

Foreign Ownership and Spillovers: An Econometric Study of Ghana's Manufacturing Industry

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“This thesis was written as a part of the master program at NHH. Neither the institution, the supervisor, nor the censors are –through the approval of the thesis -responsible for neither the theories and methods used, nor results and conclusions drawn in this work.”

Abstract

This paper studies the total factor productivity gains, export participation and spillovers of foreign ownership in Ghanaian manufacturing industry. This is based on a comprehensive panel data on manufacturing firms collected as part of the enterprise survey over the period 1991-2002. Controlling for simultaneity, endogeneity bias, firm and year fixed effects, firm productivity is first estimated. Results show that foreign owned firms are on average 7% more productive than domestic firms in the same sub-sector and location. Besides, there is statistical evidence suggesting that domestic firms will gain in productivity via spillovers from foreign owned firms. Lastly, I find that, domestic firms are 3.1% more likely to participate in exports with increasing share of foreign owned firms in the same sector.

Foreword

The thesis has been time consuming, but also exciting and very educational. I have benefited greatly from what I have learned during the study period, especially in applied econometrics courses, economic theory and globalization and integration.

I have made use of a wide range of theories and relating to previous literature in econometrics, FDI and Spillovers. I have also gained experience with processing and cleaning datasets, which are mostly raw. The writing process has been a lot informative from start to end, with challenges along the way. I have observed how different choices influence the end result, and attempted to make the best choices on the basis of theory and practice.

I will take this opportunity to thank my supervisor, Assistant professor Ragnhild Balsvik, NHH. She has been of great help, always being available and provides prompt and comprehensive feedback along the way. I also express my appreciation to the Centre for Studies of African Economies (CSAE), Oxford University, for making the dataset available.

I will finally emphasize that all views expressed in the paper are entirely those of the author, and I take responsibility for any errors that have been committed throughout the study.

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Chapter 1 Introduction

This paper investigates the role of foreign ownership in domestic firms' productivity and export performance in the Ghanaian manufacturing industry. Foreign ownership refers to the complete or majority ownership/control of a business or resource in a country by individuals who are not citizens of that country, or by companies whose headquarters are not in that country. The focus of this paper is on three central questions. Foremost, is there a foreign ownership productivity premium in the manufacturing industry? Secondly, can domestic firms benefit in total factor productivity from foreign ownership presence? Lastly, do spillovers from the presence of foreign owned firms' export activity influence the export participation of domestic firms?

Investigating these economic questions are interesting because much of the empirical literature and economic theory establish Foreign Direct Investment (FDI) is a core macroeconomic component to every country's Balance of Payment as it contributes significantly to national output. Indeed, foreign direct investment can directly contribute to the upgrading of the productive capacities, especially in developing countries. In addition, FDI may make available needed additional capital, technology and technical know-how, as well as providing access to international markets (Asiedu 2002, Borensztein, De Gregorio and Lee, 1998; De Mello, 1999). These benefits are central for economic growth and development and for better integrating developing countries into the global economy, through its trade and investment relations with the rest of the world.

Besides, at the firm-level, literature on "the theory of heterogeneous firms" by Jovanovic (1982); Hopenhayn (1990) and Redding (2010) argue that particular firms export due to differences in technology, endowments and the structure of production. Export activities may help firms achieve greater efficiency in production through economies of scale and exposure to foreign markets (increased market size). A growing body of empirical studies document that exporting firms have superior characteristics, for example in terms of productivity, compared to firms that remain in local markets¹. Bernard and Jensen (1999) find in US data that exporters are larger,

¹ Bernard and Jensen (1995), (1998), (1999) and (2004), Richardson and Rindhal (1995), for U.S. plants, Bernard and Wagner (1997) and Bernard et al. (1997), for German plants, Clerides et al. (1998), for Mexico, Morocco and Colombia.

more productive, more capital-intensive, more technology intensive, and pay higher wages than non-exporters.

Multinational Enterprises (MNEs) have competitive advantage to operate in unfamiliar environments owing to technology, economies of scale, and other firm specific tangible and intangible factors they possess (Dunning 1977, 1988). Such intangible assets among others include, possessing information about foreign markets and consumer preferences, accruing from their presence in many markets. Therefore, foreign ownership either in the form of equity, cross border mergers and acquisitions (M&A's) or greenfields may spillover to domestic firms in the industry. Such spillovers include total factor productivity gains and export spillovers.

Channels through which domestic firms might improve productivity from spillovers include imitation, labour mobility, competition or local firms learning to export. Such spillovers have the potential to raise productivity and their exploitation might be related to the structural characteristics of the host economy, in particular absorptive capacity². Above some level of absorptive capacity, economic theory gives guidance that domestic firms may gain from potential spillovers. See for example, Grünfeld (2006).

For the case of export spillovers, the presence of foreign owned firms in developing host countries can substantially reduce the stringent conditions associated with foreign/export market entry (see Girma, Greenaway and Kneller, 2004)³. The tacit information of the foreign owned firms about foreign markets may leak out to the domestic firms. This externality is one type of 'spillovers' from FDI. Spillovers can also take place when the presence of MNEs improve the productive efficiencies of domestic firms, making their products efficient in price and quality on the international market and thus improving their export performance. The spillovers may be "horizontal spillovers" if it occurs to domestic firms in the same industry group of foreign firms, otherwise vertical. Horizontal and vertical spillovers are not necessarily the exhaustive picture.

² Absorptive capacity refers to the firm's ability to recognize the value of new information, assimilate it, and apply it in their production process. Cohen and Levinthal (1990) find that the firm's absorptive capacity is critical to its innovative capabilities and suggests that it is largely a function of the firm's level of prior related knowledge.

³ They find evidence consistent with learning by exporting.

Controlling for the endogeneity of the relationship between exporting and productivity, that is, whether more productive firms are more likely to export (self-selection) or are the exporting companies which, after starting to export, improve their performance (learning to export). The process of learning by exporting assumes that the stringent conditions of international markets, coupled with greater access to technologies, processes and products, and spillovers in general benefit the firm and improve their productivity. Hughes 1986; Clerides *et al.* 1998; Bernard and Jensen 1999; Salomon and Shaver 2005 find positive effects of learning by exporting. This means that exporting may also improve the innovative activities of the firm via new technologies, improved product quality and new methods in distribution; all of which are necessary to be competitive in terms of quality and to stay in the export business. Self-selection assumes international markets are more competitive than domestic markets as well as it entails significant initial costs of entry (see Arnold and Hussinger 2005; Lefebvre *et al.* 1998; Smith, Strojce and Dilling-Hansen 2002).

“...for an exporter to be successful in foreign market, it requires good knowledge about the foreign market conditions such as foreign preferences, regulations, distribution channels and other market characteristics. However, collecting information on some of the above mentioned variables may be usually costly and this may deter the entry of firms into foreign market (Sjoholm, 1999)”.

The methodology followed in this paper to address the questions proposed above begins with firm-level productivity estimation. The result is related to the foreign ownership of the firms to examine whether foreign owned firms have higher productivity than domestic firms. After that, this paper investigates if the foreign owned firms' productivity may spillover to domestic firms. That is, whether domestic firms may benefit from spillovers accruing from foreign presence in the same sub-industry. This is to establish whether there exist spillovers from foreign owned firms' presence. This is a major issue governments consider when designing and implementing FDI policies. Lastly, the effect of foreign presence on domestic firms' export participation is examined.

The last question, in particular, is also motivated by the special incentives like subsidies (forms of economic liberalization) provided by most governments, especially in the developing world to attract FDI (see Morisset, 2000⁴). The presence of MNEs is supposed to benefit domestic firms through some positive externalities and spillover effects. That is, MNEs, with their technological, managerial skills and knowledge about international marketing conditions, are expected to improve the productivity as well as export performance of host country firms.

A balanced plant data from a survey of 291 manufacturing firms for the period 1992 till 2003 is utilized. Even though this dataset has been available for a while and is uniquely suited to such an investigation, it has not been used for the specific purpose proposed in this paper.

The summary of my findings is, foreign owned firms are on average 7% more productive than domestic firms in the same sub-sector and location. Besides, there is statistical evidence suggesting that domestic firms will gain in productivity via spillovers from foreign owned firms. Lastly, I find that, domestic firms are 3.1% more likely to participate in exports with increasing share of foreign owned firms in the same sector.

The rest of this thesis is structured as follows. Chapter two presents a literature review stressing the theoretical framework and empirical evidence surrounding the role of foreign ownership and MNEs in host country firm productivity and export performance. Chapter three provides an overview of Ghana's manufacturing industry. The aim is to discuss the development and differences in output growth levels, foreign ownership status, and export performance across the main sectors of the manufacturing industry over the period 1950-2012. Chapter four presents the data, variable selection and descriptive statistics. Chapter five presents the methodology. That is, the econometric models and methods applied to estimate and investigate the questions raised in this paper. A robustness check is also carried out subsequently. Chapter six reports and discusses the results. Summary of findings, and conclusions deduced are presented in chapter seven.

⁴ Morisset (2000) finds that countries with attractive investment environments were able to attract a significant share of FDI and concludes that aggressive liberalization and strong economic growth will lead to an increased level of FDI.

Chapter 2 Theory and Literature Review: Role of Foreign Ownership

This chapter is divided into two sections: the first part presents definitions of key terms used in this study; the second part presents theories to explain foreign ownership productivity premium, the role of foreign presence in host country firms' productivity and export participation. Strands of empirical literature reviewed lend credence to the theories and highlight determinants influencing the realization of the advantages of foreign presence to local firms in developing host countries.

2.1 Definitions

Foreign Direct Investment (FDI): is defined as an “investment involving a long-term relationship and reflecting a lasting interest and control by a resident entity in one economy (foreign direct investor or parent enterprise) in an enterprise resident in an economy other than that of the foreign direct investor (FDI enterprise or affiliate enterprise or foreign affiliate)”⁵. FDI implies that the investor exerts a significant degree of influence on the management of the enterprise resident in the other economy. FDI may be undertaken by individuals as well as business entities.

FDI through multinational enterprises (MNEs) have attracted considerable attention in recent times. Caves (2007), defines multinational firm as “an enterprise that controls and manages production establishments (plants) located in at least two countries. It is simply one subspecies of a multiplant firm.” The two most common forms of FDI are horizontal FDI and vertical FDI. Horizontal FDI occurs if a firm invests in the same industry abroad in which it operates domestically while Vertical FDI occurs if a firm invests in a supplier industry abroad.

Foreign Ownership (FO): refers to the complete or majority ownership/control of a business or resource in a country by individuals who are not citizens of that country, or by companies whose headquarters are not in that country. FO can result from equity, Greenfield and Brownfield investments. With Greenfield investments, foreign investors build a new productive unit from scratch, while with Brownfield investments, also referred to as mergers and acquisitions, foreign investors acquire existing assets. While the former implies an accumulation

⁵ This general definition of FDI is based on OECD, Detailed Benchmark Definition of Foreign Direct Investment, third edition (OECD, 1996), and International Monetary Fund, Balance of Payments Manual, fifth edition (IMF, 1993). Link: http://unctad.org/en/Docs/wir2007p4_en.pdf

of capital, the latter is essentially a transfer of ownership. On the other hand, according to “UNCTAD Training Manual on Statistics for FDI and the Operations of TNCs” ownership of a ten (10) per cent stake in the equity of an enterprise will usually give a foreign investor an effective voice in the management of that enterprise.

FDI Spillovers: defined as the (indirect) impact of foreign firm presence on domestic firms’ economic performance. Such unmeasured benefits can be either horizontal or vertical spillovers, both of which can influence domestic firms. This paper focuses on horizontal spillovers from horizontal FDI only. That is, spillovers that occur to domestic firms in the same sub-industry group of foreign firms.

2.2 Economic Theory and Literature Review

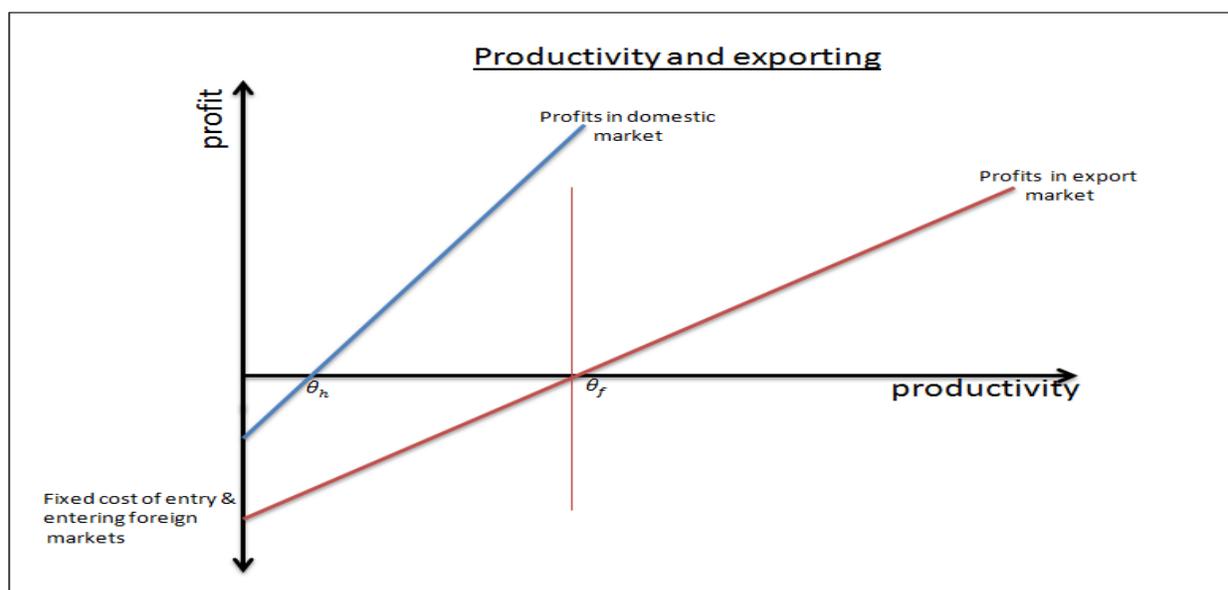
2.2.1 Firm Productivity and Exports

The level of productivity is fundamental to firms’ decision to export. Productivity is positively related to firm profits holding all other factors constant. This is because; increasing productivity reduces the marginal cost associated with production. Melitz (2003) constructs a model with monopolistic competition, exogenous productivity that differs between firms, fixed (sunk) costs of entry into domestic market and additional fixed exporting costs (information, distribution, or regulation costs) as well as variable transportation costs. Upon market entry with a low productivity draw and facing a sunk cost associated with exporting, a firm may decide to immediately remain domestic or be forced to exit the export market following a negative shock, since participating will add more to costs than to revenues. The total cost is a positive function of exports. Thus a critical threshold θ_f beyond which firms’ productivity is just enough to create positive profits from exporting is necessary. This is illustrated in figure 1⁶Figure 1 illustrates that with a large pool of prospective entrants into the domestic industry, they each make an initial investment (fixed entry costs) which is thereafter sunk. Upon entry with a low productivity draw less than θ_h threshold, a firm may decide to immediately exit and not produce due to the negative profits that will result. Firms with productivity above θ_f will stay and service the domestic market as productivity influences profits. Firms with higher productivity above θ_f threshold can

⁶ For reference, see Melitz, 2003.

cover the extra fixed costs for export market entry and still create positive profits. Thus, such firms can start exporting and face a relatively flatter slope profit curve due to trade costs.

