Aggregate & Heterogeneous Sectoral Effects of FDI in Egypt

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Abstract

This paper investigates the sectoral impacts of FDI on growth in Egypt between 1990 and 2007 based upon a unique data set. It highlights the aggregation bias inherent in many empirical studies that focus solely on the economy-wide effects of foreign investment. Aggregate inflows of FDI are shown to be detrimental to the country's economic growth performance, possibly as a result of the 'crowding-out' of more productive domestic investment. Some positive sector-specific effects however, are found for investment in Manufacturing & Petroleum, which also has beneficial spillovers into other sectors. FDI in the Finance & Retail and Telecommunications & Information Technology sectors are found to generate significantly negative growth effects while those in Services and Tourism are negative but generally insignificant. These findings suggest that 'market-seeking' FDI in certain sectors has conspicuous 'crowding-out' effects, possibly owing to insufficient domestic absorptive capacity. The results of this study further demonstrate the importance of potential sectoral heterogeneity of own sector and inter-sectoral economic growth effects of FDI. It therefore highlights the critical need for policy makers to take a more disaggregated sectoral-level evaluation of the benefits of foreign investment, particularly in developing economies such as Egypt.

JEL Classification: F23, O11, O14, O47.

1. INTRODUCTION

In the years leading up to the global financial crisis in 2007, many developing countries experienced a significant upsurge in inflows of foreign direct investment (FDI). These investment flows were generally driven by the search for new supplies of natural resources, low-cost labour for export platform activities and consolidation in strategic markets. At the onset of the global crisis in 2007, High Income countries experienced a 46.6 per cent rise in net inflows of FDI while Low and Middle Income countries experienced increases of 84 and 42 per cent respectively (World Bank, 2012). Most of these inflows to the developing countries, often via mergers and acquisition, were a critical element in the organisational restructuring of the global value chain activities of major international businesses.

The positive contribution made by FDI inflows to the economic growth process of host countries is now almost universally accepted; at the very least, it increases the domestic stock of physical capital. FDI is also likely to generate growth effects over and above those of 'pure' capital through the creation of direct local linkage and indirect efficiency and spillover effects. These additional effects accord with the emphasis of new growth theory on the critical roles of endogenous technological development and technical progress in driving long-run growth (Romer, 1990). The indirect efficiency and spillover growth effects of FDI are positive productivity externalities arising from the activities of foreign firms through the dissemination and absorption of their R&D- and human capital-intensive technology and production know-how by domestic firms (Blomström and Kokko, 1997; Meyer, 2004). The specific mechanisms through which these effects are transmitted to a host economy are less well understood and empirical studies have yet to present conclusive evidence demonstrating their significance, especially in the case of developing countries. The magnitude of these effects is determined by, among other things, the level of host country economic and institutional development, including the absorptive capacity of human capital, and the quality of domestic policy-making (see, for example, Lenhert *et al.*, 2013; Elkomy, *et al.*, 2016).

Egypt is one of the largest and most important economies in the Middle East & North Africa (MENA) region with a population of over 100 million and GDP in excess of $200bn, placing it at the upper end of the World Bank's Lower Middle Income group. Since the beginning of the Middle East peace process in the early 1980s under President Anwar Sadat, Egypt has been a key Western ally and a major recipient of US aid flows. Although its economic health appears sound with foreign currency reserves of some $40 billion, external debt is around 50 per cent of GDP and development is hampered by relatively low spending on education, health and infrastructure. Along with many other developing countries, Egypt has significantly altered its growth strategy to focus on attracting increasing inflows of FDI in order to upgrade its technological base and enhance domestic productivity. In 2006, it was the largest recipient of FDI in Africa, with an inflow of just over $10bn out of a regional total of $35.5bn, representing a share of 28.3 per cent (Table 1, p. 3, UNCTAD 2008a). In 2014, Egypt ranked fourth in Africa in terms of inflows, worth $4.9bn, up by 14 per cent on 2013. The stock of FDI in 2006 of $38.9bn was the third largest in the region (12 per cent) after South Africa and Nigeria (Figure 4, p.7, UNCTAD, 2008a). The sectoral distribution of FDI inflows to Egypt is broadly similar to that in Sub-Saharan Africa rather than in the rest of North Africa, with Primary activities taking 37.5 per cent, Secondary 8.1 per cent and Tertiary 38.4 per cent (Table 3, p. 9, UNCTAD, 2008a). Egypt was also ranked first of 178 countries in *Doing Business 2008* for business-oriented reform in 2006-07, reflecting substantial economic reform along with important changes to its domestic institutional environment (World Bank, 2009).

Since the 2011 Arab Spring, developments in Egypt have not been wholly favourable. The first democratically elected president, Mohammed Morsi, was overthrown by the military after one year in office and the country has also experienced low growth, high unemployment and a large budget deficit. As late as 2018, the country was ranked 120th for overall ease of doing business, a rise of only six places since 2006. The floating of the Egyptian pound at the end of 2016 saw its value slump by 50 per cent against the US Dollar although this did improve the country's attractiveness to foreign investors. At the end of 2017, the IMF concluded an agreement to provide $12 billion of funding to help Egypt overcome the economic crisis. As a result of this ambitious reform programme, the economic outlook is much improved; growth has re-bounded, inflation has peaked and capital inflows are increasing (IMF, 2018). In particular, FDI inflows are projected to reach four per cent of GDP by 2021/22. Going forward, foreign investment is viewed as an important facet of the country's recovery and, in 2016/17, FDI rose to $7.7bn, a rise of some 14 per cent over the previous year. Furthermore, according to IMF projections, such investment is projected to more than double, rising to four per cent of GDP in 2021/22 (IMF, 2018).

