (0.1%). From the diversification perspective, FDI impact has a larger influence in middle-high groups (0.14%) and this privilege persists in R&D intensive countries (0.013%). However, in integrated groups, high-high groups who were slightly better of (0.015%) took this advantage. Then the export diversification analysis was extended to seven industrial sectors were multinationals were particularly responsible for the increase in the variety of chemical exports in experimental areas. Though in free trade regions chemical and plastic products experienced the highest impact from FDI spillovers (0.03%) in contrast to machinery products that were concentrated minimally (-0.006). Finally, the empirical work introduced the technological gap between exporters and their partners to count for differences in absorptive capacities as a determinant factor for exports and export diversification and to test whether FDI effect was affected by this divergence. Firstly, the estimations have rejected the inverted U-shape relationship between FDI effects and technological gap that was found in the previous literature suggesting instead a U-shape connection between FDI impact and export level and a linear relation between FDI impact and export diversification.

To bring to an end, additional work can be done to provide more explicit answers to the current research questions. For instance, exports value is a general measure that fails to distinguish the value of exports coming from local firms from those of foreign multinationals located in the home country. Hence, the outcomes may overestimate the impact of inward FDI on domestic exports since any improvement might comprise increase in foreign exports that apparently do not completely represent a rise in domestic productivity. Since foreign exports are not available in a frequent basis an alternative measure could be the value of re-exports. In this way, any rise in re-exports may capture multinationals' special preferences for processing their intermediate goods in the home economy and thus improvement in domestic productivity. Furthermore, Herfindahl-Hirschman index is a broad measure of export diversification, which counts for any adjustments in the existing export shares, as well as the addition of new products in the export basket. As a result, estimations may not reveal the product creativeness of native exporters. A solution to this could be the usage of extensive and intensive margins to discriminate whether foreign investments cause a change in the allocation of the existing exports or they motivate domestic exporters to produce and sell abroad fresh products by magnifying local R&D efforts. Finally, limitations may arise from the FDI observations, which are the total number of greenfield and M&A investments. As literature review suggests that vertical FDI – usually represented by M&A – is the main source of knowledge spillovers, separating FDI stock by type of investment would give coefficients that are more precise. Moreover, obtaining FDI stock by industry would provide exact estimates for the export diversification in industrial sectors. Since access to more comprehensive data becomes quiet convenient day after day, future studies are expected to provide greater transparency of how foreign investors affect exports and export diversification in the host economy.

9.Appendix

Table A.1: Countries included in the Sample

Europe				Asia		America		Africa	
ALB	Albania	**ITA**	Italy	**ARM**	Armenia	**ARG**	Argentina	**GAB**	Gabon
AUT	Austria	**LVA**	Latvia	**AZE**	Azerbaijan	**BRA**	Brazil	**GMB**	Gambia
BLR	Belarus	**LTU**	Lithuania	**BHR**	Bahrain	**CAN**	Canada	**MDG**	Madagascar
BEL	Belgium	**MLT**	Malta	**CHN**	China	**CHL**	Chile	**MAR**	Morocco
BIH	Bosnia and Herzegovina	**NLD**	Netherlands	**HKG**	Hong Kong, China	**COL**	Colombia	**ZAF**	South Africa
BGR	Bulgaria	**NOR**	Norway	**IND**	India	**CRI**	Costa Rica		
HRV	Croatia	**POL**	Poland	**IRN**	Iran	**ECU**	Ecuador		**Oceania**
CYP	Cyprus	**PRT**	Portugal	**ISR**	Israel	**SLV**	El Salvador	**AUS**	Australia
CZE	Czech Republic	**MDA**	Republic of Moldova	**JPN**	Japan	**GTM**	Guatemala	**NZL**	New Zealand
DNK	Denmark	**ROM**	Romania	**KAZ**	Kazakhstan	**JAM**	Jamaica		
EST	Estonia	**RUS**	Russian Federation	**KOR**	Korea	**MEX**	Mexico		
FIN	Finland	**SVK**	Slovakia	**KGZ**	Kyrgyzstan	**PAN**	Panama		
FRA	France	**SVN**	Slovenia	**MYS**	Malaysia	**69**	Paraguay		
DEU	Germany	**ESP**	Spain	**MNG**	Mongolia	**70**	Peru		
GRC	Greece	**SWE**	Sweden	**OMN**	Oman	**VCT**	Saint Vincent and the Grenadines		
HUN	Hungary	**CHE**	Switzerland	**PHL**	Philippines	**TTO**	Trinidad and Tobago		
ISL	Iceland	**UKR**	Ukraine	**SAU**	Saudi Arabia	**USA**	United States		
IRL	Ireland	**GBR**	United Kingdom	**SGP**	Singapore				
				THA	Thailand				
				TUR	Turkey				

