



Foreign Direct Investment and Exports: Complementarity or Substitutability An Empirical Investigation

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ABSTRACT

The relationship between trade and direct investment, which is one of the main features of globalization, is complex and cannot be deduced from a purely theoretical analysis. The present paper seeks to lay the analytical foundation that would define the nature of the relationship – be it complementary or substitutive - between exports and foreign direct investment (FDI). The purpose of our use of disaggregate sectoral database is to explore these issues econometrically while analyzing and decomposing the nature of the relationship between FDI and exports. The estimation results showed a complementary effect or a ripple effect between exports and FDI at the macro level for both manufactured and non-manufacturing sectors. Our findings have also been supported by predominant literature which finds positive relationships between FDI and exports.

Keywords: Foreign Direct Investment, Exports, Substitutability, Complementarity, Manufacturing, Non-manufacturing

JEL Classifications: F02, F4, F14

1. INTRODUCTION

In most developing countries, import substitution strategies have failed to promote the industrialization process. Diversification was very timid and production systems have suffered from a restrictive trade policy characterized by high trade barriers. According to the literature, three methods for analyzing links between foreign direct investment (FDI) and international trade, which correspond to different levels of aggregation is over, namely the micro level, the macro level and the sectoral level (Fontagne, 1999). The links between investment and trade are generally considered from the perspective of the investor country or countries of origin, from the recipient country or host country and third countries. Moreover, in the context of our work, we will bet on the economies of some developing countries that are focusing on the host country. The links between trade and direct investment, which is one of the main features of globalization, are complex and cannot be deduced from a purely theoretical analysis.

In the same framework, an analysis has been conducted by Fontagné (1999), based on an aggregate of 14 countries, found that every dollar invested abroad produces about two dollars of

additional exports. By contrast, in the host countries, mostly, foreign short-term investments tend to increase imports while export growth appears only in longer term. However, in short-term, the host countries derive many benefits of foreign investments i.e., technology transfer (Wang, 1990), job creation and local subcontracting.

The impact of FDI on trade has been the subject of numerous debates and studies since the analysis of this impact allows having an idea about the effect of globalization on the international expertise of the economy and can therefore help to understand the effects on well-being. However, as pointed out, the extent of the links between investment and trade raises a series of questions. The purpose of our use of a sectoral database is to explore these issues econometrically. The present paper seeks to lay the analytical foundation that would define the nature of the relationship - in terms of complementary or alternative - between trade and FDI. In our work, we are primarily interested in discussing theoretically and empirically the relationship between FDI and exports. On the other hand, the nature of the relationship between FDI and exports will be analyzed by distinguishing between manufacturing and non-manufacturing exports.

The present paper has some originality. Indeed, the substitutability/complementarity issue, between FDI and exports, has been treated in the previous studies on the subject. However, most of them use aggregated data. In this work, we empirically review the question of whether export and FDI substitute or complement each other by using of more disaggregated data on the macroeconomic variables. In consequence, our study relies on a disaggregated data for the manufacturing and non-manufacturing sectors relative to 10 developing and non-developing countries.

The paper is organized as follows: Section 2 presents a review on the relationship between FDI and exports, Section 3 outlines some methodological aspects related to the estimations based on panel data analysis. Section 4 presents the empirical results and their interpretation. Section 4 presents our empirical results, and Section 5 concludes the paper.

2. FDI AND EXPORTS: THEORIES AND EMPIRICAL EVIDENCE

It is reasonable to suggest that the link between FDI and trade in goods will be strong and may be bidirectional but it is less clear whether the impact of FDI on exports is dependent on various types of trade flows.

This work aims to provide preliminary answers to these questions through theoretical and empirical analyses. The inflow of FDI is expected to increase the production and the productivity, encourage and stimulate local development and diffuse technologies investment (Alfaro et al., 2004). It can be seen as a complement of international trade as long as the relative endowment and the remuneration of the factors of production are sufficiently different between countries (Helpman, 1984). Companies would therefore be interested in fragmenting geographically the different stages of production by locating unskilled labor-intensive activities in countries with low wages and skilled labor-intensive activities in industrialized countries. In this logic, the elimination of trade barriers would facilitate verticals FDI.

The economic literature reports two main motivations for FDI: The pursuing of opportunities and the search of efficiency. Empirical analyses also tend to show that macroeconomic stability, country risk and government policies are important determinants of FDI.

During the 1990s, the international trade and the global output have tripled. There was a significant growth in the global output, increasing from 10.5 trillion in 1980 to almost 32 trillion in 2002 and the total merchandise exports incline from 2 to 6.4 trillion dollars for the same period. The surge in FDI was much more important, because the value of FDI stock in 2002 symbolized 10 times its value in 1980; >700 billion in 1980. It reached 7.1 trillion in 2002 (UNCTAD, database).

These statistics leaves us to question the causal relationship between international trade and FDI, several questions should be raised. How do we explain this jump several times greater than the growth in international trade? Is it the result of the trade liberalization? In addition, is it also linked to economic factors

such as gross domestic product (GDP) per capita, the economic stability, the inflation, the size of the economy, the government spending and the growth of the world economy?