This paper investigates the impact of inflows of FDI on Egypt's growth performance. Given that the country's absorptive capacity is unlikely to be sufficient to harness all of the benefits of imported technology and know-how, the study interrogates a model that enables the explicit identification of any spillover growth effects of these capital inflows. In so doing, the paper makes several contributions to the literature. First, it uses a unique unpublished sectoral dataset to examine whether focusing on aggregate inflows of capital obscures possible differential growth effects of flows into specific sectors. It tests formally for bi-directional causality and, by utilising both fixed-effects and GMM estimators, shows how ignoring causality and/or endogeneity can induce the ‘so-called’ Nickell bias. Second, by exploiting the time dimension, the study is the first to use the Augmented Mean Group (AMG) estimator to facilitate the disentangling of own-sector effects of FDI inflows from spillovers accruing in other sectors. The insights from this study have important policy design implications insofar as it highlights those sectors that exhibit the greatest benefits from FDI and suggests why Egypt may not be able to realise an expected growth dividend from foreign capital injections into sectors that appear to offer the greatest growth potential.

The first substantive section of the paper outlines the conceptual and theoretical underpinnings of the study and reviews the relevant empirical literature on the host country sectoral growth effects of FDI inflows. This is followed by an overview of the data employed in the study while Section 4 outlines the empirical model and its estimation along with a brief summary description of the dataset. The findings of the study with regard to the growth impacts of FDI inflows in Egypt are then presented, firstly at the aggregate economy-wide level and then at the sectoral level. The final section presents some concluding remarks and policy implications.

2. SECTORAL GROWTH EFFECTS OF FDI INFLOWS

Standard macroeconomic analyses of FDI tend to forego an important dimension of its effects; namely that these inflows are distributed heterogeneously across the sectors of a host country. This implies therefore, that the magnitude – and therefore the importance – of the growth effects of FDI is primarily determined by the technological and skill characteristics of the economic sectors in which foreign firms are concentrated. These approaches fail to take into account the potential heterogeneity of the sector-specific growth effects of FDI inflows, therefore resulting in aggregation bias by generalising the impacts of FDI on host economies (Görg and Strobl, 2005). The dynamics of the interplay between FDI and output growth, both within and between economic sectors, have been insufficiently explored in the macroeconomic literature while firm-level microeconomic studies are often unable to capture in full all of the economic effects of foreign activity in a host economy since many such studies focus exclusively on manufacturing.

The view that there are differential growth effects across economic sectors derives from Singer’s argument that the concentration of FDI in primary and resource-based sectors in developing countries confines its impacts to short-run output growth because of the reliance on advanced technologies (Singer, 1950). In a similar vein, Hirschman (1958) contends that technology spillovers and productivity gains arising from FDI are contingent on the characteristics of the targeted sector and its inter-sectoral linkages. These arguments imply that FDI inflows to the manufacturing sector might be expected to generate greater output effects relative to other sectors since manufacturing is characterised by robust industrial linkages. The discrete nature of industrial production and the divisibility of its output therefore create strong vertical linkages between foreign and domestic firms, both upstream and downstream (UNCTAD, 2001). The importance of these linkages in the dissemination of advanced technologies and knowledge capital has broad empirical support (e.g., Barbosa and Eiriz, 2009; Bwalya, 2006; Javorcik, 2004; Rodriguez-Clare, 1996). In addition, technological requirements and technical know-how in manufacturing are expected to magnify the impact of FDI on output growth since foreign firms are perceived to introduce innovatory processes and new production and management techniques (Cohen and Levinthal, 1989).

Earlier studies focus mainly on the impacts on the three principal sectoral categories (primary, secondary and tertiary) while later ones provide a greater degree of disaggregation. Alfaro (2003) finds that FDI inflows to manufacturing alone generate positive growth externalities while resource-driven FDI exhibits a robust and significantly negative impact on economic growth. This finding is ascribed to investment in the primary sector being financed mainly by domestic loan capital rather than by equity; a view partly confirmed by the frequent use of intra-company loans at the expense of equity in the oil and petroleum sectors (UNCTAD, 2007). Wang (2009) finds that the growth effects of FDI in manufacturing are three times greater than in other sectors while Chakraborty and Nunnenkamp (2008) find bi-directional causation between FDI and output growth in manufacturing but no evidence of significant FDI spillovers in the primary sector. Ben Hamida and Gugler (2009) show that efficiency spillovers of FDI in manufacturing are based upon the technological capabilities of domestic firms but these results are less robust for services. Adams (2009) finds that resource-driven FDI in the sub-Saharan African countries generates net ‘crowding-out’ effects in domestic credit and goods markets.

One of the first disaggregated sectoral-level studies, for Indonesia 1998 to 2006, focuses on FDI in resources and services, excluding manufacturing, and finds positive aggregate growth effects that are much weaker at the sectoral level (Khaliq and Noy, 2007). Growth was only enhanced in Construction while the effect of FDI in Mining & Quarrying was detrimental and attributed to a variant of the ‘resource curse’. The growth effects of FDI in construction are argued to be triggered via backward linkages to manufacturing and services (Ramsaran and Hosein, 2006) and the augmentation of labour skills (Mallick and Mahalik, 2010). In civil engineering projects, efficiency effects may also be generated through infrastructural development necessary to attract more technologically-oriented FDI (UNCTAD, 2008b). Vu, Gangnes and Noy (2008) analyse the impact of FDI in 12 sectors in China and nine in Viet Nam, 1990-2004. The strongest positive sectoral growth effects in China were again in Construction, along with Wholesale, Retail Trade & Catering, Real Estate, Social Services, Health Care and Sport & Social Welfare, while eight sectors in Viet Nam exhibited positive growth effects, the largest being Oil & Gas, with no effect found only in Other Services. Vu and Noy (2009) investigate the effects of FDI in 12 sectors in six OECD countries (Denmark, Germany, The Netherlands, Spain, The UK and The United States) and find that FDI has a positive impact on growth on nearly all of these sectors. The greatest effect is in Real Estate, that on Construction and Trade & Repair is insignificant while Agriculture & Fisheries is the only sector where a negative relationship is found. Cipollina *et al*. (2012) analyse the effects of FDI on 14 manufacturing sectors for 22 developed and developing countries, 2001-2014, and find that FDI has a significantly positive effect on growth that is most pronounced in more capital-intensive and technologically-advanced sectors. This finding is supported by Kubny and Voss (2014) who show that the productivity gains arising from FDI are almost imperceptible in low technology sectors – i.e., where the technology ‘gap’ is small.