Figure 1: Relating Productivity and Exporting



Some studies⁷ suggest that successful theoretical frameworks and empirical works for studying firms and the decision to export should include within sectoral heterogeneity in size and productivity, and a feature that leads only the most productive firms to engage in foreign trade. The latter could be a sunk cost of exporting as documented by Roberts and Tybout (1997) and Bernard and Jensen (2004), and formalized by Melitz (2003). Other studies provide evidence supporting the superior performance characteristics of exporting plants and firms relative to non-exporters. Similar results are reported in Bernard and Jensen (1999), where it is also shown that U.S. exporters tend to employ more workers, pay higher wages, and operate at a higher capital-labor ratio and record higher TFP levels. Other studies in other countries produce similar results. For instance, Bernard and Wagner (1997) show that, in a sample of German plants, exporters are significantly bigger and have higher labor productivity than non-exporters in the same region (Lower Saxony). Similarly, Aw, Chung and Roberts (2000) compute significantly higher multifactor productivity levels for Taiwanese and Korean plants that export than for plants that do not export.

⁷ Includes the new-new trade theories by Melitz, 2003; Bernard and Jensen, 1999; Aw, Chung and Roberts, 2000; Clerides et al., 1998

Is productivity exogenous? Technological progress is costly, so firms aiming for a competitive edge must possess higher factor productivity. Productivity investments may require capital and quality labor for higher factor productivity. In which case, productivity is an endogenous variable that may respond to changes in trade cost, leading to aggregate productivity changes. Also, exposure to trade forces the least productive firms to exit or shutdown (Bernard and Jensen, 1999; Aw, Chung and Roberts, 2000; Clerides *et al.*, 1998).

In short, possessing superior performance characteristics and knowledge about foreign market situations is necessary to either overcome or reduce transactions costs and trade costs associated with exporting. This includes information on the taste and preference of foreign consumers and product quality standards of the export destinations. Whatever the source of the higher productivity advantages, the only way in which domestic firms can gain from external benefits is if some form of indirect technology transfer takes place. This is an important concern because MNEs may have an incentive to limit spillovers. Through spillover channels, the benefits from FDI-firms/MNEs presence may boost domestic firm productivity.

2.2.2 Competitive Advantages of Foreign Owned Firms

Foreign owned firms and MNEs in general, possess unique characteristics that yield a foreign ownership productivity premium over domestic firms in host countries. To begin with, the competitive advantages MNEs possess are addressed. Dunning's (1977 and 1979) OLI framework, which brought together traditional trade economics, Ownership advantages, Internalization theory and Location advantages, present arguments to understanding MNEs location decisions. Helpman's (1984) theoretical model of "the horizontal FDI model and Brainard (1997) Proximity-Concentration Hypothesis" explores the extent that the location decisions of MNEs can be explained by a trade-off between achieving close proximity to customers versus concentrating production in one plant to achieve economies of scale. Behrman (1972) explains the different objectives of FDI in the OLI framework to include resource seeking, FDI market seeking, FDI efficiency seeking (global sourcing FDI) and strategic asset/capabilities seeking FDI. This partly gives insight into whether MNEs are either domestic market-seeking or export-oriented. That is, MNEs may choose a location as an export platform to serve other markets or locate in a host country to compete for domestic market share.

Based on the theories above, MNEs have sustainable competitive advantages which include *ownership* advantages, *location* advantages and *internalization* advantages. In a broad sense, the *ownership* advantages refer to MNEs control of rare, valuable, hard-to-imitate resources and capabilities which are rent yielding assets. Dunning (1977; 1979) argues that some firms have a firm specific capital known as knowledge capital, human capital, patents, technologies, brand names, reputation which can be replicated in different countries without losing its value, and easily transferred within the firm without high transaction costs.

Given that *ownership specific* advantages are present, it must be in the best interest for the firm to use it, rather than sell them or license them to other firms. These are *internalization* advantages, and can arise because a hierarchy is a more efficient way of organizing transactions than a market. The location advantages establish that there exist facilities beyond the firms' domestic markets where the resources and capabilities are most economically utilized. MNEs and FDI represents a response to high transaction costs by firms with unique assets/capabilities which have value when utilized in production located in foreign markets. The choice of location could be domestic market seeking, efficiency seeking and seeking natural resources, or to tap into renowned world-class innovation clusters.

Combining Ownership specific advantages, Internalization specific advantages and Location specific advantages, we get the "eclectic" approach to FDI - the so called OLI paradigm of international production.

Thus, MNEs possess rare, tangible and intangible assets which take the form of advanced technologies, superior management techniques or established brand names (UNCTAD, 2005). A cross-country analysis by UNCTAD (2005) provides evidence on MNEs activities. They document that MNEs engage more in research and development (R&D), possess more intangible assets, use more skilled labour, and are increasingly engaged in international production markets. UNCTAD (2005) findings are that the largest 700 R&D spenders account for approximately 50% of world R&D expenditure.

2.2.3 Domestic Firms' Productivity Gains and Spillovers from Foreign Presence

In the context of theory, a variety of models explains the role of foreign ownership in host country firms' productivity and export performance. MNEs are a potential factor that is capable of lifting domestic firms into a higher productivity path and potentially enhance firm export performance. In particular, multinationals tend to use state-of-the-art technology in their affiliates. This makes it possible for domestic firms to learn about these technologies and gain from horizontal spillovers [in the form of factor productivity gains or export spillovers]. Potential spillover drivers or learning channels include imitation, competition, exports and labor turnover. Also, the benefits could be directly through the composition effect of having more MNEs in the sub-industries.

Improving the productivity of domestic firms can occur through acquiring human capital. Generally MNEs will invest in training but, it is impossible to lock-in such resources completely. As a result, the movement of labour from MNEs to existing firms, or to start new firms can generate productivity improvement via two mechanisms; a direct spillover of increased productivity to complementary labour and also, workers that move may carry with them tacit knowledge of new technology or new management practices. Arguably, this channel is the most important channel for spillovers (Haaker, 1999; Fosfuri, Motta and Ronde, 2001). Empirical work by Görg and Strobl (2002) use data on worker characteristics in Ghanaian manufacturing sector provides evidence supporting this claim. Their results suggest that *“firms which are run by owners that worked for multinationals in the same industry immediately prior to opening up their own firm have higher productivity growth than other domestic firms. This suggests that these entrepreneurs bring with them some of the knowledge accumulated in the multinational which can be usefully employed in the domestic firm.”*

Besides, imitation is the classic transmission mechanism for new products and processes. A mechanism commonly alluded to in the theoretical literature on 'North-South' technology transfer is reverse engineering (for example, see Das, 1987; Wang and Blomström, 1992). The productivity gains from imitation include the adoption of new production methods and new management practices. Its scope depends on product/process complexity, with simple manufactures and processes easier to imitate than more complex ones. The same principle

applies to managerial and organizational innovations, though in principle, at any rate, these are easier to imitate.

Moreover, the role of competition has been emphasized (Glass and Saggi, 2002). Competition effect arises because the entry by a foreign firm increases competition, which, in turn, induces productivity improvements in some domestic firms, while also prompting the exit of poorly performing firms (Caves, 1974). Through the competition effect, domestic firms' productivity may improve through reduction in X-inefficiency and faster adoption of new technology. Unless an incoming firm is offered monopoly status, it will produce in competition with domestic firms. Even if the latter are unable to imitate the MNEs's technology or production processes, they are under pressure to use existing technology more efficiently, yielding productivity gains. Thus, competition may increase the speed of adoption of new technology or the speed with which it is imitated.

A further indirect source of productivity gain might be via export spillovers. Domestic firms can learn to export from multinationals (see Aitken, Hanson and Harrison, 1997; Barrios, Görg and Strobl, 2003; and Greenaway, Sousa and Wakelin, 2004). Exporting generally involves fixed costs in the form of establishing distribution networks, creating transport infrastructure, learning about consumers' tastes, and regulatory arrangements among other factors in international markets. MNEs generally possess ownership advantages such as information and exploit it to export from the new host. Through collaboration, or more likely imitation, domestic firms can learn how to penetrate export markets. There is a growing literature that links exporting and productivity. Recent work for developing economies like Mexico, Morocco and Venezuela suggests that productivity levels of exporting firms are higher than non-exporting firms and support the hypothesis of learning by exporting.

In all, the benefits from MNEs' presence to domestic firms include skills transfer, production techniques and improvements in the quality of human capital, all of which are crucial to improve the productivity and efficiency of domestic firms. Thus, it can be argued that MNEs bring with them new ideas and advancing techniques that may help to improve the quality of production and help boost the output growth in the manufacturing sector of the host. MNEs presence in host country is expected to induce positive spillovers due to the advanced technologies or firms-

specific effects they own. However, empirical evidence on the existence of spillovers is unclear (mixed) because MNEs may have incentives to limit spillovers.

Konings (2000) uses firm level panel data on three emerging economies of Central and Eastern Europe; Bulgaria, Romania and Poland. He finds no evidence of positive spillovers to domestic firms on average for all three countries studied. However, on average, he finds negative spillovers to domestic firms in Bulgaria and Romania, but no spillovers to domestic firms in Poland. He argues that this suggests a negative competition effect that dominates a positive technology effect.

Belderbos and Van Roy (2010) panel study of local Belgian firms during 2000-2007 reveal significant positive effects of horizontal spillovers on the productivity levels of local firms.

Also, Aitken and Harrison's (1999) study of Venezuelan plants find that foreign equity participation is positively correlated with plant productivity (the "own-plant" effect), but this relationship is only robust for small enterprises. They also document that foreign investment negatively affects the productivity of domestically owned plants. The net impact of foreign investment, taking into account these two offsetting effects, is quite small. The gains from foreign investment appear to be entirely captured by joint ventures.

The anticipated benefits from the MNEs are apparent for firms with foreign ownership status but tentative for domestic firms with no foreign ownership status. This is because, they will need to have some minimum level of absorptive capacity to tap and utilize the positive spillovers and externalities to their advantage. Evidence of this is provided in several studies, especially in developing economies. Tang (2008) conducts firm-level panel data study of 90,000 Chinese manufacturing firms over the period of 1998-2001. He examines whether there exist productivity spillovers from foreign direct investment (FDI) to domestic firms in the same sector (horizontal spillovers). He finds evidence of negative horizontal spillovers. These negative externalities become more pronounced when FDI in the same sector increases within the same province. Also, he examines whether the ownership structure of foreign affiliates affects the magnitude of productivity spillovers and documents that negative spillovers are mostly borne by domestic firms that are state-owned, technologically-backward and located in inland provinces.

Using firm level data in Vietnam (enterprise census, 2000-2005), Thang (2011), finds evidence that horizontal FDI bring negative spillovers, mainly to technical change but positive spillovers to technical efficiency. He decomposes the change of productivity into technical change, technical efficiency change and scale efficiency change using time-varying stochastic frontier approach⁸. Also, Mishra (2011) finds in an econometric investigation of Indian firms in 22 sectors over the period 2006-2010 that there is “*marginal and insignificant direct impact and mixed spill-over effects of FDI inflow on the productivity of local firms*”.

Galina and Cheryl (2006) uses the World Bank survey of 1500 firms in five Chinese cities to study whether the presence of foreign firms produces technology spillovers to domestic firms operating in the same city and industry. They find positive spillovers for more technologically advanced firms and no or negative spillovers for more backward firms. They also document that transfer of technology occurs through movement of high-skilled workers from MNEs to domestic firms as well as through network externalities among high-skilled workers.

2.2.4 Foreign Ownership and Export Behavior

The theoretical arguments discussed above have been studied empirically to find out the net effect of foreign ownership on host/domestic firm productivity through spillovers, and how it can affect export behavior. Other studies have investigated whether there can be export spillovers without productivity spillovers.

A number of empirical studies provide evidence supporting theoretical arguments on the role of FDI in export performance especially in developing economies like Mexico, Morocco and Venezuela. A study of FDI and export upgrading by Harding and Javorcik (2011) found a consistent and statistically significant positive relationship between FDI and export quality in the FDI targeted sectors in developing countries. Sectors prioritized in national efforts to attract FDI were found to have eleven percent (11%) higher unit values of exported products than other sectors.

⁸ Studies on efficiency and productivity (Cornwell et al., 1990, Battese *et al.*, 2005) pointed out that productivity change is not a single term but contributed by (1) the change in environment and overall technical progress; (2) the change in efficiency of using a unit of inputs; (3) the change in efficiency due to the scale economies.