Table A.2: Countries excluded from the Sample

Africa				America		Asia		Oceania	
DZA	Algeria	**NGA**	Nigeria	**AIA**	Anguilla	**AFG**	Afghanistan	**COK**	Cook Islands
AGO	Angola	**RWA**	Rwanda	**ATG**	Antigua and Barbuda	**BGD**	Bangladesh	**PYF**	French Polynesia
BEN	Benin	**SHN**	Saint Helena	**ABW**	Aruba	**BTN**	Bhutan	**GUM**	Guam
BWA	Botswana	**SYC**	Seychelles	**BHS**	Bahamas	**BRN**	Brunei Darussalam	**KIR**	Kiribati
BFA	Burkina Faso	**SOM**	Somalia	**BLR**	Barbados	**KHM**	Cambodia	**MHL**	Marshall Islands
BDI	Burundi	**SDN**	Sudan	**BLZ**	Belize	**IDN**	Indonesia	**FSM**	Micronesia
CMR	Cameroon	**SWZ**	Swaziland	**BMU**	Bermuda	**IRQ**	Iraq	**NRU**	Nauru
CAF	Central African Republic	**TZA**	Tanzania	**BOL**	Bolivia	**JOR**	Jordan	**NCL**	New Caledonia
CPV	Cape Verde	**TGO**	Togo	**NL-BQ**	Bonaire, Sint Eustatius and Saba	**KWT**	Kuwait	**NIU**	Niue
TCD	Chad	**TUN**	Tunisia	**VGB**	British Virgin Islands	**LAO**	Laos	**MNP**	Northern Mariana Islands
COM	Comoros	**UGA**	Uganda	**CYM**	Cayman Islands	**LBN**	Lebanon	**PCI**	Pacific Islands, Trust Territory
COD	Congo	**ESH**	Western Sahara	**CUB**	Cuba	**MAC**	Macao	**PLW**	Palau
CIV	Cote d'Ivoire	**ZMB**	Zambia	**CUW**	Curacao	**MDV**	Maldives	**PNG**	Papua New Guinea
DJI	Djibouti	**ZWE**	Zimbabwe	**DMA**	Dominica	**MMR**	Myanmar	**WSM**	Samoa
EGY	Egypt			**DOM**	Dominican Republic	**PAK**	Pakistan	**SLB**	Solomon Islands
GNQ	Equatorial Guinea			**FLK**	Falkland Islands	**QAT**	Qatar	**TKL**	Tokelau
ERI	Eritrea			**FJI**	Fiji	**LKA**	Sri Lanka	**TON**	Tonga
ETH	Ethiopia			**GRL**	Greenland	**PSE**	The State of Palestine	**TUV**	Tuvalu
GHA	Ghana			**GRD**	Grenada	**SYR**	Syria	**VUT**	Vanuatu
GIN	Guinea			**GUY**	Guyana	**TWN**	Taiwan, China	**WLF**	Wallis and Futuna Islands
GNB	Guinea-Bissau			**HTI**	Haiti	**TCA**	Turks and Caicos Islands		
KEN	Kenya			**HND**	Honduras	**PRK**	Korea, Dem. Rep	**Europe**	
LSO	Lesotho			**MSR**	Montserrat	**TJK**	Tajikistan	**AND**	Andorra
LBR	Liberia			**ANT**	Netherlands Antilles	**TLS**	Timor-Leste	**FRO**	Faeroe Islands
LBY	Libya			**NIC**	Nicaragua	**TKM**	Turkmenistan	**GEO**	Georgia
MLI	Mali			**PRI**	Puerto Rico	**ARE**	United Arab Emirates	**GIB**	Gibraltar
MRT	Mauritania			**LCA**	Saint Lucia	**UZB**	Uzbekistan	**VAT**	Holy See, Vatican City
MUS	Mauritius			**KNA**	Saint Kitts and Nevis	**VNM**	Vietnam	**SCG**	Kosovo
MWI	Malawi			**SPM**	Saint Pierre and Miquelon	**YEM**	Yemen	**LIE**	Liechtenstein
MOZ	Mozambique			**SXM**	Sint Maarten			**LUX**	Luxembourg
NAM	Namibia			**SUR**	Suriname			**MKD**	Macedonia, FYR
NER	Niger			**URY**	Uruguay			**MCO**	Monaco
								SRB	Serbia
								MNE	Montenegro