However, before analyzing theoretically the nature of relationship between FDI and exports we will discuss the contribution of the theory of multinational enterprises. Indeed, the factors that cannot be observed, such as the style of organizational activities of the company or the size and the income level of the host country, the proximity, the transportation costs and tariffs, affect the results of the nature of the link. To date, this link has never been systematically studied in previous works that have been devoted, that is to say, in light of the disaggregated data by sector for many countries data.

2.1. Theories of Multinational Company (MNC)

The traditional literature on international trade was the first approach advancing models of multinational enterprises. The theory of capital flows (Caves, 1971; 1996) reports that FDI has an impact on the industry for both host and investor country. This theory has generated clear results, arguing that corporate activities should be placed in the capital abundant countries with subsidiaries in capital poor countries. There is no reason that the FDIs are implanted between identical countries. Moreover, the different approaches and the main theories concerned with multinational discussed and debated a relative contribution on the nature of the FDIs.

Horizontal FDIs encourage foreign producers to “jump” trade barriers by replicating similar businesses in different markets. These IDEs involve substitution between trade and FDI. However, vertical FDIs associated with production fragmentation, create trade in intermediate goods.

New Theory of International Trade (NTIT) has enriched the analysis of the MNC (Brainard, 1993; Markusen, 1995) by addressing the shortcomings of the traditional theory through integrating elements such as imperfect competition, product differentiation and economies of scale. It points to an arbitration of multinational firm (MNC) between proximity and concentration. Economies of scale and transport costs recreate a key role in the decision process. Increasing returns to scale limit the number of Effective production units while transport costs and, more generally, trade barriers tend to work in the opposite direction. Moreover, the trade-off between “proximity and concentration” (Brainard, 1993) serves to explain the circumstances in which one can provide the substitutability between FDI and trade. However, the question of whether FDI and trade are complementary or not, cannot be determined theoretically, the nature of their relationship is essentially an empirical question. However, while analyzing the nature of the relationship between the two variables, it is expected to detect the given factors that explain FDI, being the size of the market for horizontal strategy, and the search for low-cost strategy for vertical factors.

2.1.1. Horizontal FDI

The NTIT focuses on the horizontal FDIs that cover conquest strategies of local markets, essentially in developed countries.

High transport costs incurred by horizontal FDI make them more costly trade. The MNCs of horizontal type are created if the benefits of consumer nearby location are greater than those related to the concentration of activities. Therefore, the firm implements several production sites to serve local markets provided it achieves economies of scale, the costs of implementing of these different sites should reduce transport costs and increase market demand.

The strategies of multinationals are able to serve the foreign market through the establishment of a new subsidiary instead of resorting to export based on many factors, like trade costs and size market determining the creation of a horizontal MNC. Markusen (1984) is one of the pioneers in explaining that the horizontal FDI model is generated by the engine of the economies of scale at firm's level. He argues that a company with two subsidiaries has a fixed cost twice less than the fixed cost of a company with one subsidiary, which encourages the multiplication of subsidiaries.

Markusen (1995) described the horizontal multinational as an alternative option to trade and local firms provided that the amount of direct investment abroad increases with a greater proportion than trade, as rates and transportation costs increase. However, Brainard (1993) suggests that horizontal FDI appear as an alternative to export if trade costs are higher than the fixed costs of setting up a new subsidiary, known as proximity-concentration approach. MNCs horizontal type split their activities between countries according to different comparative advantages. The model of Markusen and Venables (1996) distinguishes multinational according to this typology and complete results of Brainard (1993) model.

2.1.2. Vertical FDI

The production in a foreign country may be accompanied by exports of intermediate goods from the country of origin to the host country in order to be used as resources for local production of final goods. However, the increase in trade costs may encourage producers to fragment the production process, by implementing the intensive stage production work in low-wage countries, and the more capital-intensive (R and D assembly, headquarters units, etc.) stage production in industrialized countries. The various operations of subsidiaries of MNCs specialize from localization advantages in the host country as a strategy for international division of the production process (Mulder and Rabaud, 1996).

Low transport costs encourage vertical FDI since they make available the use of a cheap labor work. Each subsidiary specializes in a segment of the value chain and the production is only for export and not for the host market.

The vertical MNCs type seeks to gain price competitiveness for all sectors, with regard to the traditional labor-intensive sectors like textiles and clothing, or technology-intensive sectors. Yeaple (2003), Hansen et al. (2003), Feinberg and Keane (2003) showed that vertical FDIs are significant in the sectors of mechanical and electronic industries.

However, the distinction between horizontal and vertical FDI is not so clear in practice; MNCs often engage in a complex integration

strategies that encompass both forms of integration, vertical in some countries and horizontal in other ones (Yeaple, 2003). The complex integration strategies are preferred to single expansion strategies abroad horizontal or vertical when transport costs fall below a certain threshold.

Furthermore, there is a marked difference between the two patterns which leaves us design distinguishes the relationship between trade and FDI for two reasons, discussing what type of FDI for what kind of relationship and for what sector.