It is important to note that services activities are highly diverse, such that they differ greatly in terms of their technology and human capital requirements. Some of the literature argues that services incorporate more standardised production methods and technologies so that the long-run growth effects of FDI in the sector is necessarily weak (e.g., Lee, 1996) or inconclusive (Alfaro, 2003), generating temporary spillovers that are not sustained in the long-run (Chakraborty and Nunnenkamp, 2008). Further, Dullien (2005) finds that FDI in the service sector tends to be market-seeking and ‘crowds-out’ domestic investment. Several studies (Arnold, *et al*., 2008; Kim and Kim, 2010; Fernandes and Paunov, 2012) however, find that transactional services with strong linkages with other sectors – such as telecommunications, information technology, finance and banking – channel significant inter-sectoral technology and efficiency gains.

The sectoral-level estimation strategy adopted in this paper follows that of two earlier studies. Doytch and Uctum (2011) find that, for a broad cross-section of countries, the growth effects of FDI in manufacturing tend to be restricted to that sector. This is most evident in Latin American & the Caribbean and Europe & Central Asia as well as in middle and low income countries whose economies are characterised by high industrial concentration. In many cases, FDI in financial services stimulates output in both services and manufacturing while in other service activities it aids own sector growth but harms manufacturing. These findings are reinforced by a study of 14 Asian economies (Doytch and Uctum, 2019) in for which FDI in manufacturing is found to have no impact on GDP; any growth dividend accrued from services, both directly and via spillovers. Again, this positive stimulus is the result of FDI in financial services while inflows have no impact on other services but have a negative impact on manufacturing.

Certiain studies investigate the impact of FDI on sectoral growth in Egypt. Massoud (2008) analyses the three broad categories of economic activity separately, 1975 to 2007, and finds that FDI only promotes growth in manufacturing and then only when interacting with human capital. FDI in agriculture depresses growth while that in services appears to have no discernible effect. The author also stresses that inflows of foreign capital to manufacturing increase the domestic stock of physical capital and generate tradeable commodities which are potentially major drivers of growth. These results broadly concur with the regional analysis of Hanafy (2015) except that, while FDI promotes growth in manufacturing, no support is found for any positive effect when it interacts with human capital.

The small number of empirical studies of the sectoral growth effects of FDI and the variety of different analytical methodologies employed means that it is difficult to draw clear inferences. This review identifies just four cross-country studies, one of which focuses on two, along with several single country analyses such that it is hard at this stage in the development of the literature to discern broader generalisable findings from specific national and institutional contexts. A further methodological issue relates to the substantial variation in national sectoral definitions that reflect different patterns of domestic economic activity. Inter-country differences in the growth effects of FDI may therefore be simply the result of differences in the constituent activities in the defined sector.

Several salient issues can be identified regarding the expected economic growth effects arising from inflows of FDI to Egypt. First, as a developing economy, Egypt experiences a significant technological 'lag', particularly with respect to the leading Western economies. The transfer of technology and knowledge by Western investors is therefore more likely to benefit the more advanced sectors of the Egyptian economy. The potential gains from such transfers however, will only be maximised if domestic firms are able to absorb these advanced processes which, in turn, is dependent upon the absorptive capacity of local human capital. Of particular interest is whether there exists a strong relationship between FDI and economic growth in sectors such as telecommunications and information technology since these form a critical nexus for inter-sectoral linkages in more advanced economies. Few, if any, significant benefits from FDI in other services are expected, given that foreign firms are likely to be market-seeking such that inflows of investment may simply 'crowd-out' domestic firms. Manufacturing FDI has been the most important channel for enhancing economic growth in many developing and industrialising countries but the analysis of this sector in Egypt however, is hampered by the inclusion of the petroleum industry in the classification data. Finally, FDI in Egyptian agriculture is not expected to promote growth given that the sector's technological requirements tend to be low in developing economies generally.

3. DATA & THE MODEL

The source of the sectoral FDI data is unpublished data from GAFI (Government of Egypt, 2008a). Data were also obtained from the 25-year report on *Time-Series Production, Investment, Employment & Wages* from the Egyptian Ministry of Economic Development (Government of Egypt, 2008b). All variables are in real terms and calculated using the 1992 GDP deflator from the World Development Indicators database (World Bank, 2012). The data set employed covers the period 1990 to 2007, with the end date of the analysis being determined by the fact that the political upheaval brought about by the Arab Spring in 2010 also had repercussions for agencies charged with data collection.[1] Thus, although the General Authority of Free Zones and Investment (GAFI) remains operational, it has been transformed into an investment promotional agency for Egypt and the sectoral FDI data used here do not exist post-2007. The time window employed however, does have compensating advantages. First, the analysis is free from noise generated by the 2008 global financial crisis. Second, Egypt has faced severe economic and political difficulties over the last decade and the improved economic conditions and relative political stability conducive to foreign capital have only recently resurfaced. It is therefore timely to investigate whether there are lessons that will help the country gain the greatest benefits from FDI. It must be recognised however, that the

[1] The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

resulting panel is small and its time dimension of 18 is large relative to its cross-section dimension of seven.

