Empirical Study on the Spillover Effect of FDI in the Egyptian and Polish Manufacturing Sector

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Abstract

This Paper has attempted to address the spillover effect of FDI on productivity in the Egyptian and Polish manufacturing sector. Empirical analysis has been implemented to determine the factors that influence productivity. In explaining the spillover effect of FDI, the study will apply a two stage least squares technique using the data panel between 2006 and 2014 across 9 sub sectors of the Egyptian and Polish manufacturing sector. A Cobb Douglas production function was used where productivity is established as a function of capital, labor, foreign direct investment, exports, imports, and technology gap.

The results from the production function suggest that physical capital and labor force are the main factors in determining the manufacturing productivity that accordingly enhance the fact that both physical capital and labor inputs are important to the productivity of manufacturing sector. It is also found that the foreign presence enhance productivity in the Egyptian and Polish manufacturing sector. We view the positive effect of FDI on productivity as evidence which indicates that the FDI inflow is not merely a source of capital; it is also a conduit for technology transfer. On the other hand, both imports, and technology gap exert a negative and significant effect on productivity. This is due to high protection, high tariffs in Egypt, and the technology of foreign firms is too advanced for domestic firms to adjust and absorb. In addition exports have a negative but insignificant effect as exports are mainly low-skill products.

Keywords: Spillover effect, FDI, manufacturing sector, productivity

1. The Objective of the Study

This paper is targeting the examination of the FDI spillover effect as the spillover effect has been considered as one of the most important benefits of inward FDI in developing countries. The spillover effect is however a potential impact of FDI on host countries. This paper discussed the necessary factors for spillover of FDI to be realized that represented in technological capacity and policy settings of host countries.

The study aims to explain the impact of foreign direct investment on the industrial sector, by clarifying the most important concepts and the areas of foreign direct investment, and review the economic determinants of foreign direct investment, and measure the impact of foreign direct investment on the productivity of the industrial sector in Egypt and Poland, through the construction of a standard model helps to analyze this relationship, as well as the study seeks to shed light on the decision-makers and policy-makers about formulating their decisions about foreign direct investments in the respect of the appropriateness of the environments to receive the FDIs

1.1 Introduction

The spillover effect is however a potential impact of FDI on host countries. UNCTAD (2000) discussed the necessary factors for spillover of FDI to be realized that represented in technological capacity and policy settings of host countries. The spillover effect of FDI means that the inflow of foreign capitals would promote contribute in promoting the performance of domestic companies in the host country, and the monopolistic advantage which is owned by MNEs would spillover into the host country

Reputation and Public image is an important element for attracting foreign investors, and Poland has it all as Poland is the most attractive location in Central Eastern Europe according to a survey of investment attractiveness conducted by EY.

Poland has adopted the early market reforms with robust institutional building, and was rewarded with an accession to the OECD in 1997. Poland has managed to succeed the privatization process in a broadly efficient and transparent way. There are no Polish oligarchs today. Lastly, Poland benefited from a large and rapidly growing domestic market, which helped to insulate it from external shocks, such as those in 2008-09.

Egypt has created many schemes in attempt for attracting foreign direct investment inflows into special economic and trade zones.

Egypt has a structure that enhance a growth in environment where sectors such as manufacturing, energy, agriculture, tourism and services interact to create economies of scale and make use of its benefits. This accordingly generates a fair distribution of the nation's income, employment and export revenues, and multiplies the opportunities for investment and growth.

This paper is concerning of analysing FDI in Egypt and Poland, as they have benefited from foreign direct investment flows, where there was a positive influence on economic growth, considering that those associated with modern technology investments

2. Literature Review

Goldberg (2007) proposed that many researchers assume that since the industries with high FDI concentration are more productive, the high productivity is due to the MNE presence. Nevertheless those industries could have been more productive even before the arrival of MNE and maybe that's why MNE selected those industries due to their high productivity. Cross sectional studies cannot deal with such reverse causation problems that FDI leads growth or follows it. For instance, is frequently indicating to the rise of Indian software industry as a result of FDI coming from North America, however, Parthasarathy and Aoyama (2006) attribute the rise of the Indian software industry to the Diaspora effect and not to the FDI. They propose that FDI actually comes to Indian software industry when the initial development and growth has already occurred. They see that the return of Indians from USA led to a wide range of skills including managerial skills and international marketing and networking locally available which initiated the boom in Indian software industry.