2.2. FDI and Exports: Complementarities or Substitution?

FDI is either, susceptible to substitute directly trade, in this case exports are replaced by the on-site sales of subsidiaries abroad, or complementary to trade increasing the competitiveness of the firms involved in the home market through competition, thus favoring exports from the investing countries.

Based on a theoretical model, Aizenmana and Noy (2006) showed that a developing country having known a rapid improvement in productivity is attracting increasingly vertical FDI inflows, increasing therefore its international trade. They noted that in the case where the multinational employs skilled workers in developing countries, the increasing volume of trade that comes with vertical FDI is expected to increase the demand for skilled workers. This trend leads to increased returns on human capital in these countries. Therefore, there has been an increase in the supply of skilled labor, potentially increasing the FDI.

In this last work, the authors confirmed that the effect of feedback between trade and FDI is stronger in developing countries than in industrialized ones, advocating the hypothesis that FDI in developing countries were vertical in nature.

Otherwise, the empirical result of the study of Mebratu et al. (2014) reveals a bidirectional causal relationship between trade openness and FDI in sub-Saharan economies. Concurrently, African countries should devote more emphasis for the promotion and attraction of FDI in order to expand their productive capacity to produce and export. Acaravci and Ozturk (2012) provide a survey of the literature on FDI, export and growth, and empirically investigates the causal relationship between economic growth, export and FDI for the ten transition European countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic and Slovenia). The ARDL bounds testing approach is used to investigate the existence of long-run relationship between FDI, export and economic growth for these countries. The results reveal that there is causal relationship between FDI, export and economic growth in four out of ten countries considered.

Aizenmana and Noy (2006) examined measures of financial and trade openness, and have shown that these measures are closely related. Another approach, linking trade and financial openness advocated by Portes and Rey (2005) showed that international trade in goods and assets are explained by similar gravity regressions. Aviat and Coeurdacie (2004) extended the methodology of Portes

and Rey (2005) by studying the geography of trade in goods and asset portfolios. They find a very significant causal link between bilateral asset portfolio and trade in goods in either direction.

The study of Shuhei (2013) employs newly-constructed product-level data covering 32 products and 49 host countries over the period 1993-2008 and finds evidence that FDI by upstream firms leads to additional exports of intermediate goods from the home country. The finding of a complementary relationship between FDI and intermediate exports from Japan runs counter to the popular view that the growing overseas activity of multinational enterprises could replace intermediate exports from a home country, thereby depriving the home country of job opportunities.

Fontagné (1999) analyzed this effect by advancing that the nature of the link depends on the level of the analysis. They suggested that the substitution effect is predominant at the microeconomic level, the fact that the FDIs are an alternative for the company to trade in goods when transportation costs and the cost of labor are high. While the effect of complementarity or the ripple effect on exports is predominant at the macroeconomic level which disputes the substitution principle of Mundell (1957)¹. In the same context of analysis, it is conceivable that effect of complementarity between FDI and trade by arguing that an investment in services may have an impact on the industry².

However, this complementarity may suffer from a statistical illusion because the same factors that explain the FDI can explain the trade (Fontagné and Pajot, 1999). By discussing the impact of FDI on trade, we must understand the mechanisms by which FDI affects trade. Certainly, it is clear to note, according to the economic literature, the impact of domestic investment on export promotion, it's a potential relationship. Therefore, we should demonstrate the substitution effect between FDI and investment in the economy of origin.

FDI inflows are likely to crowd out domestic investment since foreign companies benefit from an initial advantage on the market of goods and services sold or on the market factors. Nevertheless, one can identify a complementary effect to the extent that the benefits in technology promoted the return on capital in the host economy, thus promoting investment.

In this context, Borensztein et al. (1998) detected a positive effect between FDI and domestic investment in the host economy; they noted that the final increase in the total investment represents twice the initial FDI inflows.

Operating in the same direction, another channel is subject to the dependence of international trade to credits trade. Greater openness to trade flows of money causes a reduction in the cost of credit and

an increase in the international trade. Fontagné and Pajot (1999) detected an impact of FDI on trade which is much stronger in the USA than in France. They noted that substitution effects can be offset by exports driven by FDI in other sectors (stimulating effects). The ripple effects are more pronounced for FDI made in France by foreigners rather than in the United States.

Exploiting the unused potential of export growth and the search for new export opportunities are essential for developing countries, in order to reposition itself in the international market in the areas where they can build comparative advantages. We need also to consider the indirect effects of FDI on trade. Since the FDI is likely to increase efficiency, it would be necessary to support the argument that there is overall a complementary relationship between FDI and trade, the market share of company that invests increases in general and that this increase benefits for both the country of origin and the host country. Indeed, the fallout between the various manufacturing sectors provides further opportunities for complementarities.

Therefore, in overall that FDI goes to manufacturing and towards services it can exert profound effects on trade complementarities, to the extent that an investment in the retail sector may lead to increased exports of manufactured goods, while the establishment of production facilities abroad may lead, at company level, to replace previous or potential exports.

However, we are interested in an angle namely export diversification. The IDEs can cause the diversification of exports for host countries, directly or indirectly (López-Cálix et al., 2007). Directly by simulating the intensity of non-traditional exports which lead to greater diversification of exports from the host country and indirectly by promoting exports diversification through spillover effects on export intensity of domestic firms in the sector of non-traditional exports.

