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# Foreign direct investment and structural transformation of exports

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## *Abstract*

*Sizeable efforts are invested across the globe in attraction of foreign investors. These activities are motivated with theoretical predictions and empirical evidence from numerous countries on beneficial effects of foreign direct investment (FDI) on host economy. Among spillover channels of FDI, one that is particularly important for open economies is improvement of export competitiveness and productivity. Through knowledge and technology transfer, integration in parent company distributor and supplier network and horizontal and vertical spillovers to other firms in host economy FDI can ease access to international market for producers from host economy but more importantly the sophistication of their exported goods and services. The objective of this paper is to explore how FDI influences structural transformation of exports (improvement in export sophistication) in short and long run of almost 100 world economies. Evidence reveals differences in export sophistication between different groups of countries and point to beneficial effect of FDI on export sophistication.*

*Keywords: FDI, export sophistication, dynamic analysis*

## **1. Introduction**

Recent popularity of endogenous growth and new trade models has pointed to the importance of production structure for growth and development. It is now taken as stylised fact that specialization in knowledge and technology intensive commodities offers much higher growth prospects than production of standardised goods and services. Actions of policy makers across the globe seem to follow these theoretical predictions. Growth and development strategies of many nations and supranational associations are built around notion of knowledge-driven economy. These issues are particularly important for less developed economies. Structural transformation of production and exports is for these countries an imperative and precondition of catching up with their developed counterparts.

The importance of export structure for growth and development has triggered research on channels for structural transformation of exports. Among these channels inflow of foreign direct investment (FDI) stands as particularly important. Recent World Bank data reveals that over 19 billion USD of FDI inflows have circulated in global economy over past decade. Although majority of these inflows targeted developed and rapidly developing economies of OECD and BRIC countries, a substantial amount of evidence from across the globe witnesses beneficial effect of FDI on enterprise restructuring, export competitiveness and productivity growth. These effects do not seem accrued solely to subsidiaries of foreign companies but rather spread throughout the economy on rivals, suppliers, distributors and all other business entities via horizontal and vertical spillover channels. For this reason FDI attraction strategies are ranked high on agenda on economic policy measures in many modern economies and significant efforts are being invested in attraction of foreign investors.

Bearing in mind the importance of structural transformation of exports for growth and development as well as efforts invested in attraction of foreign investors it is worth to examine

whether incentives provided to latter are warranted and whether countries should continue to pursue structural transformation of exports through promotion of FDI. To this end, the paper uses data on 99 world economies over 2007-2015 period to explore how inflow of FDI influences sophistication of exported commodities. Unlike majority of studies in the field that determine structure of exports on the basis of available industrial classifications this paper adopts a more complex approach. The level of export sophistication is determined with means of an index that reflects productivity embodied in exported commodities. For this reason, the data on over 5000 commodities at the most detailed 6-digit level of aggregation are used.

The findings of paper offer support to the thesis about positive impact of FDI on export sophistication. It appears that the complete realization of positive FDI effects takes place over lengthier period of time. Such finding stands as an important policy implication for less developed economies on the path of catching up with their advanced counterparts. Their ability to initiate FDI-driven structural transformation of exports shall depend not only on reversal of FDI inflow trends observed in paper from developed economies but also on strengthening of local absorptive capacity. The paper is structured as follows. Next section discusses importance of structural transformation of exports for the economic development. The relationship between export sophistication and foreign direct investment is discussed in section three. Fourth section provides overview of recent trends in FDI and export sophistication while the model and methodology of investigation are discussed in section five. Discussion of findings obtained through dynamic panel regression analysis is provided in section six. Finally, section seven concludes.

## **2. Structural transformation of exports and development**

Our study is related to the literature on export sophistication and the literature of host country effects of FDI. Existing research shows that variety of goods that a country produces and exports is affected by knowledge spillovers and specialization (Hausmann et al., 2007; Rodrik, 2006). Specialization and production and export of goods with higher value added has important implications for productivity and economic growth. Specialization promotes a better reallocation of resources from (relatively) inefficient nontradable sectors to higher productivity export-oriented sectors, while enabling comparative advantages and increase in domestic production (Andraz and Rodrigues, 2010). A country's specialization reflects different structural phenomena such as factor endowments, economies of scale, technology and productivity gaps and specific advantages of firms and industries such as the level of innovativeness (Santos-Paulino, 2010).

The link between country export performance and economic development has long been analysed by international trade literature. This literature broadly encompasses two strands. The first strand argues for export specialization. In the Ricardian model, the levels of technology explain trade and specialisation patterns between countries (Dornbusch et al., 1977). According to Heckscher–Ohlin theory country's factor endowments determine the relative costs of production and hence the patterns of specialization and the composition of a country's export basket. Hence, countries with abundant natural resources are expected to export natural resources or labour intensive goods. Similarly, more developed countries are expected to export more sophisticated capital- and technology-intensive products such as pharmaceuticals, chemicals, automobiles, and electronic machinery (Schott, 2008). For example, Gaddy and Ickes (2010) have argued that Russia should focus on exploiting its natural resource base more efficiently, rather than seek to divert resources toward the development of new industries.