Also Kosova (2010) has been pointed out another issue in estimating the spillover effects out. He notes that there is a prevalent assumption among researchers including that the developing country has several of local firms and only one MNE. This assumption is over simplistic and can affect the research findings. Vertical linkages with suppliers and customers are considered as the most effective channel of positive spillover effects to the host economy, but what if the up and down stream companies are themselves MNE! In this case the positive spillover to host country will be greatly reduced.

Kosova (2010) further introduced that estimating productivity enhancement is not a good idea for measuring spillovers, as measuring the productivity at the firm level is not easy from distance while using the industry level data. Thus all the studies that measure spillover effects in term of productivity increase of the local firms suffer from this issue. Kosova (2010) thus proposes that growth is not a good criteria to evaluate the effects of FDI. The local firms will grow in a highly growing industry even if the presence of MNEs has negative effects for them, therefore relative growth rates or changes in market share and profitability can be better indicators of firm's performance.

Kosova (2010) presented another interesting issue in measuring the spillover effects. In many cases, the number of firms at the start of study differs to the number when the study is concluded, as during the study time many firms exit from the industry, with the exit of each firm, some data is lost. For example, if there were hundred firms at the start when MNE arrives and after one year only ninety have survived, the firms that exited were most likely the least productive ones. Subsequently, exit of these firms in itself may help raising the average productivity of the remaining 90 firms without any positive spillover effect. A final issue in estimating the spillover effect comes from the criteria that how the firms are called as local and foreign (Kosova, 2010).

3. Method

This thesis will use the modeling method as this method will identify if there is a relation between the variables that result in spillovers effect, or there is no relation and still the spillovers exist or there is a multi correlation between variables that result in spillovers effect, in this method FDI is regarded as an independent variable as Cobb-Douglas production functionwill be used to investigate spillover effect.

4. Analysis

4.1 Data and Econometric Approach: Model Specification

The econometric approach uses annual observations on a cross-section of nine sub-sectors of the Egyptian manufacturing sector over the period 2006 to 2015.

To investigate whether inward FDI generates productivity spillovers for domestic industries, we utilize a Cobb-Douglas production function as the following:

$$InY_{i,t} = a + \beta_k InInput_{i,t} + yInFDI_{i,t} + \delta_k z_{i,t} + u_{i,t} \tag{1}$$

Where $u_{i,t} = u_i + v_{it}$

In (1) subscripts i, and t, stands for industry, and time. α, β, γ, and δ are parameters under estimation. Value added of industries is denoted *Y,* their inputs denoted *Input*, foreign presence in the industry *FDI*, *Z* are other control regressors, and $u_{i,t}$ is the usual equation error term.

We identify three potentially important determinants of productivity within the Egyptian and polish manufacturing sector. The choice of these explanatory variables was dictated by sub-sectoral characteristics which may influence the factors are as follows:

4.2 Foreign Direct Investment

It has been widely argued that vertical and horizontal linkages resulting from inward FDI facilitate technology spillovers for the host economy. Vertical linkages are formal contacts between multinational enterprises (MNEs) i.e., the FDI source firms and their local suppliers or buyers. The existence of a formal relationship provides an incentive to the MNEs for directly transferring their technology and know-how to the local firms. Spillovers resulting from horizontal linkages, on the other hand, are unintended 'leaks'. These occur when the competing domestic firms appropriate the MNEs technology through means such as imitation and reverse engineering (OECD, 2002). Technology spillovers may also accrue to the host economy when the MNE trained labour relocates to the domestic firms (Fosfuri et al., 2001).