This diversification is due to the lower fixed costs of the introduction of products of this sector in the international market and the transmission of learning behavior on the export from the foreign subsidiaries to the local businesses which become more responsive to international markets.

Although horizontal IDEs are the most common, vertical IDEs are increasingly growing. This type of FDI is likely to have a greater impact on export diversification (Report of the World Bank, 2007). The impact of FDI on export diversification is a priori ambiguous. If FDIs are mainly directed towards the exploitation of natural resources, they should lead to more concentrated exports, being the case of oil-exporting countries. In the case of horizontal FDI, where foreign companies can invest in order to serve the market in the host country, the impact on the concentration of exports should be zero or even negative, as domestic costs increasing due to the influx of foreign capital (Aizenmana and Noy, 2006).

It is interesting to analyze in the last part of our work, if the complementarities between FDI and exports playing in a sectoral level. Indeed, the theoretical approaches discussed the

1 FDI raising converging factor payments and therefore product prices change. "The movements of substitute products, at least to some extent, the movement of factors (...) an increase of trade barriers stimulates factor movements and (...) capacity restrictions on the movement of factors stimulates trade".

2 Including Carrefour sells French products in Tunisia, Orange and Vodafone are selling their services on the French North African market and enact contracts with local industrial.

two extreme cases: The substitutability and complementarities that meet respectively on a micro or macro level. Also, a decomposition of substitutability or complementarities has not been addressed. However, for the industry and specifically in the case of manufacturing cases, the results are mixed and can attend a coexistence of two effects.

3. METHODOLOGY: PANEL DATA ANALYSIS

In our work, panel data analysis is used in order to study the link between FDI and exports. To do this we have disaggregated the two variables for the manufacturing and non-manufacturing sector for 10 countries³. So our investigation will focus on three specifications: The first, for total FDI, the second for the manufacturing FDI and the third for non-manufacturing FDI.

The empirical treatment involves the applications of panel estimation procedures. Three dependent variables are considered in our study, which are the total FDI (FDI), the manufacturing (FDIMP) and the non-manufacturing FDI (FDINMP). The independent variables that are expected to explain FDI inflows are exports, GDP and inflation rate. All the variables are expressed in natural logarithm. In connection with discussions of the previous section, we propose three specifications as follows, where the selected variables are expected to determine the FDI:

$$LFDIT_{it} = \alpha_0 + \beta_1 LXT_{it} + \beta_2 LGDP_{it} + \beta_3 LINFL_{it} + \varepsilon_{it} \quad (1)$$

$$LFDIMP_{it} = \alpha_0 + \beta_1 LXMP_{it} + \beta_2 LGDP_{it} + \beta_3 LINFL_{it} + \varepsilon_{it} \quad (2)$$

$$LFDINMP_{it} = \alpha_0 + \beta_1 LXNMP_{it} + \beta_2 LGDP_{it} + \beta_3 LINFL_{it} + \varepsilon_{it} \quad (3)$$

Where,

i and t represent respectively the country index, and the time index. $LFDI T_{it}$ is the log of FDI in current US\$ for country i at time t . $LXTOTAL_{it}$ is the log of total exports in current US\$ for country i at time t .

$LGDP_{it}$ is the log of GDP in current US\$ for country i at time t .

$LINFL_{it}$ is the log of inflation rate (annual percent) for country i at time t .

$LFDI MP_{it}$ is the log of FDI in manufacturing product in current US\$ for country i at time t .

$LFDINMP_{it}$ is the log of FDI in non-manufacturing product in current US\$ for country i at time t .

$LXMP_{it}$ is the log of manufacturing product exports in current US\$ for country i at time t .

$LXNMP_{it}$ is the log of non-manufacturing product exports in current US\$ for country i at time t .

ε_{it} is the standard error which is assumed to be white noised and varies over both country and time.

The panel data estimation is employed in the study to capture the dynamic behavior of the parameters and to provide more efficient

estimation and information of the parameters. Further, using a panel data model with incorporation of individual effects has a number of benefits for example, among others; it allows us to account for individual heterogeneity and if this heterogeneity is not taken into account it will inevitably bias the results, no matter how large the sample is.

There are basically three types of panel data models namely, a pooled ordinary least square (OLS) regression, panel model with fixed effects and panel model random effects. The common constant method (also called as pooled OLS method) of estimation presents result under the principal assumption that there are no differences among the data matrices of the cross-sectional dimension (N). In other words the model estimates a common constant for all cross-sections (common constant for countries). Practically, the common constant method implies that there are no differences between the estimated cross-sections and it is useful under the hypothesis that the data set is a priori homogeneous. However, this case is quite restrictive and case of more interest involves the inclusion of fixed and random effects in the method of estimation.