Table A.3: HS Industrial Sectors

Industry	HS 1988/92 Nomenclature	Description
Food Production	16	PREPARATIONS OF MEAT, OF FISH OR OF CRUSTACEANS, MOLLUSCS OR OTHER AQUATIC INVERTEBRATES
	17	SUGARS AND SUGAR CONFECTIONERY
	18	COCOA AND COCOA PREPARATIONS
	19	PREPARATIONS OF CEREALS, FLOUR, STARCH OR MILK; PASTRYCOOKS' PRODUCTS
	20	PREPARATIONS OF VEGETABLES, FRUIT, NUTS OR OTHER PARTS OF PLANTS
	21	MISCELLANEOUS EDIBLE PREPARATIONS
	22	BEVERAGES, SPIRITS, AND VINEGAR
	23	RESIDUES AND WASTE FROM THE FOOD INDUSTRIES; PREPARED ANIMAL FODDER
	24	TOBACCO AND MANUFACTURED TOBACCO SUBSTITUTES
Chemicals	28	INORGANIC CHEMICALS; ORGANIC OR INORGANIC COMPOUNDS OF PRECIOUS METALS, OF RAREEARTH METALS, OF RADIOACTIVE ELEMENTS OR OF ISOTOPES
	29	ORGANIC CHEMICALS
	30	PHARMACEUTICAL PRODUCTS
	31	FERTILISERS
	32	TANNING OR DYEING EXTRACTS; TANNINS AND THEIR DERIVATIVES; DYES, PIGMENTS, AND OTHER COLOURING MATTER; PAINTS AND VARNISHES; PUTTY AND OTHER MASTICS; INKS
	33	ESSENTIAL OILS AND RESINOIDS; PERFUMERY, COSMETIC OR TOILET PREPARATIONS
	34	SOAP, ORGANIC SURFACE-ACTIVE AGENTS, WASHING PREPARATIONS, LUBRICATING PREPARATIONS, ARTIFICIAL WAXES, PREPARED WAXES, POLISHING OR SCOURING PREPARATIONS, CANDLES AND SIMILAR ARTICLES, MODELLING PASTES, 'DENTAL WAXES' AND DENTAL PREPARATION
	35	ALBUMINOIDAL SUBSTANCES; MODIFIED STARCHES; GLUES; ENZYMES
	36	EXPLOSIVES; PYROTECHNIC PRODUCTS; MATCHES; PYROPHORIC ALLOYS; CERTAIN COMBUSTIBLE PREPARATIONS
	37	PHOTOGRAPHIC OR CINEMATOGRAPHIC GOODS
	38	MISCELLANEOUS CHEMICAL PRODUCTS
Plastics	39	PLASTICS AND ARTICLES THEREOF
	40	RUBBER AND ARTICLES THEREOF
Textiles-Clothing	50	SILK
	51	WOOL, FINE OR COARSE ANIMAL HAIR; HORSEHAIR YARN AND WOVEN FABRIC
	52	COTTON
	53	OTHER VEGETABLE TEXTILE FIBRES; PAPER YARN AND WOVEN FABRICS OF PAPER YARN
	54	MANMADE FILAMENTS; STRIP AND THE LIKE OF MANMADE TEXTILE MATERIALS
	55	MANMADE STAPLE FIBRES
	56	WADDING, FELT, AND NONWOVENS; SPECIAL YARNS; TWINE, CORDAGE, ROPES AND CABLES AND ARTICLES THEREOF
	57	CARPETS AND OTHER TEXTILE FLOOR COVERINGS
	58	SPECIAL WOVEN FABRICS; TUFTED TEXTILE FABRICS; LACE; TAPESTRIES; TRIMMINGS; EMBROIDERY
	59	IMPREGNATED, COATED, COVERED OR LAMINATED TEXTILE FABRICS; TEXTILE ARTICLES OF A KIND SUITABLE FOR INDUSTRIAL USE
	60	KNITTED OR CROCHETED FABRICS
	61	ARTICLES OF APPAREL AND CLOTHING ACCESSORIES, KNITTED OR CROCHETED
	62	ARTICLES OF APPAREL AND CLOTHING ACCESSORIES, NOT KNITTED OR CROCHETED