Similarly, UNCTAD's (1999) cross country analysis of fifty-two (52) countries found a positive relationship between FDI and manufactured exports⁹. The relationship was stronger for developing countries than advanced countries. This highlights that FDI plays an important role in influencing the productivity and export performance of firms in host countries. However, the benefits depend on the source and destination country as examined by Harding and Javorcik (2011). Their findings are consistent with a positive effect of FDI on unit values of exports in developing countries while the evidence for high income economies is ambiguous. Aitken *et al.* (1997) finds that there is a positive relation between decision to export by Mexican firms and the presence of foreign firms' over the period from 1986 to 1990. This effect was measured with two different variables; the production by MNEs (output) and their exports. The results showed positive coefficients for the presence of foreign firms and their export activities on the average export performance of Mexican firms. However, the benefits from "spillovers" do not necessarily apply. Kokko *et al.* (2001) use a cross-sectional data on Uruguayan firms to examine the association between FDI spillovers and the export behavior of domestic firms. Their estimation results show that, domestic firms are more likely to export if they operate in sectors where the presence of foreign firms is relatively high. Prasanna (2010) examines the export participation of manufacturing firms in India following inward FDI for the period 1991/92 to 2006/07. He finds that foreign firm presence influence domestic firms export participation. Prasanna (2010) also documents that the local Indian manufacturing over the same period did not significantly impact on export participation. Also, Sjöholm (1999) finds a positive effect of foreign ownership on the propensity of Indonesian manufacturing firms to become an exporter.

Greenway *et al.* (2004) examine the influence spillovers from foreign firm presence on domestic firms' export decision. They conclude that the presence of foreign firms have a positive impact on the probability of a firm being an exporter in the United Kingdom. This was premised on their hypothesis that increased competition from foreign firms is the most important channel for export spillovers.

In conclusion, the effect of foreign ownership on domestic firms' productivity in the same industry and export behavior is unclear.

⁹ The direction of causality was however not obvious in their study

Chapter 3 The Manufacturing Industry in Ghana: Trade and FDI policies

3.1 Overview: Economy of Ghana

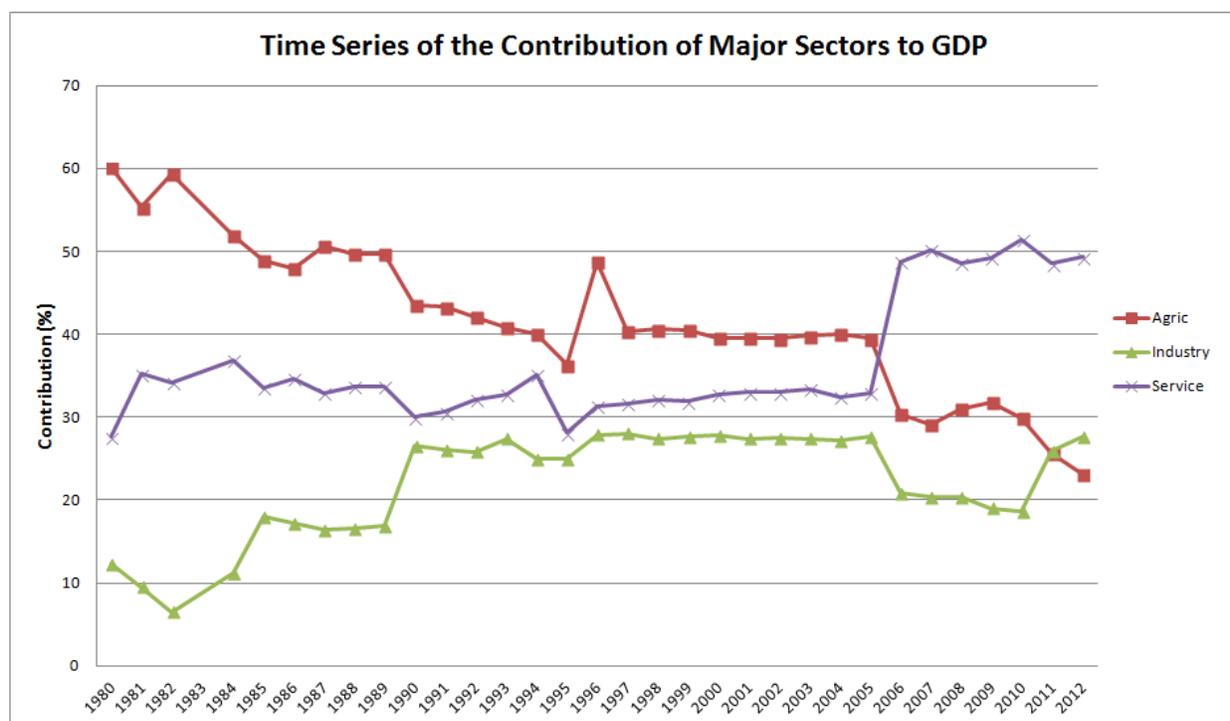
Figure 2 shows the development in major sectors contribution to GDP over the past three decades. Agriculture has been the backbone of the Ghanaian economy and contributes the highest share to gross domestic product (GDP) for the period 1985 until 2006. The share of agriculture declined from 60 percent in 1980 to 23.1 percent in 2012. Ghana's agriculture sector is seriously underperforming in a number of critical areas. The output of cocoa, the main cash crop, is relatively low, and the yield per hectare is also low in comparison to other cocoa producing countries. Also the nation's exports earnings from the agriculture products have been declining in recent years and this has no doubt compounded the problems faced by the sector. The agricultural sector remains the least contributor to GDP although its share continues to decrease over the years partly due to significant improvements in Industry and Service sectors over the same period (ISSER & GSS, 2011; 2012). Crops, however, remains the largest activity¹⁰ in the economy with a share of 19.3 percent of GDP.

Over the same period 19801-2006, the service sector was the second largest contributor to GDP. From 2006, the services sector, now the largest sector, contributes approximately 50 percent to GDP as shown in figure 2. The services sector grew by an estimated 6.5 percent in 2006, slightly higher than the 6.2 percent achieved in the preceding year. The expansion in 2006 was driven by increased government expenditure in the provision of services and increased activity in finance and insurance services. Also, growth in mobile telecommunication was strong in 2006, as Ghana Telecom, Millicom and Scancom—providers of mobile phone services – all expanded their services. Nevertheless, the services sector overtaking agriculture as the biggest contributor to GDP is no good news. It is a sign of an economy with an unbalanced structure. There are serious implications for overall development when agriculture, the sector with the largest labour force, is still primitive (using cutlass and hoe, characterized by very low productivity and still rain fed). Added to this is a manufacturing sector in decline. Ideally, the leading sector should be the one

¹⁰ See table 9 in appendix A for a summary of the various activities that aggregate for the major sectors.

that employs the largest labour force. Unfortunately, the services sector is not playing that leading role (ISSER, 2010).

Figure 2: Time series Contribution of Major Sectors to GDP



Source: Data obtained from mundi database and graphed by author

From same figure 2, Industry remained the least contributor to GDP since 1980s until 2011, when it overtook agriculture as second largest contributor to GDP with share hovering around 27 percent. The recent improvement in industry is due to the exploration and extraction of crude oil. The dip in Industry share in 2006 was due to reduced electricity supplies resulting in part from low water levels at the Akosombo Dam, the largest source of electricity in Ghana, as well as a failure to invest in additional generating capacity. Since 2006 to late 2010, there has been a seasonal power supply reduction which in part explains the downward trend. Underlying the decline in the [manufacturing] sub-sector’s contribution to industrial GDP since 2002, appears to be stagnation in manufacturing productivity. This productivity stagnation can also be explained by the low level of technological capabilities, which increasingly inhibits the buildup of competence and innovation.

3.2 Trends in Manufacturing Industry

As of 1957, Ghana was endowed with rich natural resources and a sizeable level of skilled labor due to the presence of strong British influence. The period immediately following independence was marked by high GDP growth and accelerated economic change (Rimmer, 1992). Ghana's economy diversified away from agriculture into large-scale manufacturing and services. Along with these positive changes, the public sector expanded in order to provide social services. The prosperity was short-lived as political instability, economic mismanagement in early 1960s led to poor economic performance. As such, Ghana lacked the entrepreneurial skill and thus, pursued an inward-oriented state-directed industrialization policy to modernize its economy (Appiah-Adu, 1998). State owned manufacturing enterprises (SOEs) produced 11.8% of manufacturing output in 1962, growing to 19.5% of manufacturing output in 1966 (Steel 1972).

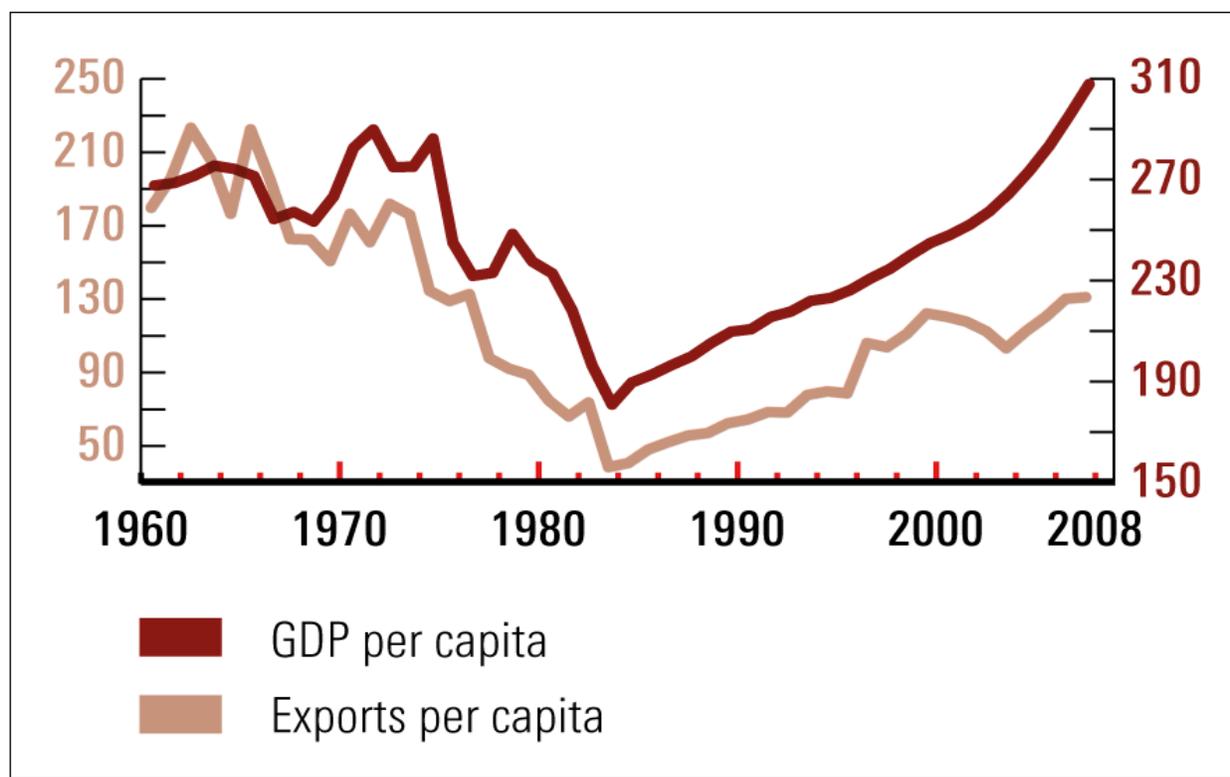
However, inefficiencies in the management of the state-owned manufacturing enterprises (SOEs) led to huge excess capacity. Ghanaian firms became dependent on the government for subsidies and/or protection to survive since they remained uncompetitive in international markets, due in part to discrimination against foreign companies and an overvalued currency (Ghana Cedi). Series of political instability and economic mismanagement from the mid 1960's to the early 1980's led to the deterioration of the economy, which adversely affected the manufacturing sector through the scarcity of foreign exchange to obtain the needed raw materials and the migration of skilled labor to foreign countries. Steel (1972) argues that the overall import substitution industrialization strategy failed for a variety of reasons, including a lack of foreign exchange to meet the needs of imported inputs for the manufacturing sector.

Aiming to improve the state of the Ghanaian economy, the structural adjustment program (ERP/SAP) was implemented in 1983. The SAP was expected to induce growth in productivity and private sector development since the programme included monetary policy reforms to improve access to capital, minimize government intervention in the market by removing subsidies, price legislations, foreign exchange restrictions and also the privatization of unprofitable SOEs, See for example Debrah (2002). SAP helped the recovery and restructuring of the Ghanaian economy. The contributions include the elimination of the foreign exchange rationing and making available, foreign exchange to local businesses. The trade and FDI policy

reforms since the 1980's have had significant impacts on domestic firms, especially in the manufacturing sector. This is evident in figure 2 which shows a growing share of manufacturing in Ghana since 1985. Steel and Webster (1992) highlight the ways in which small manufacturing firms were responding to the reform program by becoming more competitive, changing product mix, and seeking new market niches. These efforts were not without constraints as even the “dynamic” entrepreneurs in their survey cited several challenges, most notably, access to finance.

Diyne (2001) documents that the reforms contributed positively to export performance and played a role in enhancing technology transfer. Diyne adds that exposure of domestic firms to international competition improved the efficiency of firms in the use of resources and improved product quality. Trade policy reforms have been successful in placing Ghana, and its firms, on a path to global competitiveness in the 1990's by being able to sustain macroeconomic adjustment for an appreciable period (Lisa, 2000). Figure 3 show that exports per capita and GDP per capita (2000, US dollars) reversed from declining in the early 1980's.

Figure 3: GDP per Capita and Exports per Capita (2000, US dollars)



Source: Penn World Tables version 6.1.