The fixed effects method treats the constant as group (section)-specific, i.e., it allows for different constants for each group (section). The fixed effects also called as the least squares dummy variables estimators, because it allows for different constants for each group and it includes a dummy variable for each group. Therefore, by incorporating unobservable individual effects in Equations (1-3), the models to be estimated are as following:

$$LFDIT_{it} = \alpha_0 + \beta_1 LXT_{it} + \beta_2 LGDP_{it} + \beta_3 LINFL_{it} + w_{it} \quad (4)$$

$$LFDIMP_{it} = \alpha_0 + \beta_1 LXMP_{it} + \beta_2 LGDP_{it} + \beta_3 LINFL_{it} + w_{it} \quad (5)$$

$$LFDINMP_{it} = \alpha_0 + \beta_1 LXNMP_{it} + \beta_2 LGDP_{it} + \beta_3 LINFL_{it} + w_{it} \quad (6)$$

Where, $w_{it} = u_i + \varepsilon_{it}$, with u_i being countries unobservable individual effects. The difference between a pooled OLS regression and a model considering unobservable individual effects lies precisely in u_i .

When we consider the random effect model the Equations (4-6) will be same however in that case u_i is presumed to be having the property of zero mean, independent of individual observation error term ε_{it} , has constant variance σ_ε^2 , and independent of the explanatory variables.

Hausman (1978) provides a test for discriminating between the fixed effects and the random effects estimators. The test is based on comparing the difference between the two estimators of the coefficient vectors, where the random effects estimator is efficient and consistent under the null hypothesis and inconsistent under the alternative hypothesis. The fixed effects estimator is consistent under both the null and the alternative hypothesis. If the null is true then the difference between the estimators should be close to zero.

3 Tunisia, Morocco, Egypt, Finland, Hungary, Poland, Portugal, Czech, Ireland, and Slovenia.

4. EMPIRICAL RESULTS

4.1. Data and Descriptive Statistics

Data used in this study is panel data, which have space as well as time dimension. The space dimensions are 10 countries (Tunisia, Morocco, Egypt, Finland, Hungary, Poland, Portugal, Czech, Ireland, and Slovenia) while the time dimension is that each country contains 25 years of time series of annual data ranging from 1988 to 2012. The panel data in this study is characterized as a balanced panel where each unit of cross-section has exactly the same number of time-series observation; a total of 250 observations is collected for the whole sample. The main variables of interest in our study are FDI, exports, GDP and inflation. Data used is collected from World Development Indicators published by World Bank.

Before moving on to the results of the panel data analysis for the specifications describes above, this paper will consider some graphical and descriptive evidence. In Figures 1-6, we can see the

Figure 1: Evolution of total exports for the sample countries during 1988-2014

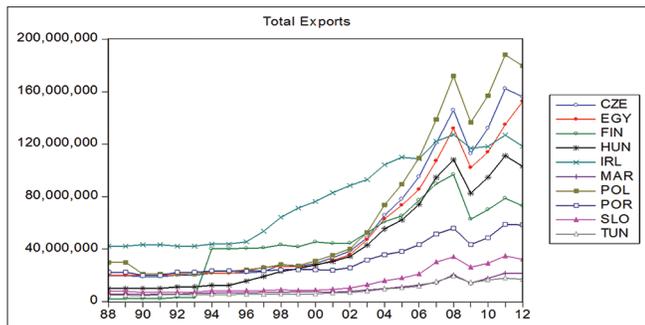


Figure 2: Evolution of manufacturing exports for the sample countries during 1988-2014

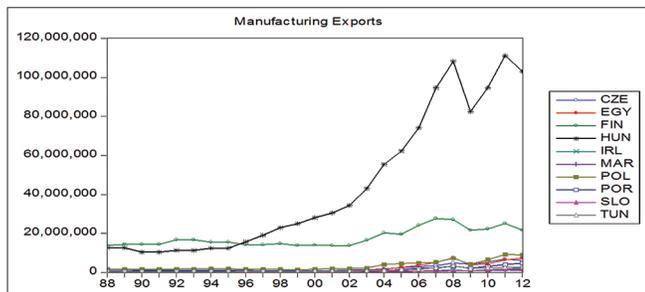
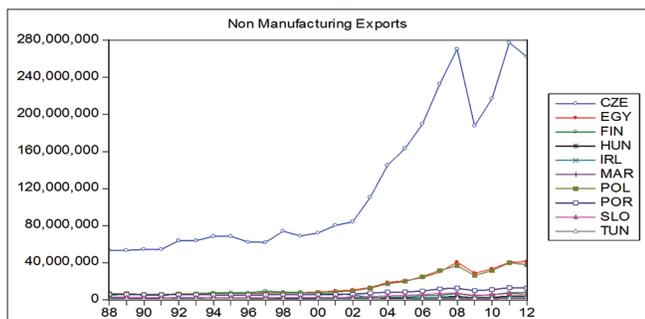


Figure 3: Evolution of non-manufacturing exports for the sample countries during 1988-2014



mean evolution of six series over the 25 years period from 1988 to 2012, for the whole sample. The key variables are the FDI (total, manufacturing and non-manufacturing) and the exports (total, manufacturing and non-manufacturing) variables between 1988 and 2012.