The baseline model employed derives from the Solow-Swan growth literature and is given by:

$$lnY_{it} = (1 + \beta)lnY_{i,t-1} + \Gamma W_{it} \quad [1]$$

Where Y_{it} is sectoral output; W_{it} is a vector of the logs of the variable of interest FDI – measured by the ratio of the inflows of foreign-issued capital to output (Alfaro, 2003) and other growth determinants, namely the ratio of domestic investment to output (*DI*) and the ratio of government expenditure to output (*GE*); i and t indicate the sector and time dimensions of the data respectively.

Initial data screening reveals that *DI*, *GE* and *FDI* are all positively correlated but no figure exceeds 0.43, suggesting that no serious bi-variate correlation is evident in the data. The choice of variables included in the model is, in large part, determined by data availability. While it would have been desirable to have had additional information on human capital and R&D, such data do not exist at the requisite sectoral level. Employment level data were utilised initially but an auxiliary regression showed that over two-thirds of the variation in employment was explained by variations in domestic investment. In terms of parameter expectations, domestic investment is expected to boost output and some persistence is expected with regard to lagged output. Government expenditure is more nuanced insofar as it may simply 'crowd out' other sources of funds although, in the context of a developing country where investment funds are scarce, a positive effect is likely. The expectation regarding FDI is that, in aggregate, it is likely to be beneficial to Egypt's economic performance although studies of other countries suggest that its effects may be heterogeneous at the sectoral level.

Sectorally, the following might be expected. First, in those sectors where Egyptian firms experience the greatest technological lag, the gains from inflows of foreign capital might be expected to be the greatest, especially in advanced sectors, such as Manufacturing, Telecommunications & Information Technology and Finance & Retail, although this is the subject of some debate in the literature. Second, the Telecommunications & Information Technology sector, in particular, might be expected to generate extensive inter-sectoral growth spillovers (Arnold *et al*., 2008; Francois and Hoekman, 2010; Kim and Kim, 2010) while the Petroleum sector is expected to have few, if any, such spillover effects given its high degree of technology- and capital-intensity. Given that this is an exploratory analysis with few existing findings, it should be stressed that this study is, in effect, an *ex ante* exploratory investigation regarding the sectoral distribution of the beneficial effects of FDI inflows to the Egyptian economy

Summary statistics for the raw data are given in Table 1. In aggregate, FDI inflows are low when compared to both domestic investment and government expenditure, being only one-fifth the size of the former, and one-sixth the size of the latter. As expected, the highest foreign capital inflows go to Manufacturing & Petroleum with an average figure of in excess of one thousand million Egyptian pounds, representing around 37% of the total, although the standard deviation of the data shows a high degree of variability over the sample period. In second place was the Finance & Retail sector which attracted approximately E£676 million. It is noticeable that the Telecommunications & IT sector which is one where Egypt lags behind its more advanced competitors, attracted the second lowest volume of foreign funds, only agriculture received less.

[Table 1 about here]

4. METHODOLOGY

The primary estimation strategy is as follows. First, the impact of aggregate FDI on output is analysed using the specification:

$$lnY_{it} = \beta_1 + \beta_2 \, ln \; Y_{it-1} + \beta_3 \, ln \, DI_{it} + \beta_4 \, ln \, GE_{it} + \beta_5 ln \, FDI_{it} + v_i + \mu_{it} \qquad [2]$$

Where the v_i capture sector specific effects and μ_{it} is a white noise error term. In order to further understand the impact of specific sectoral FDI, the foreign investment variable is disaggregated into seven economic sectors that comprise total private output in Egypt: Manufacturing & Petroleum (*MP*); Financial & Retail Services (*FR*); Services (*S*); Tourism (*T*); Construction (*C*); Telecommunications & Information Technology (*IT*); and Agriculture (*A*) which are listed in order of the magnitude of the FDI inflows they attract. This results in the following:

$$lnY_{it} = \beta_1 + \beta_2 \, ln \; Y_{it-1} + \beta_3 \, ln \, DI_{it} + \beta_4 \, ln \, GE_{it} + \beta_5 ln \, FDI\_MP_t + \beta_6 ln \, FDI\_FR_t + \beta_7 ln \, FDI\_S_t + \beta_8 ln \, FDI\_T_t + \beta_9 ln \, FDI\_C_t + \beta_5 lnFDI\_IT_t + \beta_5 ln \, FDI\_A_t + v_i + \mu_{it} \qquad [3]$$

In the light of the relatively long time span compared to more conventional panels, unit root tests are conducted. Given the shape of the panel, the Levin-Liu-Chu test is selected and, using a demeaned model with or without trend, the null of a unit root is rejected for all variables.[2]

The standard methodology for the estimation of these models is to use a panel model such as the fixed-effects (FE) specification. This is the starting point although it is somewhat problematic. First, the model is dynamic insofar as the lagged dependent variable appears on the right-hand side of the equation which can lead to the 'so-called' Nickell bias, although the problem is more severe when *N* is large. Second, the standard FE approach has an embedded assumption that the errors across sectors are independent. This may be unrealistic given that, for example, all of the sectors may be commonly affected by an exogenous shock such as a change in government policy. If this is ignored, although coefficient estimates from standard panel models are consistent, commonly-employed covariance matrices are biased, thereby rendering statistical inference unreliable (Hoechle, 2007). Here, a variant of the Driscoll and Kraay (1998) covariance matrix, developed by Hoechle (2007), is used. This is robust to general forms of spatial and temporal dependence and is suitable for the shape of the panel employed.