Researchers consider FDI as a key channel for technological spillovers. It is also regarded as superior organizational form from highly industrialized to developing economies. Besides, FDI is thought to create positive externalities as knowledge spills over into domestic economies. Such generation takes place through linkages with local suppliers and close clients (including both backward and forward linkages), learning from nearby foreign firms and training programmes directed to employees. Research also refers to negative externalities which are also possible hindrances to the access of technology and competition. The assumption prevalent in the recent literature on the subject is that positive externalities prevail over the negative ones. Consequently, FDI is encouraged by governments as well as international organizations by providing grace periods for taxation purposes and other business enhancing schemes. Thus, FDI can constitute a cost rather than a profit if the outflow of profits becomes too high. In addition, FDI may replace domestic production instead of increasing competition.

4.3 Open Economies

Open economies are currently believed to grow more rapidly than closed economies. Integration into the global economy provides firms with access to larger markets, a wider variety of goods and services and more highly sophisticated technologies which can be adjusted for domestic use. In addition, exposure to international competition can lead to higher quality products and reduce the duplication of R&D efforts (Rivera-Batiz & Romer, 1991; Grossman & Helpman, 1994). Imports and exports are held to be the two main channels of openness.

With regard to imports, it is arguable that capital goods imports can increase domestic productivity, since capital goods encompass technological knowledge, and, subsequently R&D activity spillovers from one country to another through worldwide trade. The current literature on the subject seems to provide two fundamental mechanisms for such trade- related R&D spillover effects. First, recipient counties can imitate the technology if the cost of attaining it is lower than the cost of the corresponding invention. Secondly, R&D expenditure by foreign countries leads to the creation of new capital goods which differ from, or are superior to those already in existence.

As for exports, it is arguable that export expansion can endorse sector specialization where a country has a distinctive advantage, including a re-allocation of resources from the relatively incompetent non-trade sector to

the more production-orientated export sector. Second, exports growth may raise production levels by providing greater economies of scale. Third, increasing exports can have a profound effect upon aggregate productivity through dynamic spillover effects on the rest of the economy (Feder, 1983).

To capture the intricate relationship between foreign trade and productivity, the following export and import ratios will be applied, Exp/GDP and IMP/GDP. This will allow for considering specific differences in the relative contribution of exports and imports.

4.4 Technology Gap

Technological advancement has been increasingly seen as the principal driver for long-term national prosperity. As this doctrine has taken roots, using public policy and funding to stimulate innovation are deemed not only desirable, but indeed indispensable if a country wants to maintain its global competitiveness. The need to design and, subsequently, evaluate any innovation policies has led to the search for methods to measure and compare technological capability across countries and over time. As a result, there has been a proliferation of works aiming at quantifying technological capability at the national level

There are two basic approaches to the measure of technological capability of a country – the indicators approach and the modeling approach. The indicators approach includes the collection of a range of statistics that describe various aspects of innovation, such as the number of scientific publications and the expenditure on R&D.

The theoretical literature on this topic reveals, albeit rather tentatively, that all firms are supposed to benefit by knowledge spillovers from multinationals. Instead, a firm's benefits rely, for the most part, on its absorptive capacity for assimilating knowledge and its relative backwardness. In this part, we follow Carkovic et al. (2002), Alfaro 2003, and Borensztein et al. (1998) in taking the difference between GDP per capita of the United States and Egypt's GDP per capita as a ratio to Egypt's GDP per capita, as a measure of the technological gap since the US is considered the most technological advanced country, and the same approach will be applied to Poland .

4.5 Data Description and Sources

Table 1 presents definitions that will be used in the estimated equation.

Table 1. Dependent and independent variables measures and summary statistics in Egypt

Variables	Symbol	Definition	Calculation	Mean	Std. Deviation
Value Added	$Y_{i\,t}$	Real value added per industry	(VA/Deflator)*100	13.376	1.762
Capital	$K_{i\,t}$	Real values of capital per industry	(Capital/Deflator)*100	14.253	2.762
Labor	$L_{i\,t}$	Total number of employees per industry		5.074	5.376
Foreign Direct Investment	$FDL_{i,t}$	Real values of FDI inflows per industry	(FDI/ Deflator)*100	10.176	1.960
Exports to GDP	$Exp_{i,t}$	The percentage of exports to GDP per industry	Exports/ GDP	2.577	1.522
Imports to GDP	$Im\,p_{i,t}$	The percentage of imports to GDP per industry	Imports / GDP	0.888	0.730
Technology Gap	TG_t	The difference between US GDP per capita and Egypt GDP per capita as a ratio to Egypt GDP per capita	(US) GDP per capita- (Egypt) GDP per capita/ (Egypt)GDP per capita	3.192	0.079

Source: 1-The data for foreign direct investment were collected from the General Authority for Investment (GAFI). (CAPMAS) (IMF).