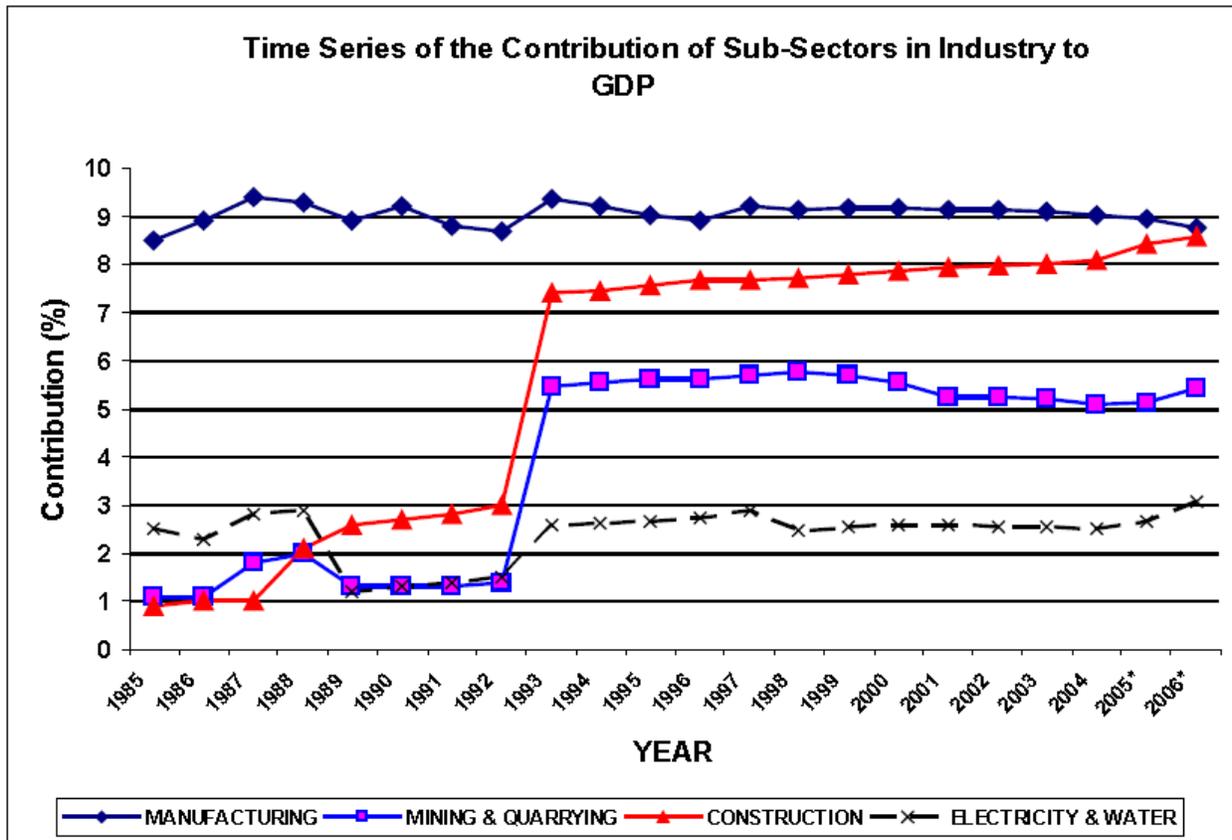
As such, Ghana attained an emerging economy status in 1999 (International Finance Corporation -IFC, 1999). The economic, trade and FDI reforms led to a continued liberalized labour and trade market structure from 1992, when sustained political stability was achieved in Ghana till presently. The development plan; “*Growth and Poverty Reduction Strategy*” (2006-10; GPRS II) had private sector competitiveness and export led growth as one of its major objectives and implemented policies aimed at attracting MNEs into the domestic economy. According to Krakah *et al.*; GSS; and Teal (2009) the number of manufacturing firms in Ghana increased from about 8,000 in 1987 to 26,000 firms in 2003. Most of the firms are predominantly small and medium-sized firms. The number of large firms over the period remained the same.

However, empirical evidence has shown that, stability among the macroeconomic indicators is insufficient for sustained manufactured-export growth¹¹. Policies encouraging export growth have typically complimented macroeconomic stabilization policies in high-growth, export-led economies. For most of the period since 1983, this observation was consistent with the Ghanaian experience. A measure to illustrate the performance of the manufacturing sub-sector relative to the other sub-sectors, the contribution to gross domestic product (GDP) at purchasers’ value is used. The contribution of the manufacturing industry, even though was far and above that of the other three activities under industry sector, has remained around nine percent (9%) since the reform in the early 1980s till 2006, a margin most economist perceive as not good enough if the objective to become an industry-led nation is to be achieved. This is shown in figure 4. This suggests that, there is more room for improvement in manufacturing firms’ total factor productivity.

After a huge jump from a near 3% manufacturing growth in 1982 to approximately 7.5% 1983, the growth rate has been rather steady thereafter. This growth tapered over time to a rate of 2.6% between 1988 and 1995. Asante, Nixson, and Tsikata (2000) suggest that the slowdown in growth was a result of liberalization as competitive industries continued to grow but uncompetitive industries declined or folded up in the competitive environment.

¹¹ For reference, see the study by Radelet and Sachs (1999). It is a recent empirical investigation of the link between export growth and economic growth.

Figure 4: Time Series Contribution of Sub-Sectors in Industry to GDP



Source: Ghana statistical service, National accounts division

Regarding the productivity and export activity of manufacturing firms, like most countries in Sub-Saharan Africa and other third world economies, manufacturing firms in Ghana are mostly limited to the domestic market. The domestic market is however limited in size and scope; as such domestic firms focused on the local market have limited growth potential. This need not remain so because, trade liberalization following reforms induced increasing imports penetration which led to unfair competition on the local market. For instance, the near collapse of textile manufacturing industry in 1990's was due to stiff import competition. As such, there is the need for domestic firms to become productive, in order to remain in business. Frazer (2005) addressed the question of whether less productive manufacturing firms in Ghana are in fact the ones that are more likely to go out of business, based on a survey which was initially conducted as part of the Regional Program on Enterprise Development (RPED) surveys of manufacturing firms in African countries. Frazer (2005) argues that firms that are going out of business in Ghana are found to be less productive than surviving firms, with and without a variety of controls.

At the macro-level, the ERP/SAP was the turning point towards a growth path. The downward trend in GDP growth reversed and hovered around a 5% mean annual rate for the rest of the 1980s. The economic recovery continued through the 1990s. In 2011, GDP growth increased further to 14.39 % (The World Bank, 2013). As of 2011, Ghana attained middle income¹² status following a rebase of the economy in November 2010 (World Bank, 2011) and is on a promising path. Even so, it is unclear what factors drive the domestic firms' productivity and export performance.

3.2 Foreign Ownership and Local Manufacturing industry Performance

FDI and trade reforms aimed at strengthening private sector competitiveness have continually attracted significant FDI share in GDP and encouraged MNE presence. Years after the 1983 ERP/SAP, poor performing SOEs have mostly been acquired by foreign firms (MNEs). A typical example is the acquisition of 70% ownership of Ghana Telecom by Vodafone in early part of year 2000. Some studies for the post ERP/SAP period suggest that, foreign firms have shown higher export performance as compared to domestic firms (see Teal, 2002; Waldkirch and Oforu, 2008).

All in all, from the 1990s to early 2000s, the manufacturing sector as a whole was growing, albeit slowly. Moreover, while the overall success of the reforms has been limited for a variety of different reasons (Aryeetey, Harrigan, and Nissanke 2000), the economy has been healthy over this period, both in comparison to Ghana's early history and in relation to other African countries over the same period. This is the time frame for which this paper investigates the effect of foreign ownership as well as the potential FDI spillovers on the productivity and export performance of Ghanaian manufacturing firms in a liberalized economic framework.

¹² The World Bank classification, which was updated on July 1, 2011, saw Ghana moving from a lower income to a low-middle income country. According to the World Bank, lower-middle-income economies had average incomes of \$1,006 to \$3,975. Statistics provided by the Ghana Statistical Service (GSS) after the economy was rebased in November 2010 indicated that the country's per capita was \$1,343 with a GDP value of \$32.5 billion.

Chapter 4 Methodology and Model Estimation

This chapter details the econometric models to estimate the effect of foreign ownership on domestic firms. That is, the potential total factor productivity gains from spillovers from MNEs presence in the manufacturing industry and also, the extent to which the spillovers influence export participation. To begin with, firm-level productivity is estimated. The result is related to the ownership of the firms to examine whether MNEs are more productive than domestic firms. After that, I investigate if the MNEs productivity may spillover to domestic firms. That is, whether domestic firms may benefit from spillovers accruing from MNEs presence in the same sub-industry. This is to establish whether there exist spillovers from MNEs presence. Lastly, the effect of MNEs presence on domestic firms' export performance is examined. Differently stated, we seek to investigate the extent to which the spillovers are export spillovers.

4.1 Estimating the Firm Level productivity

Suppose the production function is expressed as;

$$q = TFP \cdot f(l, k, m)$$

Taking as a starting point, I assume that the production function is Cobb Douglas. The variables of interest in estimating the production function are the real value of output (Q), real total cost of raw materials (M); Physical capital stock (K) and labour. K is measured as, the sum of real investment in plant & equipment less the real imputed sales value of all lands and buildings. Labour (L) is defined as the total number of workers.

$$Q_{it} = TFP_{it} \cdot (L_{it}^{\alpha_l} M_{it}^{\alpha_m} K_{it}^{\alpha_k})$$

Taking logs, we arrive at,

$$\ln Q_{it} = \ln TFP_{it} + \alpha_l \ln L_{it} + \alpha_m \ln M_{it} + \alpha_k \ln K_{it}$$

More generally, the model is expressed as;

$$\ln Q_{it} = \ln TFP_{it} + \alpha_l \ln L_{it} + \alpha_m \ln M_{it} + \alpha_k \ln K_{it} + \alpha(\text{dummies}) \quad [1]$$

Where: Q_{it} is output of firm i in year t

Dummies are defined for location, sector and year

The total factor productivity TFP_{it} is however not directly measurable, as such it is derived as the residual following the estimation of equation 1.

$$\ln TFP_{it} = \ln Q_{it} - (\alpha_l \ln L_{it} + \alpha_m \ln M_{it} + \alpha_k \ln K_{it})$$

In the estimation of productivity, the measurement issue is what variables, if any, should be treated as exogenous? It is generally thought that, input use may be endogenous, as managers decide on factor demand (employment and capital) and output simultaneously (Gorter et.al, 1997). That is, firm input choices such as -how many workers to employ, or amount of inputs to purchase- are endogenous. All these firm-level choices depend on the level productivity. As such, there is a possible correlation between the residual $\ln TFP_{it}$ and output $\ln Q_{it}$.

Simultaneity is a specific type of endogeneity problem in which the explanatory variable is jointly determined with the dependent variable. The problem is that, at least a part of the TFP_{it} will be observed by the firm at a point in time early enough so as to allow the firm to change the factor input decision. If that is the case, then profit maximization of the firm implies that the realization of the error term of the production function is expected to influence the choice of factor inputs.

For purposes of exposition, one can split up the error term TFP_{it} into two elements:

$$\ln TFP_{it} = \omega_{it} + \varepsilon_{it}, \quad \text{where } \varepsilon_{it} \text{ is white noise} \quad [2]$$

Where ω_{it} is the part of the error term that is observed by the firm early enough to influence decisions, while ε_{it} is a true error that may contain both unobserved shocks and measurement errors and assumed to be white noise.

Substituting equation (2) into equation (1), the econometric model specification to estimate is expressed as;

$$\ln Q_{it} = \alpha_l \ln L_{it} + \alpha_m \ln M_{it} + \alpha_k \ln K_{it} + \alpha(\text{dummies}) + \omega_{it} + \varepsilon_{it} \quad [3]$$

Ordinary least squares (OLS)

OLS estimation of equation 3 is based on a strict assumption that there is no correlation between explanatory variables and error term. Firm input choices such as -how many workers to employ, or amount of inputs to purchase- are endogenous and depend on the level productivity. This means that the regressors and the error term are correlated, which makes OLS estimates biased. Awareness of this phenomenon was first pointed out by Marschak and Andrews (1944).

Using OLS to estimate equation 3 will result in upward biased estimates¹³. The endogeneity problem resulting from firm's input decisions makes the parameter estimates for labour and materials to be upward biased. This is because materials and labour are considered more easily adjustable than capital. Thus they are stronger positively correlated with $\ln TFP_{it}$.

Fixed effects model (FE)

In addition, it is necessary to control for firm specific effects and time specific effects. Applying the fixed effect estimation procedure will be appropriate if the part of $\ln TFP_{it}$ that influences firm behavior is a firm-specific attribute and invariant over time. In that case, including plant dummies into the regression, i.e. a fixed-effect panel regression, will eliminate the problem caused by ω_{it} and deliver consistent estimates of the parameters. That is, if ω_{it} is plant-specific attribute, and invariant over time then, $\Delta\omega_{it} = \Delta\omega_i = 0$ and FE-estimation will be appropriate.

However, the fixed effects solution requirement that a component of the productivity shock ω_{it} to be fixed over time is unappealing.

$$\Delta\omega_{it} \neq \Delta\omega_i = 0$$

Also, a substantial part of the information in the data will be left unused. A fixed-effect estimator uses only the across time variation, which tends to be much lower than the cross-section one. This means that the coefficients may be weakly identified.

¹³ See Marschak and Andrews (1944); Verbeek (2012) "A Guide to Modern Econometrics" fourth edition. p146-147

General Method of Moments (GMM)

Instrumental variables approach is another alternative, but valid instruments need to be correlated with firm-level input choices and orthogonal to the productivity shock. Is there any variable that is correlated with inputs but not with ω_{it} ? In general it is hard to find such instruments, but the GMM use only the firm level production data already available. The basic and system General Method of Moments (GMM) are potential estimation techniques.

Potential instruments at the firm-level include input prices and lagged values of input use. Firm-level input prices are rarely observed. Lagged values of inputs are valid instruments if the lag time is long enough to break the dependence between the input choices and the serially correlated shock.