Endogeneity – implying simultaneous determination – and/or reverse causality however, remain a potential problem. A formal approach to examine the direction of causality is to use a panel causality test, such as that proposed by Dumitrescu and Hurlin (2012). This test involves the estimation of the model:

$$y_{it} = \alpha_i + \sum_{k=1}^{K} \gamma_{ik}\, y_{i,t-k} + \sum_{k=1}^{K} \beta_{ik}\, x_{i,t-k} + \varepsilon_{it} \qquad [4]$$

and, to test whether $x_{i,t-k}$ Granger causes y_{it}, the relevant test is:

$$H_0: \beta_{i1} = \cdots = \beta_{ik} = 0 \; \forall i = 1, \dots, N$$

$$H_1: \beta_{i1} \neq or \dots or \neq \beta_{ik} = 0 \; \forall i = 1, \dots, N.$$

Under this scenario, F tests are conducted on the k linear hypotheses on the βs, the Wald statistics are retrieved and an average Wald statistic, $\bar{W} = {}^{1}/_{N} = \sum_{i=1}^{N} W_i$ computed. This is then evaluated using either the standardised $\bar{Z}$, which assumes that first $T \rightarrow \infty$ and then $N \rightarrow \infty$. The main caveat to this approach is that rejection of the null only indicates that there is evidence of Granger causality in at least one panel; there is no indication of how many or which

[2] Of course, caution must be exercised, insofar as the power of panel unit root tests is low. However, the tendency is that they tend to over-reject the null.

these are. The results of these causality tests indicate bi-directional relationships between sectoral output per capita and FDI (at the five per cent level), domestic investment (one per cent), government expenditure (one per cent), as well as with FDI into both the construction and services sectors (both at the one per cent level).

In the light of these findings, recourse to instrumental variables is necessary although, as is common, there are no readily available external instruments available. Recently, GMM estimators have become popular and have been employed in similar work (Doytch and Uctum, 2011, 2019). A degree of caution is required in the application of such techniques however, since the methodology suffers from a proliferation of instruments leading to the over-fitting problem (Roodman, 2009). For example, in system GMM, lagged differences of all variables are used as instruments in the levels equation while their lagged levels are used as instruments in the difference equation. Using a standard model, the number of instruments exceeds one hundred; i.e. very close to the number of observations. In an attempt to mitigate this problem, the following estimation strategy is adopted. First, a collapsed instrument set is employed whereby one instrument was constructed for each variable and each lag distance, a procedure that considerably reduces the bias that arises as the number of instruments approaches the sample size. This contrasts with the standard procedure where separate instruments are also constructed for each time period. Second, from the collapsed instrument set, principal components (PCs) can be constructed to further reduce the dimensionality of the instrument set. As is common in PC analysis, only those components whose eigenvalues exceed one are retained. An alternative, albeit similar, strategy uses a routine which applies PC analysis to the initial instrument set instead of working initially with a collapsed instrument set prior to the extraction of the principal components (Bontempi and Mammi, 2014). In the results that follow, both estimation strategies are employed for comparison.

The final model affords the possibility of parameter heterogeneity to disentangle the own sector effects of FDI from any spillovers that it might create. The length of the series precludes the use of a full autoregressive distributed lag model but the methodology permits a preliminary look at how time series can be used to examine both own and indirect effects of foreign capital inflows. The estimation proceeds using the Augmented Mean Group Estimator (AMG) (Eberhardt and Teal, 2010), which works as follows. First, a pooled regression model is augmented with year dummies and estimation is via first difference OLS. The coefficients on the differenced year dummies, which represent a cross-group average of the evolution of unobservables over time, are then retrieved. In AMG terminology, this is the common dynamic process (CDP). Sector-specific regressions are then undertaken including this CDP as an additional variable.[3] An intercept is also included in the model to capture time-invariant FEs.

Formally, the model becomes:

$$lnY_{it} = \beta_{i1} + \beta_{i2}\, ln\ Y_{it-1} + \beta_{i3}\, ln\, DI_{it} + \beta_{i4}\, ln\, GE_{it} + \beta_{i5} ln\, SEC_{it} + \beta_{i5} ln\, N\_SEC_{it} + \mu_{it} \quad [5]$$

Where: $u_{it} = \alpha_{1i} + \lambda_i f_t + \varepsilon_{it}$, with α_{1i} capturing time-invariant FEs, f_t the unobservable common factor with heterogeneous loadings λ_i. ε_{it} is assumed to be white noise. Two FDI measures appear in [5]. The first, SEC_{it} refers to inflows from sector j to sector j. With a sufficiently long time series, it would have been optimal to also include in the model inflows between all other sectors; i.e. $j \rightarrow k; j \neq k$. However, here, as in many FDI studies, the time span of the data prevent this and so an aggregate variable was constructed, N_SEC_{it}, which captures the sum of other flows into a given sector, other than those that originate from the sector itself; i.e. . $\sum j \rightarrow k; j \neq k$.

4. RESULTS & ANALYSIS

The results of the baseline estimation of the model are presented in Table 2. Column 1 contains standard FE results and only reveals that domestic investment is a positive driver of growth. Both FDI and government expenditure depress performance – suggesting possible crowding out – although the magnitude of the parameter estimate for FDI is quite small. The lagged dependent variable term is both positive and significant, suggesting persistence in the output series. As discussed above, these results assume cross-sector independence; Driscoll Kraay standard errors are therefore given as a comparator in Column (2). The parameter estimates are, of course, unchanged. The sole difference between these two sets of results is that the significance of the FDI measure is reduced; from 5 per cent in (1) to 10 per cent in (2), thereby suggesting that inflows of foreign capital may not have such adverse effects as the initial results suggest. In terms of preference between these two specifications, the Pesaran test of cross-sectional dependence is not significant, although this does not mean that such dependence is absent since it could come about if there is a negative correlation between the errors in some sectors and a positive one between errors in others.