2-The data for the technology gap were collected from the Global Market Information Database.

Table 2. Dependent and Independent variables measures and summary statistics in Poland

Variables	Symbol	Definition	Calculation	Mean	Std.Deviation
Value Added	$Y_{i\,t}$	Real value added per industry	(VA/Deflator)*100	15.065	3.985
Capital	$K_{i\,t}$	Real values of capital per industry	(Capital/Deflator)*100	15.587	2.783
Labor	$L_{i\,t}$	Total number of employees per industry		8.658	6.257
Foreign Direct Investment	$FDL_{i,t}$	Real values of FDI inflows per industry	(FDI/ Deflator)*100	15.258	2.652
Exports to GDP	$Exp_{i,t}$	The percentage of exports to GDP per industry	Exports/ GDP	2.434	3.256
Imports to GDP	$Im\,p_{i\,t}$	The percentage of imports to GDP per	Imports / GDP	0.748	1.583

		industry			
Technology Gap	TG_t	The difference between US GDP per capita and Poland GDP per capita as a ratio to Poland GDP per capita	(US) GDP per capita- (Poland) GDP per capita/ (Poland)GDP per capita	5.965	0.37

Source: The data for the technology gap were collected from the Global Market Information Database.
(IMF), (World Bank), Central Statistical Office, Annual Statistical Abstract of Poland, Warsaw.

5. Empirical Results

In order to assess the influence of the variables described, an augmented production function may be built up in the following form:

$$InY_{i,t} = a + \beta_1 Ink_{i,t} + \beta_2 InL_{i,t} + \beta_3 InFDI_{i,t} + \beta_4 In\left(\frac{Exports}{GDP}\right)_{i,t} + \beta_5 InTGap_t + \beta_6 In\left(\frac{imports}{GDP}\right)_{i,t} + u_{i,t} \tag{2}$$

i = 1,…….., N;

t= 1,………, T;

With i stands for manufacturing sectors, and t stands for time. a is a scalar, (*K, L, FDI, Exports/GDP, Imports/GDP, TGap*), (B1,……, B6) represents explanatory variables and parameters respectively. Yi,tthe dependent variable Ui,t represents the vector of the error component, with

In the panel data literature, an important distinction is drawn between models with fixed and random individual specific effects. Subsequent investigation was therefore concerned with choosing the correct specification. The Hausman specification test is the classical test to discriminate between fixed and random effects models. Initially, a fixed effects model was estimated via a simple OLS regression of Equation 3 inclusive of dummy variables to account for fixed effects. Misspecification tests applied to the fixed effects model revealed the absence of multicollinearity (as shown in Table 3), first-order auto-correlation, and the presence of heteroskedastic residuals.

Table 3. Partial correlation, VIF & Tolerance to Egypt

Variables	Correlation	VIF	1/VIF
Capital	0.454	3.29	0.325
Labor	0.740	4.10	0.259
FDI	0.463	2.51	0.436
Exports to GDP	-0.280	1.16	0.888
Imports to GDP	-0.039	1.15	0.900
Technology Gap	0.098	1.19	0.777
Mean VIF	2.25		

Table 4. Partial correlation, VIF & Tolerance to Poland

Variables	Correlation	VIF	1/VIF
Capital	0.547	3.24	0.581
Labour	0.655	4.03	0.248
FDI	0.453	2.49	0.401
Exports to GDP	-0.290	1.13	0.888
Imports to GDP	-0.038	1.14	0.877
Technology Gap	0.097	1.13	0.994
Mean VIF	3.42		

In order to simultaneously account for heteroskedasticity within panels, we can rely on a feasible generalized least squares (FGLS) estimator. The advantage of this approach is that it allows estimation in the presence of heteroskedasticity across panels (as shown in Table 5, 6).