Consider $y_{it} = \beta X_{it} + u_{it}$,

Where $u_{it} = \omega_{it} + \varepsilon_{it}$ and X_{it} is a matrix of explanatory variables

The time differenced model is

$$\begin{aligned} y_{it} - y_{it-1} &= \beta(X_{it} - X_{it-1}) + \gamma(y_{it} - y_{it-1}) + (\varepsilon_{it} - \varepsilon_{it-1}) \\ \Delta y_{it} &= \beta \Delta X_{it} + \Delta \varepsilon_{it} \quad t = 2, \dots, T_i \quad [4] \end{aligned}$$

Instead of regarding (4) as one equation, it can be thought of as a system of $T - 1$ equations

$$\begin{aligned} t = 3: \quad \Delta y_{i3} &= \beta \Delta X_{i3} + \Delta \varepsilon_{i3}, \quad \text{instruments } z_{i3} = y_{i1}, \Delta X_{i3} \\ t = 4: \quad \Delta y_{i4} &= \beta \Delta X_{i4} + \Delta \varepsilon_{i4} \quad \text{instruments } z_{i4} = z_{i3}, y_{i2}, \Delta X_{i4} \\ t = T: \quad \Delta y_{iT} &= \beta \Delta X_{iT} + \Delta \varepsilon_{iT} \quad \text{instruments } z_{iT} = z_{iT-1}, y_{iT-1}, \Delta X_{iT} \end{aligned}$$

More generally, the GMM (instrumental variable-IV) estimator achieves consistency by instrumenting the explanatory variables with regressors that are correlated with the inputs but uncorrelated with the idiosyncratic error term (Arellano and Bover, 1995; and Blundell and Bond, 1998). The use of different instruments for equations of different time periods defines the Arellano and Bond method compared to the conventional IV estimation, which uses the same instrument set for all endogenous variables. The IV approach can also alleviate measurement error problems, which tend to be most pronounced in capital (Levinsohn and Petrin, 2003).

The system GMM estimator is an appropriate estimation method in the presence of endogenous variables. The GMM estimation gains efficiency by utilizing additional moment conditions. GMM utilizes all available lagged values and lagged differences of the dependent variable, and all the lagged values of the exogenous variables as instruments¹⁴. As such the use of instrumental variables estimator (more generally, GMM) could be a valid estimation procedure.

In some cases, however, there simply are no valid instruments. Olley and Pakes (OP, 1996) developed a new approach to addressing this problem— one which did not require instruments. Levinsohn and Petrin (LP, 2003) made further refinement to the OP estimation approach.

Henceforth, the GMM method will be used to estimate the total factor productivity.

Specification Testing in Dynamic Panel Models

- i. Test for overidentifying restriction. This tests whether the instruments appear exogenous using the standard *Sargan* and *Hansen* tests. The Sargan J and Hansen test routines are carried out when Stata estimates the GMM model. But, the Sargan test is not robust to heteroscedasticity or autocorrelation. As such, the Hansen test is often considered. A significant p-value for Hansen test statistic indicates that we have over fit our endogenous variables, or that we have utilized too many instruments. A Hansen test p-value which is not significant at the conventional levels seems appropriate and indicates that overidentifying restrictions does not seem to be a problem in the estimated model.

- ii. Testing for Residual Serial Correlation. If the ε_{it} are serially independent, then

$$E(\Delta\varepsilon_{it}\Delta\varepsilon_{it-1}) = E[(\varepsilon_{it} - \varepsilon_{it-1})(\varepsilon_{it-1} - \varepsilon_{it-2})] = -E[\varepsilon_{it-1}^2] = -\sigma_\varepsilon^2$$

Thus, we would expect first order serial correlation. However, we would not expect there to be any second order serial correlation. That is,

$$E(\Delta\varepsilon_{it}\Delta\varepsilon_{it-1}) = E[(\varepsilon_{it} - \varepsilon_{it-1})(\varepsilon_{it-1} - \varepsilon_{it-2})] = 0$$

The presence of second order serial correlation indicates a specification error. As such, testing for second order serial correlation is necessary.

¹⁴ See Judson & Owen (1996). Blundell and Bond (1998)

4.2 Estimating Foreign Ownership Productivity Premium

Given consistent estimates of TFP, the between group (BE) regression is used to estimate foreign ownership productivity premium. The econometric models of interest to test this claim are expressed as follows.

Model 1: Relating the firm level productivity $\ln TFP_{it}$ to the foreign ownership

$$\ln TFP_{it} = \beta_0 + \beta_1 FDI_{it}^{dummy} + \beta_2 Fmage_{it} + \beta_3 Exports_{it} + \alpha_{it} dummies_{it} + \varepsilon_{it} \quad [5a]$$

$$\ln TFP_{it} = \beta_0 + \beta_1 FDI_{it}^{dummy} + \beta_2 Fmage_{it} + \beta_3 Exp_share_{it}^{outside} + \beta_4 Exp_share_{it}^{Africa} + \alpha_{it} dummies_{it} + \varepsilon_{it} \quad [5b]$$

$$\ln TFP_{it} = \beta_0 + \beta_1 FEquity_{it}^{foreign} + \beta_2 Fmage_{it} + \beta_3 Exports_{it} + \alpha_{it} dummies_{it} + \varepsilon_{it} \quad [5c]$$

$$\ln TFP_{it} = \beta_0 + \beta_1 FEquity_{it}^{foreign} + \beta_2 Fmage_{it} + \beta_3 Exp_share_{it}^{outside} + \beta_4 Exp_share_{it}^{Africa} + \alpha_{it} dummies_{it} + \varepsilon_{it} \quad [5d]$$

With equation 5a and 5b, firm productivity $\ln TFP_{it}$ is regressed on a dummy variable “*anyfor*” defined for *any firm with partial or full foreign ownership*. Partial ownership is defined for the case foreign ownership is less than 100%. To isolate any potential effects of macroeconomic shocks, sector related influences and investment climate of location, the year, location and sector dummies are included in the regressions. These linear models also include export destinations: *share of exports within and outside Africa*.

Equation 5c and 5d re-estimates a similar specification under 5a and 5b except, the FDI dummy is replaced with the *share of foreign equity*, a variable ranging from zero to one [0, 1].

A priori expectation: a positive and significant coefficient on $\beta_1 > 0$ indicates that there is a foreign ownership productivity premium. Also, based on existing evidence of an exporter premium, it seems natural to expect that the coefficients’ on exports and share of exports outside Africa to be positive ($\beta_3 > 0$) for each of the specifications (5a-d). I have no a priori expectation of the sign on share of exports within Africa.

4.3 Investigating Productivity gains from Spillovers

The next step is to investigate if domestic firms may benefit in terms of productivity from the firms with foreign ownership in the same sub-industry. A within group (WG) regression is used in this case to investigate the relationship between;

Total factor productivity $\ln TFP_{it}$ of the domestic firms and the presence of firms with foreign ownership in the sub-sectors. Following the methodology by Aitken and Harrison (1999), the presence of MNEs in sub-sector s (FP_{st}), is captured as the share of MNEs employment (W_{it}) in the sub-sectors in a given year, adjusted by the fraction of foreign ownership ($perfor_{it}$) of the MNEs, for all firm i in sub-sector s . Thus, FP_{st} is defined as the FDI share in the sector s .

$$FP_{st} = \frac{\sum_{i \in s} W_{it} \cdot perfor_{it}}{\sum_{i \in s} W_{it}} \quad \forall s \in \text{sector}, i \in \text{firm and } t \in \text{year}$$

$$\begin{aligned} \ln TFP_{it}^d = & \beta_0 + \beta_1 FP_{st} + \beta_2 Fmage_{it} + \beta_3 Exp_share_{it}^{outside} + \beta_4 Exp_share_{it}^{Africa} \\ & + \alpha_{it} dummies_{it} + \varepsilon_{it} \end{aligned} \quad [6a]$$

In addition, I relate the estimated total factor productivity of the domestic firms $\ln TFP_{st}^{fdi}$ to the total factor productivity $\ln TFP_{it}$ of MNEs in the same sub-sector and year. The TFP of MNEs for a given sector s in time period t is weighted with the share of MNEs foreign equity and the share of employment in the manufacturing industry to capture the economic influences of MNEs productivity. Thus, TFP_{st}^{fdi} is defined as the productivity of FDI in the sector s at time t .

$$\ln TFP_{st}^{fdi} = \frac{\sum_{i \in s} W_{it} \cdot perfor_{it} \cdot \ln TFP_{it}}{\sum_{i \in s} W_{it}} \quad \forall s \in \text{sector}, i \in \text{firm and } t \in \text{year}$$

$$\begin{aligned} \ln TFP_{it}^d = & \beta_0 + \beta_1 TFP_{st}^{fdi} + \beta_2 Fmage_{it} + \beta_3 Exp_share_{it}^{outside} + \beta_4 Exp_share_{it}^{Africa} \\ & + \beta_5 Fmsize_{it} + \alpha_{it} dummies_{it} + \varepsilon_{it} \end{aligned} \quad [6b]$$

A priori expectation: $\beta_1 > 0$; a positive coefficient of FP_{st} - means that an increase in FDI share in sector s improves the TFP of domestic firms. Also, for $\ln TFP_{st}^{fdi}$, an increase in the productivity of FDI in the sector improves the TFP of domestic firms.

4.4 Spillovers and Domestic firms export participation

In this section, we formulate the econometric model to test the hypothesis that foreign ownership influences the export behavior via spillovers. Particularly, that horizontal spillover from MNEs' exports may improve the export performance of domestic firms in the same sub-industry. Sector and location fixed effects may exert deterministic influence on export performance of firms. The dependent variable $Exp_partn_{it}^d$ is the export participation. Export participation is measured as a dummy; it takes the value one if domestic firm exports and zero otherwise. A fixed effect probit model is used to estimate equation 7.

$$Exp_partn_{it}^d = \beta_1 + \beta_2 Fmage_{it} + \beta_3 K_{it} + \beta_4 L_{it} + \beta_5 Mtech_{it} + \beta_6 Fexp_{it} + \beta_7 \ln TFP_{it} + \alpha_{it} dummies + \varepsilon_{it} \quad [7]$$

Control variables such as firm size, technology embodied in imports (technology import intensity) are included as these can influence firms export performance. Where;

$Fexp_{jt}$: is a measure of horizontal spillover from foreign firms' exports. It is calculated as the share of exports by foreign firms in a sector to the total exports in that sector. See Joseph and Reddy (2009).

$$Fexp_{jt} = \frac{Exports_{jt}^{FDI}}{Total\ Exports_{jt}} \quad \forall \text{ firm } i \text{ in sector } j \text{ in time period } t$$

$Fmage_{it}$: Firm age; proxy for firm experience

$Mtech_{it}$: Technology transfer from the importation of inputs and is derived as the logarithm of imported inputs (see Acharya and Keller, 2007; Yasar and Paul, 2008). International trade has long been considered as a channel of technology transfer. The most influential test of this hypothesis is based on open economy versions of endogenous growth models of the early 1990s (Grossman and Helpman 1991). It asks whether a country's productivity is higher, all else equal, if it imports predominantly from high-R&D countries. This would be consistent with technology being embodied in the imported goods, and there could also be imports-related learning effects.¹⁵

¹⁵ Keller (2002) supported this conclusion with industry-level data. Results from micro data are more mixed; Kraay, Soalaga, and Tybout (2001) and Keller and Yeaple (2003) found little evidence of importing effects on productivity at the firm level, but Rodrigue and Kasahara (2004) and Blalock and Veloso (2004) found significant but variable effects depending on measurement methods.

A priori expectation: the sign of the share of foreign firms' exports in a particular sector j to the total sales of that sector for a given time period t is expected to be positive. A positive coefficient seems to suggest that spillovers from MNEs presence in the sector may have a positive effect/influence on domestic firms export participation.

Chapter 5 Data

This study is based on a comprehensive balanced panel from a survey of firms operating within the Ghanaian manufacturing sector. The survey was conducted in seven rounds over a 12 year period from 1992 to 2003. The data is made available by the Centre for the study of African Economies (CSAE) at the University of Oxford database. The data contains firm level information relating to 1991-2002. The first part of the data (I-III) from 1991-1993 was collected as part of the World Bank's Regional Program on Enterprise Development (RPED). Rounds IV-VI covers two years each for the periods from 1994 to 1999. The final round VII covers a three year period from 2000 to 2003. The data for rounds IV-VII was collected by a team from the Centre for the Study of African Economies (CSAE), University of Oxford, the University of Ghana, Legon, and the Ghana Statistical Office. Summary of the above information is shown in table 1.

Table 1: Summary of Survey Data Collection

Round	Date of survey	Period of firm-level data	Number of firms	Firm attrition rate relative to next period
I	Aug/Sep 1992	1991	200	0%
II	1993	1992	212	0%
III	Sep 1994	1993	215	30.2%
IV	Sep 1996	1994, 1995	186	12.4%
V	Sep 1998	1996, 1997	195	14.4%
VI	Oct 2000	1998, 1999	182	27.5%
VII	Oct 2003	2000, 2001, 2002	133	.

Source: based on the explanatory notes on dataset (April, 2011)

The 1992 sample of firms was drawn randomly from the Census of Manufacturing Activities conducted in 1987. The firms were categorized based on sector and location. In all there are 11 sectors including textiles, garments, chemical, wood, machinery, food, furniture, bakery, beverage, small scale resource intensive subsector and metal products. They were also categorized by location: Accra, Cape Coast, Kumasi and Takoradi, all of which constitute major industrial centers in Ghana. This is summarized in table 2

Table 2 summarizes the sector level information on the number of firms and observations.

Table 2: Number of Firms and Observations in Each Sector and Location

Sub-Sector	No. of firms	Observations	Region	No. of firms	Observations
1 Food, Drink & ssrii*	45	540	Accra	171	2052
2 Bakery	24	288	Cape Coast	12	144
3 Textiles	10	120	Takoradi	18	216
4 Garment	55	660	Kumasi	90	1080
5 Wood	23	276			
6 Furniture	54	648			
7 Metal & Machines	63	756			
8 Chemical	17	204			
Total	291	3492		291	3492

*ssrii refers to *small scale and resource intensive industry*

The coverage of this dataset is quite extensive as most of the major manufacturing sectors at the time under investigation are represented. Over the course of data collection, 34 firms of the 200 initially surveyed exited their respective industries. However, these were replaced with firms of similar size from the same sector and location.