Second strand of international trade literature advocates for export diversification. According to Singer (1950) and Prebisch (1950) concentration on primary products is subject to commodity shocks, price fluctuations and declining terms of trade since the income elasticity for primary products is relatively low. They argue for vertical diversification in manufacturing goods which would enable higher rates of economic growth. By increasing the number of export sectors can increase the stability of export earnings and reduce the risks of export instability (Ferreira, 2009). The additional benefit of export diversification is related to knowledge spillovers arising from improved production techniques, new management practices and labour training which can benefit other industries and improve aggregate productivity (Herzer and Nowak-Lehmann, 2006; Naudé et al., 2010).

Although diversification is necessary it is not a sufficient condition for development and economic growth. Rodrik (2007) argues that the share of manufacturing export matters as well. The increasing share of manufacturing export in GDP generates stable and well paid employment, reduces inequality and helps boost domestic demand by increasing purchasing power (Reinert, 2007). In addition, it is important that countries move towards more sophisticated exports as countries which export higher value added goods achieve higher rates of growth (Hausmann et al., 2006).<sup>1</sup> Export of more sophisticated goods also leads to more efficient management practices while stimulating innovation and technological advance (McCann, 2007). Differences in countries' ability to upgrade their production and diversify into complex goods appear to explain why they progress or remain poor (McMillan and Rodrik, 2011). According to Hidalgo and Hausmann (2011) numerous and exclusive capabilities are required to move toward new activities associated with higher productivity levels.

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<sup>1</sup> Sophistication "has a multitude of interpretations but it broadly aims to capture the productivity level associated with a country's production, empirically mirrored in exports data" (Mishra, Lundstrom, and Anand 2011, p. 2).

New trade theory has proposed models explaining how developing countries should benefit from import and foreign advanced technology. Grossman and Helpman (1994) discuss three main modes of technology acquisition: learning by doing, investment in research and development, and diffusion and spillover effects. New growth theory emphasizes that knowledge capital is the engine and stimulus of economic growth in the long run (Romer, 1990). Knowledge capital can be created from indigenous knowledge creation or acquired through the access, transfer, and assimilation of international knowledge through participation in international trade and openness to FDI (Zhu and Fu, 2013). However, learning and adoption of technology are costly process as the ability to produce and export goods is determined not only by factor endowments but also by existing capabilities. In other words, it depends on the ability to manage technology in an efficient manner (Jarreau and Poncet, 2010).

In contrast with neoclassical theory where technology is easily priced, codified and imported by producers ready to be exploited, in new trade theory it is tacit. Moreover, the process of learning new technologies involves the costly process of learning where the comparative advantage of a country lies and it is subject to externalities (Hausmann and Rodrik, 2003; Hausmann et al., 2007). Therefore, Hausmann et al. (2007), Reinert (2007) and Rodrik (2007) argue that while factor endowments are clearly of considerable importance, government policy encouraging technology learning and the investment by firms can also move a country toward more sophisticated export activities citing the example of East Asian countries. For example, countries behind the technological frontier can imitate existing technology and national policy should then focus on facilitating the absorption of technology. However, as argued by Nelson and Pack (1998) successful technological imitation and absorption also require institutional innovation.

The above discussion can be summarized as follows. The expansion of exports alone, without structural transformation of the export sectors may not lead to sustainable economic growth. This is particularly true if export is concentrated on few markets and few products leading to potential vulnerabilities in terms of instability in foreign exchange earnings and investment planning, inflation and capital flight (Lederman and Maloney, 2002). The advocates of export diversification argue that the vulnerability of country to external shocks can be reduced if country diversify its exports across products and markets, either horizontally or vertically (Harrison and Rodriguez-Clare, 2009). In order to obtain the benefits associated with export diversification and upgrade technology content of their export, many countries have attempted to attract FDI. For example, Rodrik (2006) and Klinger and Lederman (2006) argue that FDI play an important role in the discovery of new methods and products as well as in changing the technology content of exports. Next section sheds more light on expected effect of FDI on export upgrading.

### **3. Foreign direct investment and export sophistication**

The attraction of FDI has often been seen as an important tool in promoting product upgrades to the country product structure. Moran (2010) argues that MNCs can act as channels of transformation for the local economies in which they invest through their contribution to productivity in existing industries and firms. In addition, they can also bring new ideas and best practices to start exploring new production activities, that is, they engage in “cost discoveries” (Hausmann and Rodrik, 2003).