Table 5. GLS estimation results to Egypt

Variables	Coefficient	Std. Error
Capital	.2856***	.0235
Labor	.6587***	.0415
FDI	0.2425***	.0293
Exports to GDP	.0954***	.0184
Imports to GDP	.0229	.0467
Technology Gap	.9380***	.2533
Constant	1.242	1.646

Table 6. GLS estimation results to Poland

Variables	Coefficient	Std. Error
Capital	.2686***	.0287
Labor	.6473***	.0436
FDI	0.2425***	.0293
Exports to GDP	.0944***	.0184
Imports to GDP	.0229	.0467
Technology Gap	.9290***	.4633
Constant	1.242	1.646

Notes. 1. All variables are expressed in natural logarithms.

2. *, **, and *** denote significance at the 10, 5, 1 percent level, respectively.

It should be noted, however, that further considerations regarding the specification were necessary, in other words, endogeneity, or two way causality, presents problems for both FDI and value added in regression. This is a particular concern for our key regressor of interest, FDI. To address this possibility, we model value added in the current time period as a function of FDI in the previous period so that the endogeneity problem is unlikely to arise. In addition, the above model is estimated under the assumption of exogeneity of the variables. However, if input choices are correlated with unobservable factors (factors arise from difficulties in observing and quantifying differences in the quality of human capital, intensity and effects of demand shocks across firms and industries), the exogeneity assumption will be violated. This information is barely captured and hence causing input variables to be correlated with the error term. In this case, both capital and labor may be endogenous.

To solve the problem of endogeneityone would usually use fixed-effects instrumental variables estimation (two-stage least squares or 2SLS). In addition, (Equation 2) was augmented with time dummies to capture time specific effects.

$$InY_{i,t} = a + \beta_1 Ink_{i,t} + \beta_2 InL_{i,t} + \beta_3 InFDI_{i,t} + \beta_4 In\left(\frac{Exports}{GDP}\right)_{i,t} + \beta_5 In\left(\frac{Im\,ports}{GDP}\right)_{i,t} + \beta_6 InTGap_t + y_t + y_i + \varepsilon_{i,t}$$ (3)

Table 7. Fixed effect two stage least squares estimation to Egypt

Variables	FE estimation
Capital	.4065***
	(.124)
Labor	.4290*
	(.1163)
Lagged FDI	.0848***
	(.0382)
Exports to GDP	-.0707
	(.0532)
Imports to GDP	-.3461***
	(.1042)
Technology Gap	-1.769*
	(1.039)
Hansen J Statistic χ^2 P-val	(0.655)

Notes. 1. All variables are expressed in natural logarithms.

2. Standard errors are in parenthesis.

3. *, **, and *** denote significance at the 10, 5, 1 percent level, respectively.

Table 8. Fixed effect two stage least squares estimation to Poland

Variables	FE estimation
Capital	.4065***
	(.124)
Labor	.4290*
	(.1163)
LaggedFDI	.0758***
	(.0382)
Exports to GDP	-.0709
	(.0532)
Imports to GDP	-.4581***
	(.1042)
Technology Gap	-1.639*
	(1.039)
Hansen J Statistic χ² P-val	(0.527)

The estimation of the production function:

Table 7, Table 8 reveals that the coefficients on capital and labor are statistically significant, reflecting that both physical capital and labor have a positive effect on productivity. The contribution of capital to the level of productivity is high with the value of 0.405, and is statistically significant at the 1% level. This implies that ceteris paribus firms raising more capital have higher productivity. In addition, the effect of labor force on output for the Egyptian and Polish manufacturing sector is correctly signed and statistically significant at the 10 per cent as the Egyptian and Polish industry is low-tech and endowed with large quantities of semiskilled and unskilled manpower.