During the period of study, it seems that is important instability on the FDI variables. Broadly speaking, there has been an increase of total and manufacturing FDI flows during the 1990s while it's more pronounced for the first, a decline trend in about the begging of 2000s years and may continue until the mid-2000 for the total FDI. For the and non-manufacturing FDI, there has been a much stable evolution until the late 1990s with a peak on 2000, then fallings proceeded by recoveries in about 2004 and 2009, and finally decreasing trend from 1990. The marked declines in the evolution of these macroeconomic variables may explained by the impact of financial crises, especially the Asian crisis and last financial crisis.

Figure 4: Evolution of total foreign direct investment for the sample countries during 1988-2014

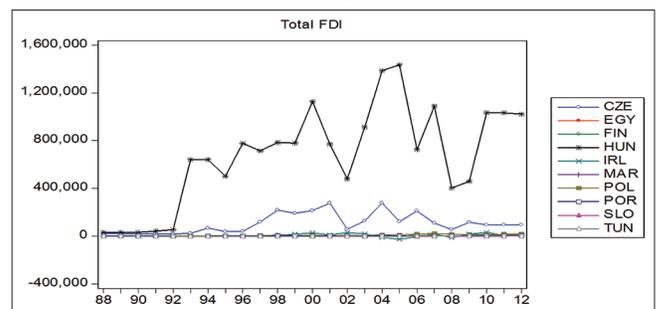


Figure 5: Evolution of manufacturing foreign direct investment for the sample countries during 1988-2014

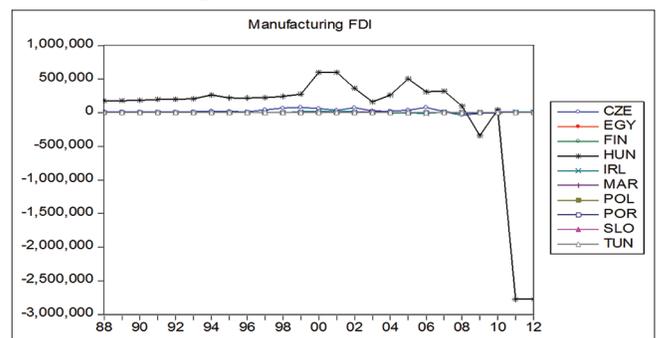
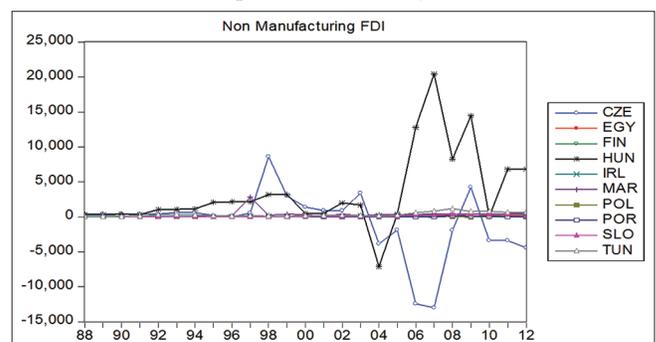


Figure 6: Evolution of non-manufacturing foreign direct investment for the sample countries during 1988-2014



For the exports, there has been an important rise in export variables and this exuberance was sustained until the occurrence of global financial crisis in the year 2008-2009. An obvious decline is observed during the period that may be due to the crisis. However, an increasing trend is observed after 2010. Tables 1 and 2 report respectively a summary statistics of the data, and the correlation results for the selected variables for the 10 countries. To gain some insight into the relationships between exports and FDI and the other variables, we provide correlation coefficients. We note that the total FDI has a positive and statistically significantly correlation with both total exports, with coefficient of 0.124919. In contrast, both manufacturing FDI and non-manufacturing FDI are significantly and negatively correlated respectively to manufacturing exports and non-manufacturing exports. On the other hand, FDI (total, manufacturing or non-manufacturing) does not seem to be significantly correlated with inflation. We also note that GDP has significant positive association with both total FDI and non-manufacturing FDI, respectively (0.73) and (0.46), however, its correlation with manufacturing FDI is negative (-0.22).

4.2. Results of Estimation

Graphical inspections of Figures⁴ 7 and 8 shows the existence of heterogeneities across countries on the main variables. Formally, the standard Breusch–Pagan Lagrange multiplier (LM) test may be conducted to test for the adequacy of the poolability assumption of our panel data. The results reported in Table 3 confirm very high computed value of LM statistic which favors the fixed effect/random effect model over cross-section model. Hausman test is then conducted to choose between random and fixed model for all the specifications. The Hausman test results in this case indicate accept the null hypothesis of random effect models at the 5% significance level for all the specifications. This implies that for our analysis a random effect model is more appropriate. The F-test result is significant at 1% level of significance in all panel data models therefore we can conclude that we cannot reject the null hypothesis that the explanatory variables do not explain FDI.