The dataset has the advantage of containing a large number of firms over a long period of time and information on many firm characteristics. It also contains pre-calculated price deflators which allow the derivation of real output and input prices. Price indices for each year were calculated based on the prices of each firm's most important goods. Where the prices of a firm's goods were unavailable, information on prices of similar goods across firms or sectoral averages were used (Teal, 2002).

The firm level data contains information on number of employees, capital, raw materials (including share imported), physical capital, output, foreign ownership status of firms-a binary variable-and information on firm export status and value of exports. The original dataset has 291 firms and a total of 3492 observations.

The nominal value of the capital stock is deflated using weighted average of consumer price index (CPI) and the nominal exchange rate with the respective rates of 0.25 and 0.75 respectively¹⁶. Price indices for output and raw materials were constructed and used to adjust the nominal values for output and raw materials.

To begin with, we have missing values for output, number of employees, capital, exports and raw materials for some years over the survey period 1991-200. To limit the number of missing values for the variables of interest, the data is cleaned. Table 3 shows the descriptive statistics for the final sample used for the estimation procedures.

The GMM estimation requires atleast that time T equal to or lager than three. In order to ensure atleast one moment condition, firms with less than three observations are dropped. The descriptive statistics of the remaining sample is summarized in table 3.

¹⁶ The Ghana manufacturing enterprise survey reports that about 75% of capital is imported. (See explanatory notes on dataset. Teal 2002)

Table 3: Descriptive Statistics of Variables

Variable	Mean	S.D	Min	Max	Observations
Labour	74.51	158.91	1	1800	2102
Quality Adjusted Labour	11.33	5.16	0	27.84	1893
Real value Materials ('000 GHC) ⁺	235	1560	0	43300	2019
Real Physical Capital ('000 GHC) ⁺	303	1090	914.91	12100	1513
Real Output ('000 GHC) ⁺	524	3950	0	118000	2032
Firm Age (years)	18.75894	12.53	0	76	2348
FDI Dummy	.23	.42	0	1	3456
Foreign Equity (fraction)	.12	.26	0	1	3336
Exports ('000 GHC) ⁺	15.6	138	0	29300	1636
Exports outside Africa (% of output)	8.53	25.24	0	100	1669
Exports within Africa (% of output)	2.07	9.55	0	100	1669
Foreign Participation (fraction)	.12	.26	0	1	3336
FDI Productivity	.15	.35	0	3.53	1163
Horizontal Spillovers					
Capital Intensity	14.60	2.27	5.12	20.26	1395
Imported Materials(% of Output)	22.03	35.38	0	100	2242

⁺ refers to value in thousands of New Ghana Cedis (GHC).

The variable definitions are presented in table 10 of Appendix B, section B.1.

Chapter 6 Results

Table 4 presents six different estimation approaches of equation 4- production function: OLS, FE (within), Basic GMM, System GMM (1-step & 2-step)¹⁷ and Levinsohn Petrin (LP). Year dummies are included to account for macroeconomic shocks and time trends that affect outcomes equally across the manufacturing industry, while firm fixed effects absorb firm-specific time-invariant heterogeneity. Outcomes of firms within a location might be correlated, since industrial composition may be correlated within a location, thus clustering standard errors by location. The results for the outcomes of interest are presented in the table below. Each panel gives the results for the same dependent variable. The *location*, *time* and *sector* specific dummies are purposely omitted in the table (4 *locations*, 12 *time period* and 8 *sector* specific dummies).

Table 4: Estimating the Production Function

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	FE	B GMM	S GMM1	S GMM2	LP
	q	q	q	q	q	q
l	0.255*** (14.22)	0.123*** (4.47)	-0.433* (-2.54)	0.146*** (4.30)	0.138*** (3.61)	0.209*** (6.42)
m	0.767*** (76.19)	0.675*** (55.04)	0.637*** (14.23)	0.636*** (17.12)	0.640*** (17.28)	0.737*** (31.99)
k	0.0704*** (9.70)	0.0226 (1.74)	-0.00982 (-0.23)	0.0457*** (4.30)	0.0454*** (3.88)	0.0328 (1.12)
L.q				0.238*** (4.89)	0.237*** (4.81)	
_cons		5.362*** (19.37)		1.603*** (4.22)	1.601*** (3.94)	
<i>N</i>	1386	1386	1116	1239	1239	1218
<i>Area dummy</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Sector dummy</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Time dummy</i>	Yes	Yes	Yes	Yes	Yes	Yes
adj. <i>R</i> ²	0.999	0.704				
<i># instruments</i>			41	175	175	
<i>AR(2)</i>			0.016	0.125	0.135	
<i>Sargan</i>			40.96			
<i>Sargan p-val</i>			0.054			
<i>Hansen stat</i>				159.56	159.56	
<i>Hansen p-val</i>				0.226	0.226	

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: year, location and sector dummies are included in estimation but not reported.

The sample size differs because the basic & system GMM and LP procedure requirements are different as discussed in chapter 4.

¹⁷ Xtabond2 command in stata

From Table 4, columns (1) and (2) are the ordinary least squares (OLS) and Fixed Effect (FE) estimation results. The results from the basic GMM (column 3) is rather unreliable because the sign of parameter estimate for physical capital did not conform to a-priori criteria expected from economic theory. Also $AR(2)$ p-value of 0.016 indicates there is second order serial correlation, an indication of model specification problem. In column (4), the system GMM [1 and 2 step] estimation produces results consistent with economic theory and statistically significant at the 1% level. The Hansen test p-value of 0.226 means we reject the null hypothesis and conclude overidentifying restrictions does not seem to be a problem in the model using the system GMM. Besides, the $AR(2)$ test returns insignificant p-value of 0.125 and seems to suggest that there is no second order serial correlation. The LP procedure for estimating the production function is applied and yields similar results as the system GMM except the parameter estimate for physical capital is not statistically significant at the conventional levels.

Henceforth, the parameter estimates of the system GMM is used in the proceeding analysis. That is, the total factor productivity $\ln TFP_{it}$ is obtained as the residual from the system GMM estimation in column (5) of table 4.

6.1 Foreign Ownership Productivity Premium

Hypothesis 1: *There is a foreign ownership productivity premium in the manufacturing industry in Ghana.*

Estimates of equations (5a-d) are reported in table 5. In column (1) of table 5, the results shows that the productivity of firms with foreign firm ownership (MNEs) is on average 7% higher than domestic firm with no form of foreign ownership (purely local-owned) without control variables and is statistically significant at the 1% level. Including firm age, share of export to destinations [within and outside Africa] together with location and sector fixed effects dummies; the results is similar conclusion as shown in columns (2) and (3) of the same table 5 using the between regression. Firms with foreign ownership are more productive than the purely local-owned firms by a margin of 7% to 9% holding the other control variables constant. The result in column (3) also suggests that firms exporting outside Africa are more productive than non-exporting firms. This is because, the estimation results show statistically significant parameter estimates for the *share of exports outside Africa*. I find no statistical significance for the variable *exporting within Africa*.

I re-estimate the model specifications in columns 1-3 but with a *share of ownership (equity)* variable denoted “*fequity*” as expressed in equation 5c and 5d. The results are similar in terms of the sign and statistical significance. In column 6, going from zero to 100 percentage foreign ownership will increase the productivity of the firm by approximately 11%.

In all the specifications presented in same table 5, the influence of firm experience measured by firm age is significant to firm productivity. It seems to suggest that overtime firms become productive. Also, the coefficient of *share of exports outside Africa* is significant and indicates that firms exporting outside Africa tend to have comparatively higher total factor productivity than non-exporters but the magnitude is rather small. I find no statistical significance for the case of exporting within Africa. Controlling for the total exports instead of the decomposed form, increase in firm exports increases total factor productivity.

Table 5: Estimating Foreign Ownership Productivity Premium

	<u>Main Regression⁺⁺</u>						<u>Robustness Checks^{xx}</u>	
	lnTFP from the system GMM						lnTFP from FE	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	BE	BE	BE	BE	BE	BE	BE	BE
	lnTFP	lnTFP	lnTFP	lnTFP	lnTFP	lnTFP	lnTFP	lnTFP
Foreign ownership dummy	0.0723** (2.83)	0.0936** (3.27)	0.0695* (2.34)				0.0838** (2.87)	
Foreign firm share in equity				0.117** (2.90)	0.148*** (3.31)	0.107* (2.32)		0.122** (2.67)
Firm age		-0.00909*** (-3.43)	-0.00866** (-3.08)		-0.00901*** (-3.35)	-0.00954*** (-3.30)	0.00208 (0.76)	0.00267 (0.97)
Firm age2		0.0000949* (2.09)	0.000106* (2.21)		0.0000957* (2.09)	0.000120* (2.47)	0.0000823 (1.78)	0.0000493 (1.06)
Exports		0.0562* (2.26)			0.0580* (2.31)			
Percentage of exports outside Africa			0.00336*** (5.35)			0.00353*** (5.17)	0.00234*** (5.09)	0.00204*** (4.26)
Percentage of exports within Africa			0.000761 (0.62)			0.000885 (0.72)	0.00134 (1.10)	0.00152 (1.26)
_cons	-0.0156 (-1.27)	0.0976 (0.83)	0.156 (0.89)	-0.0188 (-1.56)	0.139 (0.72)	0.0976 (0.83)	-0.122*** (-3.51)	-0.117*** (-3.36)
N	1163	1163	1163	1163	1163	1163	1163	1163

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Year and Sector Dummies included in all columns.

⁺⁺ TFP from GMM regression is used

^{xx} TFP from FE is used

Thus far, manufacturing firms with foreign ownership (MNEs) have 7% higher total factor productivity than domestic firms with no foreign ownership (see column 3). However the specifications estimated do not provide any insights as to whether MNEs productivity spills over to domestic firms and to what extent they are export spillovers.

As a robustness check, the total factor productivity is derived for the FE estimation of the production function. I relate the TFP of domestic firms to the foreign ownership dummy as reported in columns 5 of table 6. The results are consistent with the case with TFP derived by the GMM procedure. The bottom line is that, it provides evidence suggesting the presence of foreign ownership productivity premium. In this case, the foreign ownership productivity premium is 8% as shown in column 1 of table 9.

Using the foreign equity share instead of the FDI dummy, as the share approaches 1 (unity), the premium is about 12% (column 6 of the same table 9).

6.2 Productivity Spillovers

Hypothesis II: *Domestic firms benefit in terms of total factor productivity from MNEs presence in the same sub-industry (sector).*

The results from within-group regression estimation of equations 6a and 6b with clustered standard errors by sector-year are summarized in table 6. Clustering the standard errors is necessary because the presence of MNEs in the manufacturing industry and their productivity do not vary within each firm observation, and are specific to each industry and year. Consequently, with the aggregate variables in micro units present in the data, the standard errors of the firm level panel estimation will be artificially deflated (Moulton, 1990).

Table 6 reports the effect on only domestic firms in the estimating sample for equation 6a and 6b regressions. Controlling for firm-specific and time-invariant effects, productivity of domestic firms increases with the presence of MNEs (FP) as reported in column 1. This result is robust to the inclusion of control variables such as firm age, share of export destinations presented in column (2). The coefficient of FP is approximately 11% and significant at the 5% level. This means that, holding all other factors constant, if the share of FDI in the sector approaches 1 (unity), the productivity of domestic firms in the sector will increase by 11%. This suggests that, as the share of FDI in the sector increases, domestic firms' productivity will increase. This seems to indicate a productivity gain from spillovers to domestic firms. In column's (3) and (4), the parameter estimate for the productivity of FDI (A_FDI) is positive and statistically significant at the 1% level. It interprets that; a 10% increase in the productivity of FDI in the sector increases domestic firms' productivity in the same sector by 2.71%, all other factors constant. This seems to suggest spillover effects from MNEs on domestic firms in the form of productivity gain, in the same sub-sector.

Summarizing thus far, the results from table 6 suggest statistically significant evidence that domestic firms may benefit from the MNEs in the same sub-sector. With the higher productivity of MNEs, then evidence suggests that, more foreign ownership in the domestic economy may spillover to domestic firms; hence, contributes to improving the growth of the manufacturing industry at large. This finding supports a more open minded FDI policy for the manufacturing industry.

Table 6: Effect of Foreign Firms Presence on Domestic Firms TFP

	<u>Main regression</u>				<u>Robustness Check</u>	
	lnTFP from the system GMM				lnTFP from FE estimation	
	(1) WG lnTFP ^{*/}	(2) WG lnTFP	(3) WG lnTFP	(4) WG lnTFP	(5) WG lnTFP	(6) WG lnTFP
Share of Foreign firm employment in sector (FP)	0.146** (3.27)	0.107* (2.32)			0.0571 (0.84)	
Productivity of FDI in sector (A_FDI)			0.314*** (10.15)	0.271*** (8.26)		0.388*** (7.98)
Firm age		-0.00954*** (-3.30)		-0.00868** (-3.09)	-0.0132** (-3.08)	-0.0121** (-2.91)
Firm age2		0.000120* (2.47)		0.000108* (2.28)	0.000200** (2.77)	0.000184** (2.62)
Percentage of exports outside Africa		0.00353*** (5.17)		0.00289*** (4.35)	0.00688*** (6.79)	0.00575*** (5.84)
Percentage of exports within Africa		0.000885 (0.72)		0.000707 (0.59)	0.0000380 (0.02)	-0.000300 (-0.17)
_cons	-0.00532 (-0.03)	0.0976 (0.83)	-0.00501 (-0.03)	0.0663 (0.58)	1.075*** (6.16)	1.018*** (6.00)
<i>N</i>	853	853	853	853	853	853

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Year and Sector Dummies are included; clustered (sector) standard errors.

Notes:

^{*/} The dependent variable is the total factor productivity of domestic firms.