[Table 2 about here]

[3] Alternatively, the variable with a unit coefficient can be imposed on each sector.

The other four sets of results in Table 2 are from variants of GMM estimation (Arellano and Bover, 1995).[4] Columns (3) and (5) present estimates for difference GMM whereas the estimates in Columns (4) and (6) come from system GMM. Columns (3) and (4) use a collapsed variable set followed by a PCA of the instruments with an instrument count of 17 and 18 respectively. Columns (5) and (6) employ the principal components analysis prior to the construction of the instruments and has a count of 67 and 68 respectively, both of which exceed 50 per cent of the number of observations. The discussion therefore focuses on the former results.

In terms of the adequacy of the procedure to mitigate over-fitting, a single PC is retained for both models; for the difference model, this accounts for 82 per cent of the variance in the instruments and 60 per cent for the system model. There is also no evidence of second-order serial correlation. In terms of the parameter estimates, these are broadly in line with those from the FE models. The magnitude of the parameter estimate on the lagged dependent variable is reduced suggesting, a possible upwards bias in the FE coefficient estimate. FDI continues to exert a negative influence on growth, this finding being significant at 5 per cent in both models. The strength of the government expenditure result is reduced as the coefficient estimate is now only significant at the 10 per cent level.

The results presented so far find no evidence that foreign capital inflows have given Egypt a growth dividend while domestic investment appears to have been more productive. The finding with respect to government expenditure however, is not robust with respect to specification choice since, in the GMM results, the parameter estimate only achieves weak significance. One possible explanation for this result lies in the fact that such expenditure is diverse in that it comprises both capital and current elements which have contrasting impacts on growth. In developing countries, governments may have over-invested in capital projects, which have become unproductive at the margin, at the expense of current expenditure (Devarajan *et al*., 1996).

These results contain no explicit recognition of the temporal nature of the data so a number of additional specifications were employed. In the first, a series of standard time dummies are added to the model but the null that these are jointly equal to zero cannot be rejected. Second, a specific dummy to control for the spike in FDI when *Vodafone* made a large investment in

[4] In all of the GMM results the lag length is truncated at $t-3$. The findings are robust with respect to lag length and additional results are available on request from the authors.

the GSM market is included but also fails to achieve statistical significance.[5] The final method explored explicitly recognises that FDI inflows flat-lined until 2003 since foreign investors were fearful regarding Egypt's economic climate. To account for this, a FDI*2003 dummy is added to the empirical specification. The results presented in Table 3 reveal that this control variable has a positive and significant coefficient – albeit one that is smaller than that for FDI itself. This indicates that although the impact of FDI on growth remains negative for the later part of the sample period, the magnitude of this effect is smaller.

[Table 3 about here]

In Table 4, FDI inflows are disaggregated by sector of the Egyptian economy. Overall, the findings confirm the results presented above. The lagged dependent variable retains its strong significance and the positive role played by domestic investment in the growth process carries over, although it should be noted that the size of the effect is much greater in the GMM estimates than in the FE ones. In terms of the significance of the sectoral FDI inflows, the findings are robust.

Inflows to Telecommunications & Information Technology in all four specifications have a negative coefficient significant at the 5 per cent level, with the magnitude of the estimate being robust across all four sets of results. Although this sector dominates FDI inflows in terms of their magnitude relative to output, the anticipated benefits of foreign capital participation are not being realised. This finding is key since the sector potentially provides critical infrastructure that can generate key linkages both between and within all sectors of an economy, as in the case of Korea (Kim and Kim, 2010). The results here do not support this contention in the case of Egypt and may possibly reflect the fact that the country lacks the absorptive capacity to extract know-how associated with FDI inflows.

[Table 4 about here]

The results also highlight the negative impact of flows into Finance & Retail on growth, although the magnitude of this effect in the GMM estimates is approximately one-half of that in the FE ones. The FE results with cross-sector dependence also indicate the negative effect of flows into Tourism but this result is not confirmed in either the system or difference GMM estimates. For the remaining sectors, the parameter estimates fail to achieve statistical

[5] These results are available on request from the authors.

significance under any of the estimation procedures adopted, indicating that while FDI inflows have failed to promote growth, they have not harmed it either.[6]

Finally, AMG analysis is used to disentangle the own-sector impacts of FDI from inter-sector spillover effects; the results are reported in Table 5. The former are represented in the diagonals of the table and the latter in the off-diagonals. Comparing these findings with those shown in Table 3, Row (6) shows that the negative impact of FDI in Telecommunications & IT are not own sector effects but accrue from its impact on Manufacturing & Petroleum, Tourism and Construction. Similarly, the negative impact of inflows to Finance & Retail on growth (Row 1) comes about primarily via the Tourism sector.

[Table 5 about here]

From an Egyptian economic growth and policy perspective, the finding that FDI in the Manufacturing & Petroleum sector has positive impacts is reassuring. From Row (2), the coefficient estimate for the own sector effect of FDI is significant at the 5 per cent level and spillovers into Construction is significant at 1 per cent. FDI in the sector also has weakly significant positive impacts (at the 10 per cent level) on Finance & Retail, Tourism and Agriculture. Manufacturing & Petroleum is the principal sectoral destination for inflows of FDI inflows to Egypt with a share of 37 per cent, some 60 per cent of which flows to oil-based industries for refining and the production of basic petrochemicals (UNCTAD, 2013). In spite of the FDI in this sector mainly being focused on upstream oil activities therefore, the evidence suggests that there are strong within and between sector linkages between foreign and domestic firms.

