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Foreign Direct Investment and Labour Productivity in South Africa

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List of Acronyms

BLS	Bureau of Labour Statistics
FDI	Foreign Direct Investment
FE	Fixed Effect
FIG	Foreign Investment Grant
IGD	Institute for Global Dialogue
IMF	International Monetary Fund
IV	Instrumental Variables
M&A	Mergers and Acquisitions
MNCs	Multinational Corporations
NEPAD	New Partnership for Africa's Development
OLS	Ordinary Least Square
R&D	Research and Development
RE	Random Effect
SADTI	South African Department of Trade and Industry
SIP	Strategic Investment Program
SSA	Statistics South Africa
TI	Transparency International
TNCs	Transnational Corporations
UNCTAD	United Nations Conference on Trade and Development
WBES	World Bank Enterprise Survey
WTO	World Trade Organization

Abstract

The impact of Foreign Direct Investment (FDI) on domestically owned firms in developing countries has been a topic of much debate in the literature. The popular belief is that there is a substantial positive link between foreign investment and domestic enterprises. It has been argued that FDI provides access to advanced technologies and other intangible assets that can spillover to local manufacturing industries. Existing empirical studies in the area can be divided into two groups - one which concludes that FDI improves the productivity of domestic firms, and the other which argues that the impact is unclear or even negative. However, little is known about the effect of FDI on domestic firms in the African context.

Noting this gap, this paper uses firm level unbalanced panel data from South Africa to examine the impact of foreign investment on labour productivity of domestic firms. The estimates presented here show that while foreign firms improve the productivity of their own workers, there is no evidence of either positive or negative spillover effect form FDI on productivity of labour in local firms at either the national or regional level. This finding is consistent with a meta analysis of the existing empirical literature on the topic. The meta analysis shows that the estimates of FDI spillovers are systematically affected by the specific research approach adopted. This paper conducts a detailed sensitivity analysis using alternative specifications and taking into account alternative definitions of foreign presence, but the results are robust and show that there is no effect of FDI on labour productivity in domestically owned firms.

Relevance to Development Studies

Unlike many previous researches regarding the spillover effects of foreign investment, this study gives due attention to different estimation concerns that might be a source of potential bias while analysing firm level data. It also points out some research design factors that could determine the findings in ex-ante stage using meta analysis. In addition, it classifies foreign presence based on ownership status and examines whether FDI spillover is geographically limited. Therefore, it contributes as alternative source of evidence for better understanding the relation between foreign investment and labour productivity of domestic firms in developing countries.

Keywords

FDI, spillover, labour productivity, firm, industry, South Africa

Chapter 1

Introduction

Many developing countries offer a number of investment incentives including lower income taxes, import duty exemptions, tax holidays, and subsidies for infrastructure to attract foreign direct investment (Ofosu and Waldkirch, 2010; Aitken and Harrison, 1999). FDI is considered beneficial not only because it is expected to yield potential benefits including employment opportunities, capital and foreign exchange, but the most cited reasons for promoting FDI is the prospect of acquiring new technology and other intangible assets, which may spillover1 to the host country and allow domestic firms to improve their performance. Aitken and Harrison (1999) argue that multinational firms are supposed to possess intangible productive assets such as technological know-how, managerial skill, ability to coordinate relations with suppliers and customer good will among other assets. This may be one of the important potential mechanisms for developing countries to catch-up with the industrialized world (Gorg and Strobl 2001).

It should be noted, however, that there is no unanimous agreement on the consequences of multinational companies on the long run growth opportunity of developing countries. Historically, foreign investment has been in extractive industries like oil extraction, bauxite mining, tin mining and copper mining (Bucar, 2009). Even if international organizations such as WTO and IMF advocate access to the global economy via foreign direct investment, some self-interested multinational companies may simply exploit a host country's resources, impairing subsequent development of poor countries (Tomohara and Yokota, 2006).