Results of random effects model relative to the first specification, reported in Table 3, confirm the significance of exports, and LGDP at 1% level of significance. The effect of exports to FDI is positive, implying that an increase in exports lead to an increase in total FDI. An increase of 10% of total exports induces an increase of 5.97% of FDIs. However, the impact of inflation is statistically

insignificant. Concerning the signs of the exports variables, they would depend on the substitutability or complementarity existing between exports and FDI. A positive sign would be expected when the complementarity hypothesis is the one maintained. Our results show that there is an effect of complementarity between total exports and FDI. The effect of complementarity was accompanied by a significant impact of economic activity on total FDI. This result may be explained by the fact that the relative staffing and remuneration of production factors is sufficiently different between partner countries (Helpman, 1984).

For the second specification, where the dependent variable is the manufacturing FDI, we find that the three independent variables are statistically significant at 10% level. However, the GDP and manufacturing exports have a positive effect on manufacturing FDI

Figure 7: Total foreign direct investment, heterogeneity across countries

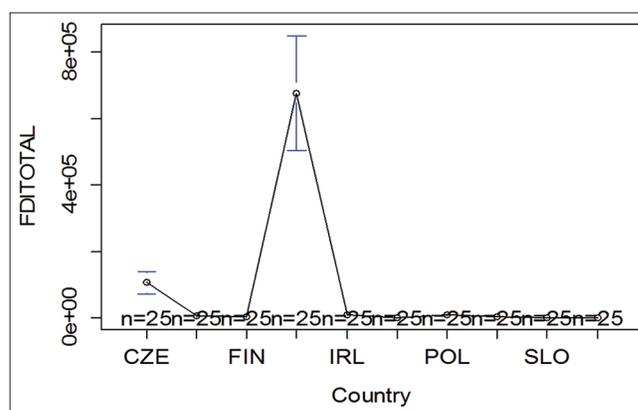
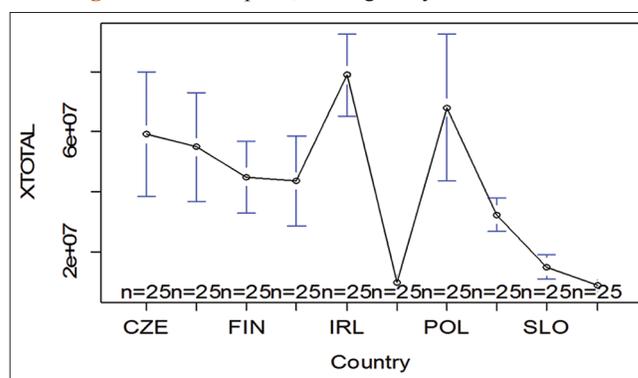


Figure 8: Total exports, heterogeneity across countries



4 We do not report the figures for the other variables in order to save space. They are available on the request to authors.

Table 1: Summary statistics for the variables considered in this study

Variables	Mean	Median	Maximum	Minimum	Standard deviation
FDITOTAL	81258.56	1939.930	1434343	-25482.00	240586.4
FDINMP	374.2681	64.50000	20422.81	-13026.99	2483.737
FDIMP	3542.892	624.8400	600951.0	-2774803	265377.4
XMP	7317916	1024808	1.11E+08	51303.91	17422875
XNMP	17422736	4908266	2.77E+08	109451.4	43131750
XTOTAL	41625729	24443333	1.88E+08	2043679	40684249
GDP	18090.07	7684.491	154233.5	105.6702	26426.15
INFL	15.17372	4.144061	209.9338	-4.479938	33.01446

GDP: Gross domestic product, FDI: Foreign direct investment

Table 2: Correlation of variables in the study

Correlation of variables in specification 1				
Variables	FDITOTAL	XTOTAL	GDP	INFL
FDITOTAL	1.000000			
XTOTAL	0.124919** (0.0485)	1.000000		
GDP	0.730338** (0.0000)	0.408907** (0.0000)	1.000000	
INFL	-0.062834 (0.3224)	-0.216318** (0.0006)	-0.165665** (0.0087)	1.000000
Correlation of variables in specification 2				
Variables	FDIMP	XMP	GDP	INFL
FDIMP	1.000000			
XMP	-0.364147** (0.0000)	1.000000		
GDP	-0.225688** (0.0003)	0.902307** (0.0000)	1.000000	
INFL	0.020360 (0.7487)	-0.109441 (0.0842)	-0.165665** (0.0087)	1.000000
Correlation of variables in specification 3				
Variables	FDINMP	XNMP	GDP	INFL
FDINMP	1.000000			
XNMP	-0.316161** (0.0000)	1.000000		
GDP	0.464212** (0.0000)	-0.066449 (0.2953)	1.000000	
INFL	-0.026328 (0.6787)	-0.088672 (0.1622)	-0.165665** (0.0087)	1.000000

P values are in parentheses. GDP: Gross domestic product, FDI: Foreign direct investment, **: Indicates the rejection at the at 0.05 significance level

Table 3: Estimation results for three dependent variables and specification tests