FP is employment weighted and A_FDI if productivity weighted. They both tell the same story about possible spillover in TFP gains to domestic firms in the same sector but the coefficients differ because it is interpreted differently.

A robustness check is presented in columns 5 and 6 in same table6. The FE estimated lnTFP for domestic firms in the estimating sample is used as the dependent variable. The results are consistent with the findings in column 4; the positive influence of increasing productivity of the FDI in sector (column 6). It interprets that; a 10% increase in the productivity of FDI in the sector increases domestic firms' productivity in the same sector by 3.88%, all other factors constant.

The result for the “employment weighted” foreign presence however is not significant (column 5, table 6). Nonetheless, there is evidence to suggest that presence of foreign ownership will benefit domestic firms via spillovers.

6.3 Horizontal spillovers and Export Behavior

Hypothesis III: *Horizontal Spillovers (horizontal) from the presence of MNEs may influence the export participation of domestic firms.*

The estimation of equation 7 is presented in Table 7. Columns (1) to (3) present the estimation of using the OLS, fixed effect probit and logit techniques respectively with sector-specific effects (dummies). The coefficient of interest - *share of foreign firms' exports in sector* - has a positive coefficient in all three regressions and seems to indicate that horizontal spillovers from MNEs will positively influence domestic firms export participation. Table 8 present the conditional marginal effects at the mean for each of the regressions. For the OLS, the conditional marginal effect at mean is 2.9% and statistically significant at the 1% level, however the OLS does not restrict predicted probabilities between zero and one¹⁸. With the fixed effect Probit and Logit, the marginal effects are similar. Thus, with an increase in foreign firms share of export activity [from zero to 100%], domestic firms are 3.1% more likely to participate in export activity as shown in column 2 of table 8, all other factors constant.

Table 7: Estimation results for domestic firms' export participation

	(1) OLS exports	(2) Probit exports	(3) Logit exports
Labour	0.0964*** (4.92)	0.285*** (4.67)	0.495*** (4.71)
Capital	0.00500 (0.50)	0.0180 (0.60)	0.0199 (0.39)
Firm age	-0.00106 (-0.76)	-0.00346 (-0.83)	-0.00562 (-0.81)
Share of foreign firms' exports in sector	0.0286*** (3.48)	0.0904*** (3.53)	0.153*** (3.50)
lnTFP	0.0822* (2.43)	0.231* (2.23)	0.406* (2.34)
lnMTech	-0.00853 (-0.60)	-0.0224 (-0.54)	-0.0446 (-0.66)
_cons	0.0123 (0.10)	-1.456*** (-3.87)	-2.318*** (-3.61)
<i>N</i>	853	853	853

t statistics in parentheses [* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$]

Sector dummies included in all columns but not reported

¹⁸ The minimum value for the predicted probabilities for the OLS reported in table 12 of Appendix B: Section B.2 is negative.

Table 8: Marginal effect of horizontal spillovers on domestic firms' export participation

	Marginal Effect at Mean			Average Marginal Effect		
	(1) OLS Exports	(2) Probit Exports	(3) logit Exports	(4) OLS Exports	(5) Probit Exports	(6) Logit Exports
main						
Labour	0.0964*** (4.92)	0.0986*** (4.67)	.1020*** (4.75)	0.0964*** (4.92)	.0964*** (4.92)	.0950*** (4.93)
Capital	0.00500 (0.50)	.0062146 (0.60)	.004102 (0.39)	0.00500 (0.50)	.0049961 (0.50)	.0038224 (0.39)
Firm age	-0.00106 (-0.76)	-.0011963 (-0.83)	-.00116 (-0.81)	-0.00106 (-0.76)	-.0010605 (-0.76)	-.0010808 (-0.81)
Share of foreign firms' exports in sector	0.0286*** (3.48)	.0312*** (3.54)	.0316*** (3.53)	0.0286*** (3.48)	.0286*** (3.48)	.0294*** (3.58)
lnTFP	0.0822* (2.43)	0.0860* (2.22)	0.0923* (2.35)	0.0822* (2.43)	0.0764* (2.24)	0.0806* (2.36)
lnMTech	-0.00853 (-0.60)	-0.0083 (-0.54)	-0.0101 (-0.66)	-0.00853 (-0.60)	-0.0077 (-0.54)	-0.0092 (-0.66)
<i>N</i>	853	853	853	853	853	853

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note:

Dependent variable is a binary variable for domestic firms exports. It equals one if domestic firm exports, otherwise, zero.

The mean values used to compute the marginal effects are reported in table 12 in appendix B; section B.3

Percentages of correctly predicted/classified value from the xtprobit and xtlogit models are 74.33% and 74.56% respectively (see table 14 in appendix B; section B.5).

From table 8, labour seems to be a significant factor that may influence the export participation of domestic firms. Firm age has a negative effect but not significant. Thus overtime, the experience of domestic firms does not necessarily induce export participation. Also, the total factor productivity of domestic firms is not statistically significant.

The odd of domestic firms participating in the export market versus not participating in export activity is 1.165731 given horizontal spillovers. With an odds ratio more than 1, it indicates that, when foreign firms export, domestic firms are more likely to participate in exports than remain domestic. The results from estimating the odds ratio is reported in table 13 of appendix B; section B.4.

Chapter 7 Conclusion

This paper studies the relationship between foreign ownership and productivity of manufacturing firms in Ghana to investigate whether domestic firms may benefit from spillovers accruing from the presence of MNEs and to what extent these spillovers are export spillovers. Firm productivity is measured by the total factor productivity (TFP). TFP reflects the efficiency in production and is defined as the level of output that is not explained by the factor inputs. Using between firm variations, I find that MNEs are on average 7% more productive than domestic firms in the same sub-sector and location.

Further, there is statistically significant evidence suggesting that domestic firms may benefit from spillovers from the MNEs. Holding all other factors constant, as the share of FDI in the sector approaches 1 (unity), the productivity of domestic firms in the sector will increase by 11%. This suggests that, as the share of FDI in the sector increases, domestic firms' productivity will increase. This seems to indicate a productivity gain from spillovers to domestic firms. Also, as the productivity of FDI in the sector increases, domestic firms benefit a TFP gain. That is, 10% increase in the productivity of FDI in the sector will lead to an increase in domestic firms' productivity in the same sector by 2.71%, all other factors constant. This seems to suggest spillover effects from MNEs on domestic firms in the form of productivity gain, in the same sub-sector.

Investigating the extent to which the spillovers are export spillovers, I examine whether there exist significant spillovers (horizontal) from the presence of foreign firms to influence the export performance of domestic firms. I find evidence of positive export participation with increasing share of foreign owned firm exports in the same sector. The magnitude of the effect is that, horizontal spillovers increase the probability of domestic firms engaging in export participation by 3.1%. The economic size of the effect is however small and seems to support existing evidence that MNEs in developing countries such as Ghana is mainly domestic market seeking than export-oriented. Sjöholm (1999) also found that increased foreign presence does not seem to benefit export (i.e., export spillovers from foreign firms are not very significant) in Indonesian manufacturing firms.

Perhaps, it is not possible to expect significant export spillovers [in terms of magnitude] from FDI to manufacturing industry in Ghana because, Ghana's factor market, including infrastructure sector, is less efficient compared with many of these countries with whom Ghana competes in international markets. Rankin *et al* (2002) argue that Ghanaian manufacturing firms have performed poorly on average, over the second half of the 1990s because the domestic firms may be producing using the wrong input mix.

The poor infrastructure like ports (both air and sea), road networks, etc. make it less feasible to export, because such costs would cancel out the competitive advantage from the location-specific factors like cheap factors of production. However, the recent policies like SEZ (special Economic Zone) policy, and increased investments in export-related infrastructure, are expected to attract more export-oriented FDI. This may domestic firms to reduce their exporting costs and to become more competitive.

In relation to the findings in his paper, I propose that, improving firm efficiency should be a fundamental part of Ghanaian industrial policy. This may be achieved in a number of ways. Firstly, trade and FDI policy should aim at incentivizing more MNEs into the economy especially in manufacturing sector. Statistical evidence from this study suggests domestic firms will gain in total factor productivity spillovers from foreign owned firms increasing presence.

Chapter 8 Reference

Acharya, Ram C. and W. Keller (2009): "Technology transfer through imports," *Canadian Journal of Economics*, Canadian Economics Association, vol. 42(4), p1411-1448

Aitken, Brian J. and Ann E. Harrison (1999): "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela," *American Economic Review* 89, No.3, p 605-618.

Aitken, Brian J., Gordon H. Hanson and Ann E. Harrison (1997): "Spillovers, foreign investment, and export behavior", *Journal of International Economics*, Vol. 43, p103-132.

Appiah-Adu, K. (1998): "Market orientation and performance: Empirical tests in a transition economy." *Journal of Strategic Marketing*, 6(1), p25-46

Arellano M. and O. Bover (1995): "Another Look at the Instrumental Variable Estimation of Error-Components Models". *Journal of Econometrics*, 1995, vol. 68, issue 1, p29-51

Arnold, J. M., and Hussinger, K. (2005): "Export behavior and firm productivity in German manufacturing." *Weltwirtschaftliches Archiv*, 141 (2): p219 - 243.

Aryeetey, Harrigan, and Nissanke (2000): "Economic Reforms in Ghana: The Miracle and the Mirage," eds., Vol 2.

Asante, Y. F. Nixon, and G. K. Tsikata (2000): "The Industrial Sector Policies and Development," Oxford: James Currey and Accra: Woeli Publication Services: p344-365

Asiedu, E. (2002): "On the Determinants of Foreign Direct Investment to Developing Countries: Is Africa Different?" *World Development* 30, p107-19

Aw, Bee Yan & Chung, Sukkyun & Roberts, Mark J, (2000): "Productivity and Turnover in the Export Market: Micro-level Evidence from the Republic of Korea and Taiwan (China)", *The World Bank Economic Review*, 14, p313-332.

Barrios, S., H. Görg and E. Strobl (2003): "Explaining Firms' Export Behaviour: R&D, Spillovers and the Destination Market". *Oxford Bulletin of Economics and Statistics*, Vol. 65, p475-496

Battese, E.G., Christopher, J. O., Tim, C, and Prasada Rao, D.S. (2005): "An Introduction to Efficiency and Productivity Analysis" 2nd Ed., Springer.

Behrman, J.N. (1972): "The role of International Companies in Latin America: autos and Petrochemicals." Lexington, MA: Lexington Books.

Belderbos, R., Van Roy, Vincent and Duvivier, Florence (2010): "International and Domestic Technology Transfers and Productivity Growth: Firm Level Evidence."

- Bernard, A. B., Jensen, B., Wagner, J. (1997): “The Good Go Abroad: Evidence from Longitudinal Micro Data on German and U.S. Exporters”, in S. Laaksonen (ed.), *The Evolution of Firms and Industries. International Perspectives* (Helsinki: Statistics Finland), p489–500
- Bernard, A. B., Wagner J. (1997): “Exports and Success in German Manufacturing”, *Weltwirtschaftliches Archiv/Review of World Economics*, 133, cap.1, p134–57
- Bernard, A., Jensen, B. (1995): “Exporters, Jobs and Wages in U.S. Manufacturing: 1976-1987”. *Brookings Papers on Economic Activity. Microeconomics*, Vol. 1995. pp. 67-119.
- Bernard, A., Jensen, B. (1998): “Understanding the U.S. Export Boom”. National Bureau of Economic Research. Working Paper No 6438.
- Bernard, A., Jensen, B. (1999): “Exceptional exporter performance: cause, effect, or both?” *Journal of International Economics*.
- Bernard, A., Jensen, B. (2004): “Why some firms export”. The review of economics and statistics.
- Blalock, G., and Veloso, F. (2004): “Trade, Technology Transfer and Productivity Growth: The Neglected Role of Imports,” unpublished manuscript, Cornell University.
- Blundell, R., and Bond, S. (1998): “Initial conditions and moment restrictions in dynamic panel data models”. *Journal of Econometrics*, 87, p115-143
- Borensztein, E., De Gregorio, J., Lee, J-W. (1998): “How Does Foreign Direct Investment Affect Economic Growth?” *Journal of International Economics* 45, p115-35.
- Brainard, S. Lael (1997): “An Empirical Assessment of the Proximity- Concentration Trade-off Between Multinational Sales and Trade,” *American Economic Review*, vol 87(4), p520-544.
- Caves, Richard E., (1974): “Multinational Firms, Competition, and Productivity in Host-Country Markets,” *Econometrica*, 41: p176-193.
- Caves, Richard E. (2007): “Multinational Enterprise and Economic Analysis. 3d ed. Cambridge University Press.
- Clerides, S., Lach, S., Tybout, J. (1998): “Is learning by exporting important? Micro Dynamic evidence from Colombia, Mexico, and Morocco.” *The Quarterly Journal of Economics*.
- Cohen Wesley M. and Daniel A. Levinthal (1990): “Absorptive Capacity: A New Perspective on Learning and Innovation”. *Administrative Science Quarterly*, Vol. 35, No. 1, Special Issue: Technology, Organizations, and Innovation, pp. 128-152.