The results for those sectors falling broadly within the broad service category are mixed. In Finance & Retail, significant impacts are found for flows into Tourism and Construction, although the latter only holds at the weak 10 per cent level. Inflows of FDI to Services have a negative impact on own sector growth and that in Finance & Retail. This provides weak support for Dullien (2005), who finds that FDI in services is likely to trigger substantial ‘crowding-out’ since foreign investors are generally market-seeking. In the case of Egypt however, this FDI is shown to be a strong promoter of growth in Telecommunications & IT. The impact of inflows of FDI to Tourism appear to be own-sector specific and indicate a dampening effect on growth.

[6] Collinearity problems precluded the inclusion of sector-specific 2003 onwards interaction terms in the model.

It is important to note that the findings for Egypt suggest that the growth effects of FDI in Manufacturing & Petroleum differ from those in other sectors – and Services in particular. This may be because manufacturing FDI primarily involves the transfer of 'hard' technology, such as equipment and industrial processes, whereas service FDI transfer 'softer' know-how, such as technical, marketing and management skills, information, expertise and organisational skills (Doytch and Uctum, 2011). The findings suggest that the Egyptian economy may be better at absorbing the former than the latter. Further, this study suggests that its policy-makers should target activities in those sectors of its economy where FDI is most likely to promote future growth – i.e., in sectors such as Telecommunications & Information Technology.

5. CONCLUDING COMMENTS

Egypt is a key player in the Middle East and of critical strategic significance to Western economies in ensuring regional stability and containing the threat of terrorism. Fostering economic growth and development in the country is therefore vitally important. According to some metrics, it has performed well; growth has been impressive and inflation has declined. In policy circles, inflows of FDI are viewed as an essential driver of key driver of future economic growth; although Egypt is a leading African destination for FDI, these capital flows 2019-20 were equivalent to just 0.6 per cent of GDP. The challenge for Egypt – like many developing countries – is to both attract FDI and be able to harness successfully the growth benefits of foreign capital and its embodied technologies.

The aggregate results presented in this paper do not support an FDI-driven growth dividend although the dampening effect of foreign capital was reduced after investor confidence began to return after 2003. The study however, reveals a considerable asymmetry between the sectoral pattern of FDI inflows and their economic growth effects that are partially obscured by an aggregate approach. The focus on individual sectors shows a positive growth effect in Manufacturing & Petroleum, which is reassuring given that this sector attracts 37 per cent of total inflows. Further, these inflows also generate positive growth spillovers in other sectors (Finance & Retail, Tourism, Construction and Agriculture). In sectors such as Finance & Retail and Telecommunications & IT however, the only positive growth effects found are spillovers from the former into Tourism. Overall, the study results suggest that Egypt may have the capacity to adopt foreign technology in mechanical industries but it is less well placed to absorb the benefits of more advanced 'softer' technologies.

This study demonstrates the existence of potentially heterogeneous sectoral growth effects that arise from inflows of FDI with important policy implications for other developing countries more generally. The findings indicate that, in order for host countries to maximise the benefits of foreign capital inflows through the adaptation and harnessing of imported technologies and know-how, policy-makers should focus more on considering possible sector-specific growth effects and inter-sector linkages rather than on their aggregate impacts.

Declaration of Interest

No financial interest or benefit has arisen from the results of this work.

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Table 1: Summary Statistics

Variable	Mean	Minimum	Maximum	Standard Deviation
Y	16,558.28	959.48	42,420.09	121.0096
FDI_MP	1,285.367	161.0425	353,697.9	1.024.63
FDI_FR	675.9712	97.12717	274,686.4	768.797
FDI_S	482.355	16.39346	356,701.4	856.3165
FDI_T	417.7366	27.60408	105,058	288.0002
FDI_C	231.1998	30.96032	157,038	364.4531
FDI_IT	225.1593	2.18078	275,116.2	646.7565
FDI_A	145.7857	1.672243	123,067.5	285.6705
FDI	494.97	1.672243	356,701.4	744.2052
DI	2,463.261	.09594837	19,316.22	2,670.541
GE	3,095.651	6,895.229	18,629.44	4,885.335

Note: Measured in Egyptian Pounds (E£, million).

Table 2: The Aggregate Growth Impact of FDI Inflows

Dependent Variable lnY	(1): FE1	(2): FE2	(3):DIFF GMM	(4): SYS GMM	(5): PCA DIFF GMM	(6): PCA SYS GMM
lnY_{t-1}	0.7655^{***}	0.7655^{***}	0.6466^{***}	0.6493^{***}	0.7696^{***}	0.8854^{***}
	(15.40)	(18.05)	(3.00)	(3.04)	(6.66)	(21.35)
lnFDI	-0.0409^{**}	-0.0409^{*}	-0.0646^{**}	-0.0646^{**}	-0.0345^{***}	-0.0477^{**}
	(2.44)	(2.07)	(2.44)	(2.41)	(3.96)	(2.37)
lnDI	0.0638^{***}	0.0638^{***}	0.1666^{***}	0.1633^{***}	0.0710^{***}	0.0573^{**}
	(3.42)	(3.68)	(9.62)	(9.56)	(3.79)	(2.37)
lnGE	-0.1784^{***}	-0.1784^{***}	-0.2664^{*}	-0.2659^{*}	-0.1882^{**}	-0.0559
	(4.42)	(5.43)	(1.73)	(1.74)	(2.05)	(1.61)
Constant	2.4951^{***}	2.4951^{***}		3.5180		1.1395^{***}
	(4.79)	(5.68)		(1.53)		(2.67)
Within R^2	0.9526	0.9526				
Between R^2	0.9784					
Overall R^2	0.9739					
Pesaran test		0.72				
(p-value)		(0.47)				
N Instruments			17	18	67	68
N PCs			1	1		
(% var)			(82)	(69)		
(KMO)			(0.66)	(0.71)		
AR(2)			-1.40	-1.40	0.17	1.30
(p-value)			(0.16)	(0.16)	(1.38)	(0.18)
Sargan Test			12.21	12.13	71.36	133.70
(df)			(13)	(13)	(63)	(63)
(p-value)			(0.51)	(0.52)	(0.22)	(0.00)
Hansen Test			3.09	1.74	3.49	0.57
(df)			(13)	(13)	(63)	(63)
(p-value)			(1.00)	(1.00)	(1.00)	(1.00)
N	119	119	112	112	112	112

Note: absolute t-statistics in parentheses: ***, $p < 0.01$; **, $p < 0.05$; *, $p < 0.10$.