Variables	Dependent variables: Log of total FDI (<i>LFDIT</i>)	Dependent variables: Log of manufacturing FDI (<i>LFDIM</i>)	Dependent variables: Log of non-manufacturing FDI (<i>LFDINM</i>)
<i>LXTOTAL</i>	0.597822*** (0.000)		
<i>LGDP</i>	0.849891*** (0.000)	0.335177* (0.06502)	0.865839*** (0.000)
<i>LINFL</i>	-0.016098 (0.7944)	-0.024832*** (0.000)	-0.164452** (0.030899)
<i>LXMP</i>		0.467231*** (0.000)	
<i>LXNMP</i>			0.370719*** (0.008177)
Constant	-9.453348 *** (0.000)	-2.319253 (0.13656)	-8.451474*** (0.000)
F-test	87.2107** (0.000)	26.8549*** (0.000)	43.3532*** (0.000)
R ²	0.5154	0.2467	0.34585
Breusch-Pagan test (LM test)	867.7824*** (0.000)	93.32*** (0.000)	75.32*** (0.000)
Hausman test	0.688 (0.7829)	0.8434 (0.8391)	3.2389 (0.11664)

***, ** and * indicate the rejection at the 1%, 5% and 10% levels, respectively, The F test has normal distribution N(0,1) and tests the null hypothesis of insignificance as a whole of the estimated parameters, against the alternative hypothesis of significance as a whole of the estimated parameters, The Hausman test has χ^2 distribution and tests the null hypothesis that unobservable individual effects are not correlated with the explanatory variables, against the null hypothesis of correlation between unobservable individual effects and the explanatory variables. LM: Lagrange multiplier, FDI: Foreign direct investment, GDP: Gross domestic product

while the inflation is negative. We can therefore conclude that there is an effect of complementarity between manufacturing exports and manufacturing FDI. An increase of 10% of manufacturing exports leads to an increase of 3.35% of FDI in this sector. Moreover, this result can be explained by the fact that vertical FDI associated with production fragmentation creates a trade of good intermediates where none existed. However, the increase in trade costs may encourage producers to fragment the production process, being the case of manufactured products, implanting the intensive stage of production work in low-wage countries, and stage of production to higher capital intensity (R and D, assembly, headquarters units, etc.) in industrialized countries.

Indeed, these results come to plead the work of Aizenmana and Noy (2006) who showed that a developing country has known a rapid improvement in productivity will attract more entries vertical FDI, increasing international trade.

Addressing to the third specification, there is also an effect of complementarity in non-manufacturing sector, but this effect is less pronounced than those for manufactured goods. The significance and importance of the coefficient of non-manufacturing exports was accompanied by a positive and significant impact of economic activity. These results found showed that the complementary effect or ripple effect on exports is predominant at the macro level for manufactured exports relative to non-manufacturing exports, which disputes the Mundell's substitution principle. Moreover, if FDI is mainly directed towards the exploitation of natural

resources, they should lead to export more concentrated, as the case of oil-exporting countries. This difference between the two sectors is explained by the fact that FDI goes to manufacturing or to services and can exert marked effects on trade complementarity, in that an investment in the retail sector may result in increased manufacturing exports, while the introduction of foreign production units may, at the company level, leading to replacement of previous or potential exports.

5. CONCLUSION

This study is motivated by our aim to further explore the empirical evidence about the nature of relationship between FDI and exports. In other words, our principal motivations focus on determining whether the relation between them whether it is a relationship of complementarity or substitutability. This subject tackles an interesting subject for academic research, and for macroeconomic policy decision makers, too. The results of such research could provide a framework for strategic macroeconomic policies.

Furthermore, owing to a theoretical study of matter, economic theory fails to reach a clear conclusion on the links between FDI and trade. This can be traced back to various factors like the type of goods exported, the type of IDE done and the macroeconomic environment.

Our paper is a contribution in exploring analytical and empirical basis to define the nature of links - as complementary or alternative - Between exports and FDI using a disaggregated data for the manufacturing and non-manufacturing sectors relative to 10 developing and non-developing countries.

By running the necessary statistical tests, the empirical models of this paper are estimated by random effect model. Our results show that there is an effect of complementarity between total exports and total FDI. This effect was accompanied by a significant impact of economic activity on total FDI. Similar results were found between manufacturing exports and manufacturing FDI and between non-manufacturing exports and non-manufacturing FDI. The estimated results show that exports have positive impact on FDI significantly. Furthermore, the findings show that the complementary effect or ripple effect on exports is predominant at the macro level for manufactured exports relative to non-manufacturing exports; this disputes the Mundell's substitution principle. Moreover, if FDI is mainly directed towards the exploitation of natural resources, they should lead to more concentrated export, as the case of oil-exporting countries. The difference between the two sectors is explained by the fact that FDI goes to manufacturing or to services and can exert marked effects on trade complementarity, in that an investment in the retail sector may result in increased manufacturing exports, while the introduction of foreign production units may, at the company level, lead to replacement of previous or potential exports.

In sum, results suggest that exports in these countries appear to generate additional FDI flows from investing countries implying the existence of a complementary relationship. Certainly these findings should be explored further, taking into account other variables to obtain more robust results. We leave interesting questions for further research. First, a future direction for research could be that of examining the relationship between FDI and exports using a more comprehensive database including more developing and non-developing countries. Second, the incorporation of more fully disaggregated data would be a useful extension to the literature since it should reveal different behavior patterns by industry. Finally, one could extend our framework by examining the effect of FDI on export or studying the existence of any bi-directional causality relation between the two variables.

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