Exports which were included to proxy openness in the manufacturing sector and expected to have a positive effect on productivity was found to have a negative effect. In Egypt there does not appear to be a close association between FDI and exports. While manufacturing industries receive more than half of all investment, manufactured products account for only a third of total exports. This results from the fact that the majority of Egyptian manufacturing enterprises are small- and medium-size firms which generally lack operating technology, and organizational and managerial capabilities, and have difficulty in meeting the quality standards and delivery targets required by foreign companies (more than 60 per cent of manufacturing exports were low-skill products as the Egyptian industry is low-tech). Therefore, The Egyptian export pattern and trends in the manufacturing sector suggest the need to encourage manufacturers to enter export markets and upgrade the country's production and trade structure.

Imports which were included to proxy openness in the manufacturing sector and expected to have a positive impact on productivity were found to have a negative effect on productivity. First, this is due to the high trade ratios of Egypt as they are confined to consumer goods with no technological spillovers. Second, despite the massive Egyptian efforts to liberalize highly restrictive trade regime , most manufacturing sectors continue to be highly protected through the high tariff structure. Egypt's tariffs are still comparatively high, particularly in comparison with those of other developing countries that have diversified industrial economies.

The extent to which a firm is able to exploit external knowledge depends on its level of absorptive capacity as well as on the complexity of the external knowledge. Hence, if the technology gap between foreign and domestic firms is too large, local firms may not be able to comprehend and adapt foreign technology.

From Table 8 technology gap has a negative significant effect on productivity at the 10 per cent level. This means that the wider the size of the technology gap between Egypt and technologically developed countries is, the less productivity Egypt will witness. In other words the results show that to achieve higher levels of productivity, Egypt has to work on diminishing the technology gap.

As argued in most studies, foreign invested firms may transfer technology so as to foster domestic production efficiency through imports of advanced machinery and better materials, international competition, and training of local managers and workers. Therefore, one would expect to see that the larger the share of FDI in the industry, the greater the spillover effect on production. In table 7 the estimated coefficient on FDI is positive (0.084) and statistically significant at the 1 per cent level. This reflects that the presence of foreign firms positively influences the capacity for production in manufacturing industries. In other words, domestic firms in the manufacturing industries of Egypt benefit from foreign firms in the same industries. This may be due to a technological leakage from foreign firms to local firms in the same industry as local firms can learn from these

firms by observing and imitating new technologies as well as new products through the imitation. The coefficient of foreign spillover is relatively low, compared to that found in empirical studies in some other developing economies . This may not be too surprising given the level of economic development, and absorptive capacity of other countries is higher, in addition, total FDI in those countries is also much higher.

6. Conclusion

This Paper has attempted to address the spillover effect of FDI on productivity of the Egyptian and Polish manufacturing sector. After reviewing the previous literature about inward FDI and productivity spillover, empirical analysis has been implemented to determine the factors that influence productivity. In explaining the spillover effect of FDI, the study applied used a panel data between 2006 and 2014 across 9 sub sectors of the Egyptian and Polish manufacturing sector. A Cobb Douglas production function was used where productivity is established as a function of capital, labor, foreign direct investment, exports, imports, and technology gap.

It turned out from the results of the analysis of Egypt and Poland; they have benefited from foreign direct investment flows, where there is a positive influence on economic growth, considering that those associated with modern technology investments, in addition to that irregular migrant flows to their land. Foreign direct investment has had a positive impact for Egypt and Poland, which contributed effectively to the increase in exports and to have a positive impact on human capital.

The results from the Cobb-Douglas equation suggest that physical capital and labor force are the main factors inmanufacturing productivity, that enhance the fact that both physical capital and labor inputs are crucial elements to the productivity level in manufacturing sector. As Poland has Highly skilled workforce, large labor pool and competitive labor costs,the Polish labor force is well educated, flexible, and relatively young. The work ethics of the Polish professionals are praiseworthy.

And also Egypt has a massive labor force It is also found that the foreign presence enhance productivity in the Egyptian and Polish manufacturing sector.

The positive effect of FDI on productivity can indicate that the FDI inflow is not only a source of capital; it is also a channel for technology transfer. On the other hand, both imports, and technology gap exert a negative and significant effect on productivity. This is due to high protection, high tariffs, and the technology of foreign firms is too sophisticated for domestic firms to adjust and absorb. In addition exports have a negative but insignificant effect as exports are mainly low-skill products

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