	63	OTHER MADE UP TEXTILE ARTICLES; SETS; WORN CLOTHING AND WORN TEXTILE ARTICLES; RAGS

Table A.3 (Cont.)

Footwear	64	FOOTWEAR, GAITERS, AND THE LIKE; PARTS OF SUCH ARTICLES
	65	HEADGEAR AND PARTS THEREOF
	66	UMBRELLAS, SUN UMBRELLAS, WALKING-STICKS, SEATSTICKS, WHIPS, RIDINGCROPS, AND PARTS THEREOF
	67	PREPARED FEATHERS AND DOWN AND ARTICLES MADE OF FEATHERS OR OF DOWN; ARTIFICIAL FLOWERS; ARTICLES OF HUMAN HAIR
Metals	72	IRON AND STEEL
	73	ARTICLES OF IRON OR STEEL
	74	COPPER AND ARTICLES THEREOF
	75	NICKEL AND ARTICLES THEREOF
	76	ALUMINIUM AND ARTICLES THEREOF
	78	LEAD AND ARTICLES THEREOF
	79	ZINC AND ARTICLES THEREOF
	80	TIN AND ARTICLES THEREOF
	81	OTHER BASE METALS; CERMETS; ARTICLES THEREOF
	82	TOOLS, IMPLEMENTS, CUTLERY, SPOONS, AND FORKS, OF BASE METAL; PARTS THEREOF OF BASE METAL
	83	MISCELLANEOUS ARTICLES OF BASE METAL
Machinery and Electrical	84	NUCLEAR REACTORS, BOILERS, MACHINERY AND MECHANICAL APPLIANCES; PARTS THEREOF
	85	ELECTRICAL MACHINERY AND EQUIPMENT AND PARTS THEREOF; SOUND RECORDERS AND REPRODUCERS, TELEVISION IMAGE AND SOUND RECORDERS AND REPRODUCERS, AND PARTS AND ACCESSORIES OF SUCH ARTICLES
	86	RAILWAY OR TRAMWAY LOCOMOTIVES, ROLLING-STOCK AND PARTS THEREOF; RAILWAY OR TRAMWAY TRACK FIXTURES AND FITTINGS AND PARTS THEREOF; MECHANICAL (INCLUDING ELECTROMECHANICAL) TRAFFIC SIGNALLING EQUIPMENT OF ALL KINDS
	87	VEHICLES OTHER THAN RAILWAY OR TRAMWAY ROLLING-STOCK, AND PARTS AND ACCESSORIES THEREOF