The entry of MNCs is expected to affect export through two main channels. First channel is direct and associated with quality upgrades of country's export structure. MNCs are more export intensive and engage in production of more sophisticated and higher quality goods (Iacovone and Javorcik, 2010; Wang and Wei, 2010). They can contribute to an increase in intensive margin of exports (rise in export volume of existing products or increase in the number of trading partners) and extensive margin (rise in the number of export products). Xu and Lu (2009) find that China's rising export sophistication is significantly explained by an increasing presence of foreign owned MNCs. Similarly, Arnold and Javorcik (2009) show that foreign acquisitions in Indonesia lead to large increases in the export intensity in the acquired plants. Jayaweera (2009) also reports a positive association between a rise in the levels of FDI and export diversification using data on 29 low income countries and employing instrumental variable technique. Alemu (2008) employed Feasible Generalized Least Squares when examining the effect of FDI on export diversification and concludes that FDI is the key factor in speeding up both the vertical and horizontal diversification of exports in East Asia.

Wang and Wei (2010) developed a proxy for country's industrial sophistication, based on data on a country's export bundle. They develop an index for a lack of sophistication, called export dissimilarity index (EDI), which estimates the distance between a country's export structure and that of high-income economies such as Japan, the United States and the European Union. They find that FDI plays no role in increasing the similarity of Chinese exports to those of advanced countries, even though it contributes to raising the unit values (quality) of Chinese exports. Exports by MNCs in China (beyond promoting processing exports) tend to have systematically higher unit values than domestic firms, suggesting that they produce higher-end product varieties.

Harding and Javorcik (2012) investigated the relationship between FDI and export upgrading in both developed and developing countries, export upgrading being measured as unit values of exports measured at the 4-digit SITC level. Using a sample of 105 countries over the period 1984-2000, they have obtained evidence of a positive effect of FDI on unit values of exports in developing countries, but found a mix of evidence for high-income economies. In addition, by using sector-level equivalent of Rodrik's (2006) measure of export productivity (EXPY) and Wang and Wei's (2010) export dissimilarity index (EDI) they are not able to find any positive effects on productivity level associated with the host developing country's export basket nor improvements in similarity in export structure between developing and developed countries.

Amighini and Sanfilippo (2014) focused on African economies to explore whether FDI and imports contribute to upgrading African countries' exports. They have considered the particular impact of South-South and North-South FDI and imports. The results suggest that South FDI brings technology that is more likely to be adopted by host countries and therefore appears to exert a positive and higher effect on diversification of export baskets of African economies and on the improvement of export quality of these countries, when compared to the same flows originating from the North. Recently, Henn et al. (2015) have undertaken an empirical analysis of the determinants of the growth rate of product quality through product-level cross-country panel regressions using new estimates of export quality based on large sample of 178 countries. They found that export quality converges over time to the world frontier within any given product line and improvement in export quality is driven by institutional quality, liberal trade policies, FDI inflows, and human capital. However, the results vary by sector.

The above results suggest that the effects of FDI on export diversification and sophistication are far from uniform and depend on econometric methodology, sample period and sample composition. In addition, in most studies FDI inflow was used instead of stock. The former are subject to periodic fluctuations due to changes in FDI policy environment and if not properly controlled may result in spurious results (Tadesse and Shukralla, 2013). In addition, assumption of linearity and econometric method used is not able to capture differences in levels of export sophistication among countries or different patterns of FDI. For these reasons, Tadesse and Shukralla (2013) took a somewhat different approach when investigating the impact of FDI on horizontal diversification. Using two different estimation approaches: a quantile regression method that accounts for the variation in the diversification among the countries included in the study, and a semi-parametric method that does not a priori impose any restriction on the functional form. Results from quantile regression suggest that the impact of FDI on export diversification to be non-existent or negative, particularly in countries either at the lower or upper tail of diversification scale and positive only around median levels. Results from pooled semiparametric technique suggest that the overall impact of FDI on export diversification is indeed nonlinear. A relatively larger proportion of the countries where positive or negative effect of FDI is observed are developing countries.

Apart from direct influence, second channel of FDI impact on country's export structure is through various spillovers that facilitate the upgrading of domestic firms. Since MNCs are more productive, R&D intensive, possess superior management and marketing skills, know how it is expected that some of that knowledge and technologies will spill over to domestic firms due to inability to protect the leakage of knowledge (Caves, 1996). This is expected to influence export competitiveness of domestic firms in two ways. First, through technology spillovers which increase the productivity and competitiveness of domestic firms through two

main channels: horizontal and vertical. The former one is related to demonstration and imitation effects, competition effects and labour mobility. However, the effects will vary depending on domestic absorption capacity and production activities of MNCs which should be technology or skill intensive (Sjoholm, 1999). Another type of technological spillovers is associated with backward and forward linkages. In backward linkages MNCs are cooperating with domestic suppliers of intermediate inputs and directly transfer knowledge about product design, quality control and inventory management and provide financial and procurement assistance (Zanfei, 2012). In forward linkages, customers of MNCs can benefit from spillovers and knowledge embodied in products, processes and technologies as well as improved access to enhanced or previously unavailable inputs and products (Jindra et al., 2009). In each of these cases, a growing presence of foreign firms may improve the quality and diversity of products offered by local firms. Crespo and Fontoura (2007) indicate that effects of FDI spillovers depend on a number of factors: the technological gap between foreign firms and their domestic counterparts, the absorptive capacity of domestic firms, geography and policy variables related to trade, intellectual property rights and labour mobility. In addition, the effective occurrence of such spillovers is conditional on investors origin (Javorcik and Spatareanu, 2011), inputs sourcing policy (Farole and Winkler, 2014), motivations of investors (Driffield and Love, 2007).