Table 3: The Aggregate Growth Impact of FDI Inflows, with 2003 Dummy

Dependent Variable lnY	(7): DIFF GMM	(8): SYS GMM
lnY_{t-1}	0.5752***	0.5810***
	(2.97)	(3.04)
lnFDI	-0.1175***	-0.1157***
	(4.73)	(4.69)
lnDI	0.1858***	0.1812***
	(7.60)	(7.72)
lnGE	-0.2665*	-0.2658*
	(1.73)	(1.86)
*lnFDI*2003*	0.0832***	0.0804***
	(4.38)	(4.32)
Constant		4.0951**
		(1.96)
Instruments	17	18
N PCs	1	1
(% var)	(82)	(69)
(KMO)	(0.66)	(0.71)
AR(2)	-1.44	-1.40
(*p*-value)	(0.15)	(0.15)
Sargan Test	9.54	9.63
(df)	(12)	(12)
(*p*-value)	(0.66)	(0.65)
Hansen Test	2.16	0.89
(df)	(12)	(12)
(*p*-value)	(1.00)	(1.00)
N	112	112

Note: As for Table 2.

Table 4: The Disaggregated Growth Impact of FDI Inflows

Dependent Variable lnY	(9): FE1	(10): FE2	(11): DIFF GMM	(12): SYS GMM
lnY_{t-1}	0.8125***	0.8125***	0.6660***	0.6727***
	(15.94)	(21.19)	(4.55)	(4.70)
lnFDI_MP	0.0503	0.0503	0.0465	0.0466
	(1.01)	(1.32)	(0.87)	(0.88)
lnFDI_FR	-0.0853**	-0.0853***	-0.0479**	-0.0498**
	(2.39)	(8.46)	(2.15)	(2.07)
lnFDI_S	-0.0063	-0.0063	-0.0044	-0.0046
	(0.27)	(1.70)	(0.32)	(0.33)
lnFDI_T	-0.0364	-0.0364**	-0.0471	-0.0466
	(1.36)	(3.10)	(1.53)	(1.52)
lnFDI_C	0.0172	0.0172	0.0148	0.0150
	(0.66)	(1.54)	(0.24)	(0.25)
lnFDI_IT	-0.0250**	-0.0250**	-0.0251**	-0.0250**
	(2.07)	(3.08)	(1.97)	(1.97)
lnFDI_A	0.0174	0.0174**	0.0049	0.0054
	(0.55)	(2.55)	(0.12)	(0.14)
lnDI	0.0489***	0.0638**	0.1278***	0.1238***
	(2.58)	(3.16)	(5.09)	(4.93)
lnGE	-0.1552***	-0.1552***	-0.2120	-0.2100
	(3.54)	(5.11)	(1.53)	(1.53)
Constant	2.1882***	2.4951***		3.3691**
	(4.07)	(5.50)		(2.16)
Within R^2	0.9548	0.9548		
Between R^2	0.9833			
Overall R^2	0.9784			
Pesaran Test		0.39		
(*p*-value)		(0.70)		
N Instruments			17	18
N PCs			1	1
(% var)			(82)	(69)
(KMO)			(0.66)	(0.71)
AR(2)			-1.34	-1.34
(*p*-value)			(0.18)	(0.18)
Sargan Test			7.15	7.08
(df)			(7)	(7)
(*p*-value)			0.41	0.42
Hansen test			0.00	0.00
(df)			(7)	(7)
(*p*-value)			(1.00)	(1.00)
N	119	119	112	112

Note: As for Table 2.

Table 5: Own Sector & Spillover Effects of FDI Inflows

Inflow from	*MP*	*FR*	*S*	*Flow into* *T*	*C*	*IT*	*A*
MP	0.1562** (1.98)	0.0982* (1.70)	0.0265 (0.51)	0.3849* (1.84)	0.2290*** (2.48)	1.0020 (1.60)	0.0808* (1.68)
FR	-0.0687 (1.16)	-0.0193 (0.76)	0.0347 (0.91)	0.2241*** (2.46)	0.0708* (1.68)	-0.1575 (0.96)	0.0243* (1.30)
S	-0.0211 (008)	-0.3255*** (2.73)	-0.2774** (2.22)	-0.0645 (0.15)	0.0910 (0.49)	2.0165*** (3.72)	-0.0482 (0.89)
T	-0.2031*** (2.84)	-0.0503 (0.96)	0.0026 (0.08)	-0.1984*** (3.14)	-0.0569** (2.29)	-0.2084 (1.61)	-0.0240 (1.57)
C	-0.0992 (1.51)	-0.0046 (0.22)	0.0311 (1.56)	-0.0209 (0.26)	0.0343* (1.90)	0.0506 (0.77)	0.0230** (1.93)
IT	-0.1964*** (2.82)	-0.0627*** (1.25)	0.0046 (0.15)	-0.1733*** (3.03)	-0.0506** (2.33)	-0.1541 (1.60)	-0.0233 (1.65)
A	-0.0825 (1.43)	-0.0245 (0.79)	0.0120 (0.51)	0.0212 (0.30)	0.0324 (1.46)	0.0463 (1.44)	0.0141 (1.28)

Note: As for Table 2.