Table A.4: Descriptive Statistics

Variables	Observations	Mean	St. Deviation	Min	Max
Real Exports ($)	31984	2.87E+12	1.23E+13	1055.724	3.22E+14
Herfindahl-Hirschman Product Index (HHI)	32179	0.8338283	0.2109046	0.0001	0.9998
HHI-Machinery &Electronics	29864	0.8154319	0.2052061	0.0002	0.9999
HHI-Chemicals	28358	0.7332111	0.2430727	0.0001	0.9999
HHI-Textiles &Clothing	28531	0.7993879	0.2301788	0.0001	0.9999
HHI-Food	27145	0.7052861	0.2455131	0.0001	0.9999
HHI-Metals	28756	0.7573234	0.2470112	0.0001	0.9999
HHI-Plastics	27778	0.7590873	0.2351211	0.0001	0.9999
HHI-Footwear	22827	0.6843151	0.2443107	0.0001	0.9999
Real Inward FDI Stock ($)	26682	3.58E+09	1.89E+10	0	4.61E+11
Share of Raw Materials	29831	.0001689	.0002419	0	.001027
Real R&D stock ($)	808	6.63E+10	2.18E+11	75424.4	1.80E+12
R&D expenditures (% GDP)	768	.0113988	.0099696	.0002	.0448
Technological Gap	26143	3.445986	8.694232	0.007326	175
Real GDP per capita ($)	928	16520.23	16662.49	249.064	68920.2
Real effective exchange rate	892	134.2392	121.2371	30.2224	928.03
Weighted Distance(km)	2841	5716.718	4493.508	160.908	19539.5
Common Official Language	2841	0.1031453	0.3041533	0	1
Contiguity	2841	0.0593422	0.2362677	0	1
Common Colony	2841	0.0367059	0.1880416	0	1
Common Legacy	2841	0.2986181	0.4576591	0	1
Free Trade Agreement	31984	0.2628189	0.4401718	0	1
Income Group*	928	2.40317	0.5959876	1	3
Combination of Income Groups**	2841	5.797333	2.179373	1	9

*Income group: Low-Income=1; Middle-Income=2; High-Income=3
**Combination of Income Groups: Low-Low=1; Low-Middle=2; Low-High=3; Middle-Low=4; Middle-Middle=5; Middle-High=6; High-Low=7; High-Middle=8; High-High=9.

Table A.5: Correlation Matrix

	Log(Exports)	Log($FDI_{i,t-1}$)	Log (R&D $stock_{i,t-1}$	Log (R&D $stock_{j,t-1}$)	Log($GDP_{i,t}$)	Log($GDP_{j,t}$)	Contiguity	Language	Legacy	Colony	Log(Distance)
Log(Exports)	1										
Log($FDI_{i,t-1}$)	0.4331	1									
Log (R&D $stock_{i,t-1}$	0.6574	0.1923	1								
Log (R&D $stock_{j,t-1}$)	0.3783	0.3676	-0.0167	1							
Log($GDP_{i,t}$)	0.4158	0.071	0.6812	-0.0131	1						
Log($GDP_{j,t}$)	0.1386	0.3441	0.0044	0.4572	0.0121	1					
Contiguity	0.2276	0.1416	0.003	-0.0185	-0.0078	-0.0556	1				
Language	0.1609	0.1268	0.059	0.0065	0.0303	-0.0295	0.1232	1			
Legacy	0.0414	0.0043	-0.1085	-0.1861	-0.0965	-0.2199	0.2299	0.3918	1		
Colony	-0.0612	-0.0285	-0.1501	-0.1816	-0.1018	-0.1745	0.0708	0.0929	0.2604	1	
Log(Distance)	-0.1841	-0.1186	0.0736	0.1748	-0.068	-0.0691	-0.4066	0.0817	-0.1439	-0.1056	1
Log(REER)	-0.0421	-0.0105	-0.1021	0.0481	-0.2078	0.0291	-0.0017	-0.0117	0.0108	0.0032	-0.0132
$FTA_{i,t}$	0.2057	0.1421	0.107	-0.0142	0.2821	0.2331	0.1386	0.0075	-0.0074	0.0043	-0.4566
Log($TG_{it,t}$)	0.0188	-0.1034	-	-	0.2329	-0.2087	-0.0416	0.0128	-0.0126	-0.0065	0.0915

	Log($REER_{i,t}$)	$FTA_{i,t}$	Log($TG_{ij,t}$)
Log($REER_{i,t}$)	1		
$FTA_{i,t}$	-0.043	1	
Log($TG_{it,t}$)	-0.0398	-0.047	1

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