In addition to technology spillovers, MNCs can generate export information spillovers relating to export market intelligence, international marketing know-how and export operations from foreign to domestic firms (Fu, 2011). This can occur thorough either demonstration or worker mobility mechanisms. Many theoretical and empirical papers show that exporting firms represent a small fraction of active firms. This is due to sunk costs such as the establishment of distribution and logistics channels, product compliance with regulations, market research to

acquire information about consumer preferences and market structure in foreign countries (Fu, 2011). Export information spillovers from MNCs can lower such costs and enable domestic firms to access new markets or improve performance on the existing ones. In the export model by Rauch and Watson (2003) increased concentration of MNCs create learning effects that may increase the survival probabilities of domestic exporters, since information on international markets and customers will allow local firms to make better judgments about the quality of potential new trade relationships. Krautheim (2012) is one of the few theoretical works on export spillovers, where proximity to other exporters is assumed to reduce the fixed export cost thanks to the endogenous formation of informational networks between exporting firms.

However, the effect of FDI on export activities of domestic firms depends on the type of trade MNCs are engaged in. In case of processing trade, the entire supply chain and international marketing activities of processed products is controlled by MNCs while domestic firms are locked in low valued added and labour intensive activities. This provides limited scope for technology spillovers because most of the technology is embedded in imported components while the level of technical expertise is low (Fu, 2011). Moreover, foreign firms engaged in processing trade activities might be less embedded in local environment (Mayneris and Poncet, 2013). For example, Milberg (2007) found that less than 10 percent of inputs is sourced locally in developing countries. In contrast to technology spillovers, export information spillovers are expected to have positive effects on export participation of domestic firms. This is due to lower sunk costs of export market entry in processing industries and the fact that majority of supply chain activities are controlled by foreign firms. However, if foreign firms engage in processing activities themselves the competition effects arising from better availability of inputs and other high quality components may exert strong crowding out effects on domestic firms (Fu, 2011). Further, increased local labour demand due to the expansion of multinational operations raises

production costs as local wages rise. Hence, as FDI spillovers are transmitted through a variety of channels their overall effects can only be assessed through empirical analysis.

While number of studies has engaged in analysis of FDI productivity spillovers, relatively few of them investigated export spillovers. In a seminal work, Aitken et al. (1997) show that export propensity of domestic firms is positively associated with proximity to MNCs. This has also been confirmed by Kneller and Pisu (2007) for UK market. Banga (2006) finds that US FDI flows to India have a statistically significant positive impact on the intensity of the Indian manufacturing exports. By contrast, Barrios et al. (2003) do not find clear evidence of export spillovers from foreign firms in Spain, while Ruane and Sutherland (2005) find that the export intensity of foreign owned firms is negatively correlated with the export decision and export intensity of domestic firms in Irish manufacturing. Several studies related to China argue that foreign firms engaged in processing trade activities have an important role in the skill content upgrading of China's manufacturing exports (Amiti and Freund, 2010; Xu and Lu, 2009). On the other hand, Jarreau and Poncet (2012) find that the positive association between GDP per capita growth and export sophistication at the province level is limited to ordinary export activities undertaken by domestic firms.

Although, there may not be direct gains from foreign export upgrading, Mayneris and Poncet (2013) argue that there is considerable gain from export spillovers. Swenson (2008) and Chen and Swenson (2014) relate the probability of export of domestic firms and presence of MNCs and found that MNCs enhanced export capabilities of domestic firms mainly via information spillovers. Mayneris and Poncet (2013) took a step further and analysed domestic firms' capacity to start exporting new varieties to new markets and found a positive relationship with activity of neighbouring foreign firms. Foreign export spillovers are also found to emanate

mainly from ordinary trade activities. In a similar study, however, Poncet and De Waldemar (2013) using panel data on Chinese cities and export sophistication index developed by Hidalgo and Hausmann (2009) found no direct gains emanating from the complexity of goods produced by either processing-trade activities or foreign firms. They interpret these results as evidence of lack of local embeddedness and structural and geographical disconnections between ordinary activities and those based on imported technology and foreign firms.

#### **4. Trends in foreign direct investment and export sophistication**

Globalization of economic activity has facilitated the flow of capital between countries. According to recent World Bank figures, the inflows of FDI at global level exceed 19 billion US dollars (USD) over 2007-2015 period. The largest proportion of this inflow went to high and middle income countries (Figure 1) with less than 1% of world FDI inflow being directed to low income economies.