- Cornwell, C.P., Schmidt, P., and Sickles, R.C. (1990): "Production Frontiers with Cross-Sectional and Time-Series Variation in Efficiency levels." *Journal of Econometrics*, vol 46 (1/2), p185-200.
- Das, S. (1987): "Externalities, and Technology Transfer through Multinational Corporations: A Theoretical Analysis", *Journal of International Economics*, Vol. 22, p171-182.
- De Mello, L.R. (1999): "Foreign Direct Investment-Led Growth: Evidence from Time Series and Panel Data." *Oxford Economic Papers* 51, p133-51
- Debrah, Y. (2002): "Doing Business in Ghana." *Thunderbird International Business Review*, 44, p495-514
- Dunning, J. (1988): "The Eclectic Paradigm of International Production: A Restatement and Some Possible Extensions" *Journal of International Business Studies*. Vol 19, No 1, p1 – 31.
- Dunning, J. H. (1977): "Trade, location of economic activity and the MNE: A search for an eclectic approach." In: B. Ohlin, P. O. Hesselborn & P. M. Wijkman (Eds), *The International Allocation of Economic Activity* (pp. 395–418). London: Macmillan.
- Fosfuri A. M., and Ronde, T. (2001): "Foreign direct Investment and Spillovers through "Workers Mobility",", *Journal of International Economics*, 53, p205-222.
- Frazer, Garth. (2005): "Which Firms Die? A Look at Manufacturing Firm Exit in Ghana" Mimeographed, School of Management and Centre for Industrial Relations, University of Toronto
- Galina H., Cheryl L. (2006): "What Determines Technological Spillovers of Foreign Direct Investment: Evidence from China." *Economic Growth Center, Yale University Center Discussion Paper No. 934*.
- Girma, S. Greenaway, D. and Kneller, R. (2004): "Does Exporting Lead to Better Performance? A Microeconomic Analysis of Matched Firms?" *Review of International Economics* 12(5), p855-866.
- Glass, A. and K. Saggi (2002): "Multinational Firms and Technology Transfer", *Scandinavian Journal of Economics*, Vol. 104, p495-514.
- Görg H. and E. Strobl. (2000): "Multinational Companies, Technology Spillovers and Firm Survival: Evidence from Irish Manufacturing" *Centre For Research on Globalisation and Labour Markets. Research Paper 2000/12*.
- Gorter, Cees, et al, (1997): "On the Endogeneity of Output in Dynamic Labour-Demand Models". *Empirical Economics*, 1997, vol. 22, issue 3, pages 393-408

Greenaway, D., N. Sousa and K. Wakelin (2004): "Do Indigenous Firms Learn to Export from Multinationals?" *European Journal of Political Economy*, Vol, 20(4), p1027-1043

Grossman, G., and E. Helpman, (1991): "Innovation and Growth in the Global Economy". Cambridge, MA: MIT Press.

Grünfeld L. A., (2006): "Multinational Production, Absorptive Capacity, and Endogenous R&D Spillovers." *Norwegian Institute of International Affairs, Review of International Economics*, Vol. 14, No. 5, pp. 922-940, November 2006

GSS-Ghana Statistical Service (2011): "Ghana's economic performance 2011 in figures."

Haaker M. (1999): "Spillovers from Foreign Direct Investment through Labour Turnover: The Supply of Management Skills," Discussion Paper, London School of Economics.

Helpman, Elhanan, 1984. "A Simple Theory of International Trade with Multinational Corporations," *Journal of Political Economy*, University of Chicago Press s, vol. 92(3), p451-71

Harding, Torfinn and Beata S. Javorcik (2011): "FDI and Export Upgrading" *The Review of Economics and Statistics*, (forthcoming).

Hopenhayn H. (1992): "Entry, Exit, and Firm Dynamics in Long Run Equilibrium." *Econometrica*. 60(5), p1127-50

Hughes, K. (1986): "Exports and Innovation: A Simultaneous models." *European Economic Review*, vol 30 (2), p383-399.

Joseph, T. J. and V. N. Reddy, (2009): "FDI Spillovers and Export Performance of Indian Manufacturing Firms after Liberalisation" *Economic and Political weekly*, Vol - XLIV No. 52.

Jovanovic B. (1982): "Selection and the Evolution of Industry". *Econometrica* 50(3), p649-70.

Judson and Owen, (1996): "Estimating Dynamic Panel Data Models: A Practical Guide for Macroeconomists" Mimeo Federal Reserve Board of Governors.

Keller, W. (2002a): "Geographic Localization of International Technology Diffusion," *American Economic Review*, 92, 120–142.

Keller, W. (2002b): "Knowledge Spillovers at the World's Technology Frontier," working paper, University of Texas, Austin, Dept. of Economics.

Keller, W., and Yeaple, S. R. (2003): "Multinational Enterprises, International Trade, and Productivity Growth: A Firm Level Evidence from the United States," working paper, University of Texas, Austin, Dept. of Economics.

Kokko, Ari; Mario Zejan and Ruben Tansini (2001): "Trade Regimes and Spillover Effects of FDI: Evidence from Uruguay". *Weltwirtschaftliches Archiv*, Vol. 137, p124-149

Konings, J. (2001): "The Effects of Foreign Direct Investment on Domestic Firms: Evidence from Firm Level Panel Data in Emerging Economies". *Economics of Transition*, Vol. 9, p619-633

Kraay, A., Soloaga, I., and Tybout, J. (2001): "Product Quality; Productive Efficiency and International Technology Diffusion: Evidence from Plant-Level Panel Data," Policy Research Working Papers 2759, World Bank.

Krakah, GSS and Teal (2009): "Manufacturing Firms in Ghana: Comparing the 1987 and 2003 Censuses." Centre for the Study of African Economies. University of Oxford

Lefebvre, E., Lefebvre, L.A., and Bourgault, M. (1998): "R&D-related capabilities as determinants of export performance." *Small Business Economics*, 10: p365–377

Levinsohn, J., and A. Petrin. (2003): "Estimating production functions using inputs to control for unobservables". *Review of Economic Studies* 70: p317–342

Lisa cook, (2000): "Assessing Export Platforms: The Case of Ghana." Consulting Assistance on Economic Reform, CAER II Discussion Paper No. 76

Marschak, J. and Andrews, W. (1944): "Random Simultaneous Equations and the Theory of Production", *Econometrica* 12, p143-205

Melitz M. J., (2003): "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica* 71, p1695-725.

Mishra B. (2011): "Spill-over effects of foreign direct investment: an econometric study of Indian firms." Munich Personal RePEc Archive MPRA paper 37759.

Morisset, j. (2000): "Foreign Direct Investment in Africa; Policies also matter". World Bank Publications, 2000 Policy research paper 2481.

Moulton, Brent R, (1990): "An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Unit". *The Review of Economics and Statistics*, MIT Press, vol. 72(2), p334-38.

Olley, G. S., and A. Pakes, (1996): "The dynamics of productivity in the telecommunications equipment industry". *Econometrica* 64: 1263–1297.

- Prasanna N. (2010): "Impact of Foreign Direct Investment on Export Performance in India." *J Soc Sci*, 24(1): 65-71.
- Radelet S. and J. Sachs, (1999): "The Second Year of the Asian Financial Crisis: Country Strategies and Prospects for Recovery." HIID, CAERII discussion Paper No. 60
- Rankin, N., Sørderbom, M., Teal, F., (2002): "The Ghanaian manufacturing enterprise survey 2000", CSAE report REP/2002-05. Centre for the Study of African Economies, Oxford.
- Redding S.J. (2010): "Theories of Heterogeneous Firms and Trade." NBER Working Paper No. 16562, JEL No. F1, L80.
- Richardson, J.D., Rindal, K., (1995): "Why Exports Really Matter!" The Institute for International Economics and the Manufacturing, Washington D.C
- Rimmer, Douglas (1992): "Staying poor: Ghana's Political Economy 1950-1990." Oxford: Pergamon Press.
- Roberts, Mark J & Tybout, James R, (1997): "The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs," *American Economic Review*, Vol. 87, No. 4, p545-564.
- Rodrigue, J., and Kasahara, H. (2004): "Does the Use of Imported Intermediates Increase Productivity? Plant-Level Evidence," presented at the Econometric Society North American Summer Meetings.
- Salomon, R., Shaver, M. (2005): "Learning by Exporting: New Insights from Examining Firm Innovation" *Journal of Economic and Management Strategy*. 14. pp. 431-460.
- Sjoholm, Fredrik (1999): "Do Foreign Contacts enable Firms to become Exporters?", EIJIS working paper No.68, Stockholm School of Economics, Sweden.
- Smith, V., Strojer Madsen, E., Dilling Hansen, M. (2002): "Do R&D Investments Affect Export Performance". The Danish institute for Studies in Research and Research Policy.
- Steel, W. F., (1972): "Import Substitution and Excess Capacity in Ghana," *Oxford Economic Papers (New Series)*, 24, 212-40.
- Steel, William F. and Leila M. Webster (1992): "How Small Enterprises in Ghana have Responded to Adjustment." *The World Bank Economic Review* Vol. 6, No. 3
- Tang, H. (2008). http://www.hwtang.com/uploads/3/0/7/2/3072318/paper2final_hwtang.pdf
- Teal, F., (2002): "A note on the Data for Ghanaian Manufacturing Firms: 1991-1997." Centre for the Study of African Economies, University of Oxford.

Thang, T. T. (2011): “Productivity Spillovers from Foreign Direct Investment: What If Productivity is No Longer a Black Box?” South East Asian Journal of Management, vol 5(1), p1-18.

United Nations Conference on Trade and Development, (2000): World Investment Report 1999, Geneva: *UNCTAD*.

United Nations Conference on Trade and Development, (2005): World Investment Report 2005, New York and Geneva: *UNCTAD*.

Verbeek M. (2012): “A Guide to Modern Econometrics”, 4th Edition

Walckirch A. and A. Ofori (2008): “Foreign Presence, Spillovers and Productivity: evidence from Ghana” Munich Personal RePEc Archive-MPRA Paper No. 8577.

Wang, Jian-Ye and Magnus Blomström (1992): “Foreign Investment and Technology Transfer: A Simple Model”, European Economic Review, Vol. 36, p137-155.

Yasar M. and Catherine J. Morrison P., (2008): “Foreign Technology Transfer and Productivity: Evidence from a Matched Sample.” American Statistical Association Journal of Business and Economic Statistics, Vol. 26, No. 1

Database

Index Mundi Database:

<http://www.indexmundi.com/facts/ghana#Economic Policy & Debt-National accounts>

Center for International Comparisons of Production, Income and Prices. University of Pennsylvania. Penn World Tables version 6.1.

http://www.pwt.econ.upenn.edu/php_site/pwt_index.php

Firm level data:

CSAE, Centre for the Study of African Economies, University of Oxford.

<http://www.csae.ox.ac.uk/datasets/ghana-rped/Ghmain.html>

Chapter 9 Appendix

APPENDIX A

Table 9: Summary of Major Sectors Activity

Traditional sector	Sub-sectors
AGRICULTURE	Crops and livestock Cocoa production Forestry & logging Fishing
INDUSTRY	Mining & Quarrying (including crude oil) Manufacturing Electricity, Water & Sewerage Construction
SERVICE	Transport, Storage and Communication Wholesale & Retail trade, Restaurant and Hotels Finance, Insurance, Real Estate and Business services Government services Community, Social and Personal services Producers of Private Non-profit services

APPENDIX B

B.1

Table 10: Definition of Variables

Variable	Definition
Labour	Number of employees
Real value Materials ('000 GHC)	Real total cost of raw materials
Real Physical Capital ('000 GHC)	Real investment in land and buildings + real investment in plant and equipment
Real Output ('000 GHC)	Real value of manufactured output
Firm Age (years)	Firm age
FDI Dummy	Dummy equals 1 if firm has foreign ownership, and zero if purely domestic
Foreign Equity (fraction)	Percentage of foreign ownership
Exports ('000 GHC)	Real value of exports
Exports outside Africa (% of output)	Percentage of output exported outside Africa
Exports within Africa (% of output)	Percentage of output exported within Africa
Foreign Participation (fraction)	Share of foreign owned firms employment in sector
FDI Productivity	The total factor productivity of foreign owned firms in sector s in time t , weighted with the share of employment in the manufacturing industry.
F _{exp}	Share of foreign firms export in sector
Imported Materials(% of Output)	Percentage of raw materials imported

B.2

Table 11: Descriptive statistics of Predicted probabilities (Logit, Probit and OLS)

Variable	Obs	Mean	Std. Dev.	Min	Max
exports	1151	.3256351	.4687199	0	1
plogit	1151	.3608624	.1759959	.0659217	.8377864
pprobit	1151	.3609697	.1734998	.0572215	.8317435
pols	1151	.3571217	.1669906	-.0303807	.8093199

B.3

Table 12: Mean of variables used in calculating the marginal effects at mean

Variable	Mean
K	16.18133
L	3.138118
fimage	18.67175
lnhori	-2.203458
lnTFP	-.0168681

B.4

Table 13: Odds ratio (Logistic model)

exports	Odds Ratio	Std. Err.	z	P>z	[95% Conf. Interval]	
L	1.639723	.1721097	4.71	0.000	1.334831	2.014257
K	1.020087	.0525764	0.39	0.700	.9220731	1.12852
fimage	.9943921	.0069286	-0.81	0.420	.9809046	1.008065
lnhori	1.165731	.0510644	3.50	0.000	1.069823	1.270238
lnTFP	1.243306	.259035	1.05	0.296	.8264864	1.87034
_cons	.098449	.0632975	-3.61	0.000	.0279212	.3471274

B.5

Table 14: Percentage correctly predicted/ classified for the probit and logit regression

Logistic model for exports				Probit model for exports			
Classified	True		Total	Classified	True		Total
	D	~D			D	~D	
+	78	31	109	+	79	30	109
-	188	556	744	-	187	557	744
Total	266	587	853	Total	266	587	853
Classified + if predicted Pr(D) >= .5 True D defined as exports != 0				Classified + if predicted Pr(D) >= .5 True D defined as exports != 0			
Sensitivity		Pr(+ D)	29.32%	Sensitivity		Pr(+ D)	29.70%
Specificity		Pr(- ~D)	94.72%	Specificity		Pr(- ~D)	94.89%
Positive predictive value		Pr(D +)	71.56%	Positive predictive value		Pr(D +)	72.48%
Negative predictive value		Pr(~D -)	74.73%	Negative predictive value		Pr(~D -)	74.87%
False + rate for true ~D		Pr(+ ~D)	5.28%	False + rate for true ~D		Pr(+ ~D)	5.11%
False - rate for true D		Pr(- D)	70.68%	False - rate for true D		Pr(- D)	70.30%
False + rate for classified +		Pr(~D +)	28.44%	False + rate for classified +		Pr(~D +)	27.52%
False - rate for classified -		Pr(D -)	25.27%	False - rate for classified -		Pr(D -)	25.13%
Correctly classified			74.33%	Correctly classified			74.56%