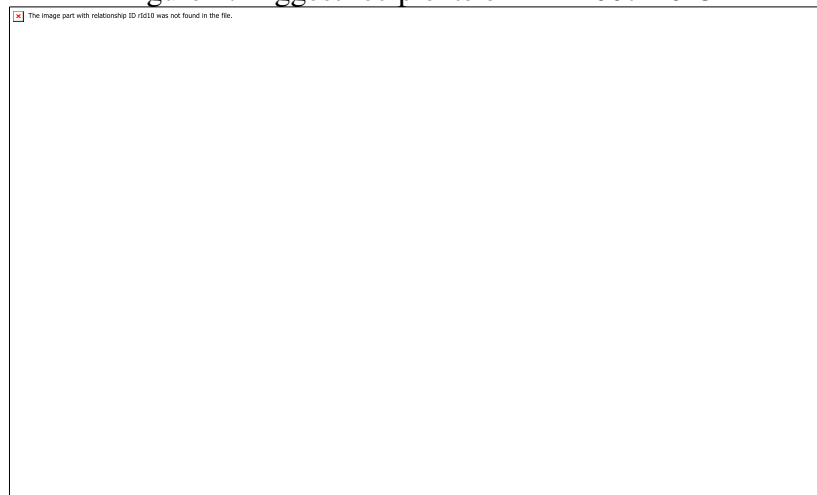
**Figure 1: Foreign direct investment inflow  
by income level of recipient countries 2007-2015**



Source: World Bank WDI database

The greatest recipients of FDI when one observes groups of countries over this analysed period were OECD member states and BRIC (Brasil, Russia, India and China) countries which together accounted for 77% of total world FDI inflows. The concentration of FDI in small number of countries is even more evident if one notes that the USA and European Union alone received almost half of total world FDI over mentioned period.

Figure 2: Biggest recipients of FDI 2007-2015

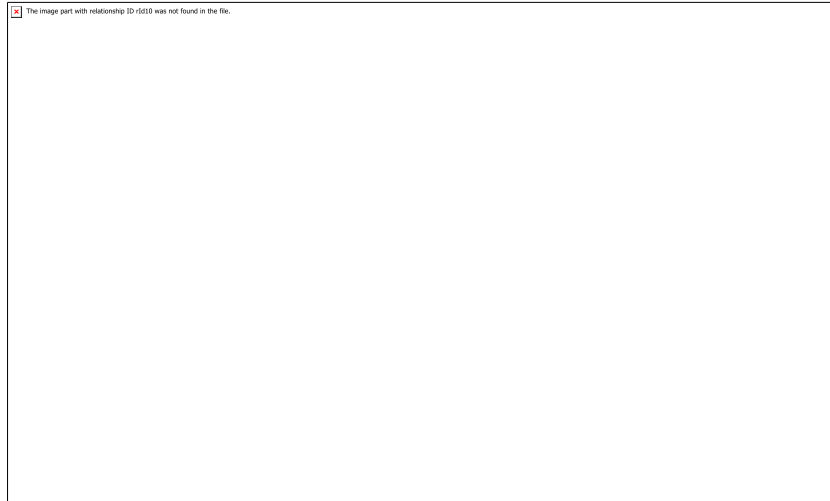


Source: World Bank WDI database

In a parallel development, the world has witnessed an increase in international trade. Compared to its 2007 levels, the exports of goods and services increased for almost an quarter (Figure 3). The developments with respect to exports have partially followed those observed in previous FDI analysis. About 98% of exports of goods and services in terms of value originated from high and middle income countries.

Figure 3: Share of world exports value in goods and services 2007-2015





Source: World Bank WDI database

The value of exports is frequently associated with its quality. It is generally considered that more sophisticated goods bear higher value added and thus can be delivered to global market at higher price. The concept of exports sophistication has been much debated over recent years. Widespread approach is based on the classification of industries (sectors) by their intensity of technology in case of manufacturing and knowledge intensity when it comes to services. However, the cross-country division of production chain means that product components of different value are being produced and assembled across number of countries. The consequence of such vertical division of production chain is that certain product components of low added value can be categorised as products of high technological intensity and thus not reveal true level of export sophistication from a given country.

Another approach to analysis of export sophistication was recently introduced by Hausmann, Hwang and Rodrik (2007). The underlying premise of export sophistication index developed by these authors is that all products traded at global market embody certain level of productivity. Through ranking of goods and services by their embodied productivity it is possible to derive an index of export sophistication that is more accurate than information

obtained on the basis of industrial classification. Supposing that the overall exports of country  $j$  consists of  $n$  goods the total export  $X$  of country  $j$  can be written as:

$$X_j = \sum_{i=1}^n x_{ij} \quad (1)$$

The productivity level associated with given good  $i$  produced by  $n$  countries can be constructed as:

$$PRODY_i = \sum_{j=1}^n \frac{\frac{x_{ij}}{X_j}}{\sum_{j=1}^n \frac{x_{ij}}{X_j}} * GDPpc_j \quad (2)$$

In (2) the numerator reflects share of each individual good in total exports of each country. The denominator is aggregate of these shares across all countries exporting particular good. Hence, this part of expression presents a revealed comparative advantage of each country in good  $i$ . The revealed comparative advantage is multiplied with GDP per capita of each country exporting given good. The overall index of productivity embodied in good  $i$  is then constructed as aggregate of weighted GDP per capita across countries where revealed comparative advantages are used as weights. Hausmann, Hwang and Rodrik (2007) note that such construction of index eliminates the effect of country size as it weights country's income more heavily for those countries exporting larger proportions of each given good.

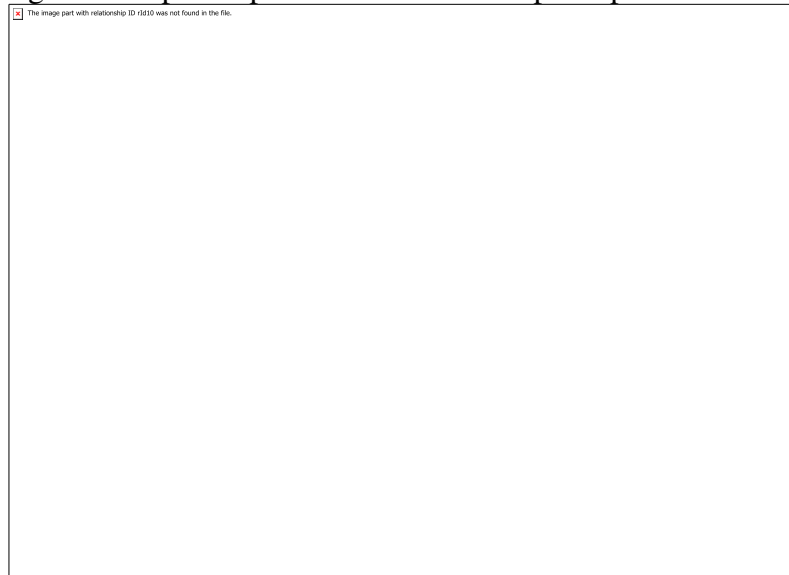
As noted previously, the productivity embodied in particular goods can be used to construct country-wide index of export sophistication. Let export basket of country  $j$  consist of  $n$  goods. From there the export sophistication index can be calculated as:

$$EXPY_j = \sum_{i=1}^n \frac{x_{ij}}{X_j} PRODY_i \quad (3)$$

In equation (3) export sophistication index is weighted sum of productivity embodied in each exported product where shares of individual products in total export basket of country  $j$  are used as weights.

The accuracy of previously described index depends on the level of aggregation at which products are defined. At lower levels of aggregation the accuracy of the index will be higher than at more aggregate levels that encompass wider group of goods and services. For the purpose of this paper data is obtained from United Nations Comtrade database at 6-digit Harmonised System (HS) commodity classification. More than 5000 commodities are assigned code at this level. The data was obtained for 99 countries for which information was available throughout an entire period of analysis.

Figure 4: Export sophistication and GDP per capita 2007-2015

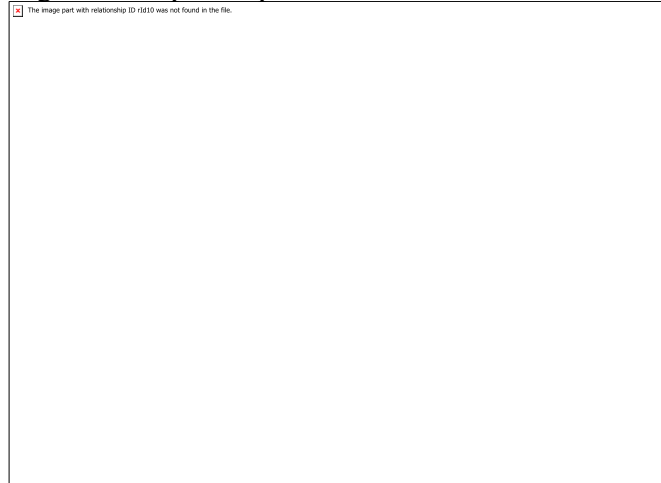


Source: Authors calculations

The visual analysis of EXPY index in Figure 4 reveals interesting fact. The plot of EXPY against GDP per capita of analysed countries makes it clear that highest values of index are found in more developed countries. Such finding supports common thesis that producers from less developed countries are specialised in less sophisticated goods while their counterparts from more advanced economies export knowledge and technology intensive goods which fall under umbrella of sophisticated exports. How does EXPY relate to FDI inflows? Figure 5 provides plot of export sophistication index against FDI inflow over analysed period. The

Figure reveals positive relationship between two even though the observed relationship can be driven with few outliers (China, USA, Netherlands).

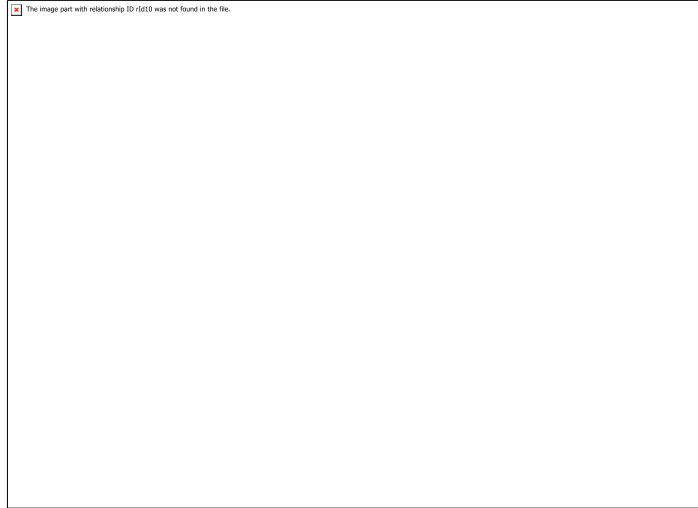
Figure 5: Export sophistication and FDI 2007-2015



Source: Authors calculations

To further investigate the relationship between FDI and EXPY, suspected outlier observations are excluded from analysis. Here, the positive relationship between the two becomes even more visible (Figure 6). More importantly, it is evident that all countries belonging to group of developed or fast developing countries are characterised with higher values of both FDI and EXPY.

Figure 6: Export sophistication and FDI 2007-2015  
(without outliers)



Source: Authors calculations

Overall, these findings suggest that highest level of productivity and thus sophistication is embodied in goods and services exported by more developed countries and countries that are highest recipients of FDI. It is likely therefore that spillover channels of FDI such as knowledge and technology transfer from parent company to its subsidiary, easier access to logistic networks of parent company and vertical and horizontal spillover effects on the rest of economy have beneficial effect on overall level of export sophistication from a given country. The rest of paper explores this issue in more detail with means of econometric analysis.

## 5. Model of investigation and methodology

To investigate the impact of FDI inflows on export sophistication a model is developed in the form:

$$\begin{aligned} \ln EXPY_{it} = & \alpha + \beta_1 \ln EXPY_{it-1} + \beta_2 FDI_{it-2} + \beta_3 OECD_i + \beta_4 BRIC_i + \beta_5 \ln GDP_{pc_{it}} + \\ & \beta_6 \ln Imports_{it} + \sum_{t=2008}^{2015} year_t + u_i + v_{it} \end{aligned} \quad (4)$$

where the dependent variable is defined as the natural logarithm of previously defined export sophistication index EXPY. The right hand side includes lagged value of dependent variable. The inclusion of this variable is motivated with intention to control for dependence between the current values of EXPY and its past realizations. It can be expected that due to the learning by exporting effect and the lengthy process of export upgrading the improvements in export sophistication take place over longer period of time. The key variable of interest in the model is the FDI, the percentage of net foreign direct investment inflow in GDP of country  $i$  in year  $t$ . As noted previously, it is expected that the intra-firm knowledge and technology transfer, access to logistic network of parent company as well as vertical and horizontal spillovers to rivals, suppliers, distributors and other firms in the host economy all together pave the way for beneficial effect of FDI on the export sophistication. The variable enters model as two year lagged value. The reason for this is the fact that the impact of FDI spillovers on export sophistication takes place over time rather than being instantaneous. Furthermore, through inclusion of variable in two year lagged form a potential endogeneity due to correlation between variable and unobservable time-invariant component of the error term is mitigated. A positive sign is expected on this variable.

The model also includes several control variables recognised as potential determinants of export sophistication. The level of GDP per capita in form of natural logarithm is intended to control for the level of development. In line with earlier literature a positive sign can be expected on this variable. We also include natural logarithm of the share of imports in GDP. Higher share of imports could affect domestic demand and alter consumer preferences towards more sophisticated goods which will have beneficial effect on export sophistication. In a parallel development, higher share of imports can also signal higher proportion of intermediate goods used in production of final goods and services that can later be used as exports. In case

of more sophisticated exports a positive sign can be expected on this variable while opposite may hold for countries specialized in standardised goods. For this reason, there is no a priori expectation on the sign of this variable. Two categorical variables are included to control for groups of countries identified in earlier part of paper as highest recipients of FDI on global level, namely OECD and BRIC countries. A positive sign is expected on these variables as well. Finally, the model includes set of annual dummy variables to control for universal cross-sectional shocks.

The estimation is undertaken with the means of dynamic panel system estimator econometric technique (Arellano and Bover, 1995; Blundell and Bond, 1998). The advantage of such methodology is possibility of control for short and long run effects of regressors on regressand, the modelling of dynamics of dependent variable as well as the ability to control for potential unobserved correlation between the dependent variable and unobserved time-invariant components of disturbance. In the estimation, Windmeijer correction was used for downward biased standard errors. All variables for which such transformation was possible enter model in logarithmic form.

## **6. Findings from regression analysis**

The starting point in regression analysis was investigation of model validity. Several tests are conventionally used to establish whether obtained findings can be considered valid or not. Table 1 provides diagnostics on several of these tests. Starting with Hansen J test it can be seen that there is insufficient evidence to reject hypothesis about the validity of instruments. From m1/m2 Arellano-Bond tests one can identify existence of first order autocorrelation but the lack of second order autocorrelation. The number of instruments is several times smaller than

the number of groups (in our case countries) and the Wald test rejects hypothesis about joint insignificance of explanatory variables. Overall, one can say that model diagnostics provide support to the chosen model.

Table 1: Model diagnostics

<b>Diagnostics</b>	<b>Value</b>
Number of observations	792
Number of groups (countries)	99
Number of instruments	19
Wald test	3169***
Hansen $J$ test ( $p > \chi^2$ )	5.31 (0.38)
Arellano-Bond test first order ( $p > \chi^2$ )	-2.94 (0.00)***
Arellano-Bond test second order ( $p > \chi^2$ )	-0.79 (0.43)

Source: Authors calculations

\*\*\*, \*\* and \* denote statistical significance at 1%, 5% and 10% level respectively

Turning to obtained results, a positive and significant coefficient is obtained on the lagged dependent variable. It suggests that an 1% increase in the value of export sophistication index in the past explains about 0.5% of its increase in the current period. Such finding can be considered as an evidence of relationship between current export sophistication and its past realizations and another evidence in favour of thesis about time requirement for improvement in the structure of exports. Our most important variable, however, is the share of foreign direct investment in GDP of country which enters model in original form due to negative values on some observations. Overall, the increase in share of FDI in GDP for 1% leads to the 0.02% increase in the export sophistication. The effect is more than two times greater in the long run. We can conclude from there that all previously described channels of FDI for improvements in export sophistication are functional.

Table 2. Results of estimation

<b>Variable</b>	<b>Short run</b>	<b>Long run</b>
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Lagged dependent variable	0.52***	-
FDI	0.0002**	0.0005**
GDPpc	0.14***	0.29***
Imports share	0.03*	0.07**
OECD	0.03	0.06
BRIC	0.18**	0.38***
Constant	3.29***	-

Source: Authors calculations

Note: \*\*\*, \*\*, \* denote statistical significance at 1%, 5% and 10% level respectively; *p*-values estimated with two-step dynamic panel estimator with Windmeijer robust standard errors corrections. Annual time dummies included.

Among control variables positive sign is observed on both level of GDP per capita and share of imports in GDP. The former suggests that more developed economies have higher levels of export sophistication. Such finding is somewhat expected as investment in high technology intensive or sophisticated goods requires sizeable financial, human and capital resources which are difficult to obtain for less developed economies. The positive coefficient on the share of imports in GDP can be interpreted as an evidence of both the indirect impact through changes in preferences of domestic consumers and the role of reexport in improvements in export sophistication. Finally, among control variables for groups of countries only control for BRIC group is positive and significant.

## 7. Conclusion

Growth of modern economies is closely related to their performance on international market. It is argued by many academics nowadays that the structure of export basket is behind faster growth of some economies than others. The premises of endogenous growth theory and new trade models have taught us, if anything, that knowledge and technology intensive commodities embody higher levels of productivity and sophistication that manifests itself in their added value. These predictions have found their place in modern economic policies as well. Across the globe, policy makers invest significant effort in building of knowledge-driven economies

and promotion of knowledge-driven, sophisticated exports hoping that such strategies can pave way to higher growth rates and better standard of living of their citizens. Among strategies for upgrading of exports particularly important place belongs to attraction of foreign direct investment. It is considered that knowledge and technology transfer as well as horizontal and vertical spillovers to other firms and industries have beneficial effect on structural transformation of exports and building of international competitiveness.

Bearing in mind the importance attached to structural transformation of exports and efforts invested in attraction of foreign investors by policy makers around globe the objective of this paper was to explore whether incentives provided to FDI are warranted with respect to its impact on export sophistication. Our findings reveal positive influence of FDI on improvements in export sophistication. It was also established that this process takes place over time with its full effects being visible only in the long run. Such findings provide support to efforts of all those policy makers aiming to facilitate structural transformation of their exports and encourage economic growth through attraction of foreign direct investment. The importance of these findings is particularly pronounced in case of less developed countries that struggle to catch up with their more developed counterparts. Yet, as our evidence reveals majority of FDI inflow is concentrated in few highly developed and rapidly developing economies. The reversal of this trend remains challenge that needs to be addressed for diminishing of development differences in global economy.

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