Some critics in the area also argue that investment by multinational corporations enriches few in developing countries, and causes economic, humanitarian, and environmental devastation. According to Fan (2002: 2):

> The dependency school theory views foreign investment from the developed countries as harmful to the long-term economic growth of developing nations out in the periphery. It considers that the penetration of peripheral economies by large companies allowed them to control resources that might otherwise have been used for national development.

Even if foreign investment flows brings capital initially, the balance of payments of the country may be negatively affected later on due to transfer of profit and capital flight by transnational corporations (TNCs). Foreign subsidiaries also exhibit a strong tendency to remit excess profits by manipulating prices, and the type and quantity of their international transactions are mostly kept within the boundaries of the firm (Ofosu and Waldkirch , 2008). Subsidiaries within one country may integrate among themselves and thereby influence the allocation of public resources and the sovereignty of the country, as noted by Sunkel (1972).

The contribution of FDI for the host/domestic economy can be long lasting if there are positive spillovers to the local firms since foreign capital will be taken as a profit and factor income to the foreigners. Several studies have also show that foreign firms initiate more on-the-job training programs than their domestic counterparts (Aitken and Harrison, 1999).

[1] Spillover from FDI shows either positive or negative externalities that occurred due to the crowding in or out effects created by the presence of foreigner on domestic investment (Cheung and Lin, 2002.)

Firms which are run by owners who worked for multinationals in the same industry prior to opening up their own firms are on average more productive than other domestic firms (Gorg and Strobl, 2001; Liu and et al, 2001). Therefore, if benefits from foreign investment are not completely internalized, some type of subsidy as incentive to foreign investment could be justified to encourage further investment.

Other studies, however, show that there may be no positive gain from foreign companies to local firms in developing countries. The lack of spillovers via labour productivity to domestic firms is attributed to a number of factors, including limited hiring of national employees in higher level positions, very little labour mobility between domestic firms and foreign subsidiaries, limited subcontracting to local firms, and few incentives by multinationals to diffuse their knowledge to local competitors (Aitken and Harrison, 1999). In addition, foreign firms may also pay higher wages compared to their domestic counterparts to attract the most able workers, leaving less skilled labour for domestic firms.

Africa has attracted far less FDI as compared to other developing regions such as Asia and Latin America. However, annual investment inflow to the continent has shown significant growth over the past few years (Kumo, 2009). The World Investment Report (2009) also reveals that FDI flow to Africa reached a record of $88 billion in 2008. This achievement is special as it occurred during a time when the world was experiencing a financial crisis. South Africa was the leading recipient of foreign investment, with about 21% ($6.4 billion) of the region's total inflows in 2005 and hosting the greatest number of foreign subsidiaries across a broad range of industries (Kumo 2009).

While there is substantial empirical work on the effects of FDI on the productivity of domestically owned firms for a number of other countries, research on this issue in the African context is limited. Accordingly, the main objective of this study is to analyze the effect of foreign investment on labour productivity within the firm and spillover effects on South Africa domestic firms using firm level panel data. In addition, it also examines the impact of different ownership status and investigates whether the spillover effect is geographically limited.

Chapter 2

Literature review

This section begins by providing arguments on why improving 'labour productivity' is important for domestic firms in developing countries and the role that may be played by FDI. Then, it presents different theoretical arguments and empirical findings on the spillover effects of foreign enterprises. Finally, it concludes by providing a brief introduction on FDI flows and the environment for foreign investment in South Africa.

2.1 Why Labour Productivity?

Labour productivity shows the technical relationships that exist in production among workers, material inputs and outputs (Mahmood, 2006). It is supposed to be a reasonable indicator of technical efficiency and it reflects the changing pattern of factor use. Labour productivity growth is one of the significant sources of increasing national income in the developed world. For instance, the U.S. economy has been able to produce more goods and services over time not by requiring a proportional increase of labor time, but by making production more efficient (BLS, 2008).

It is usually argued that most industries in developing countries are not competitive in quality and price in international markets. Thus, their contribution in the national economy, unlike that of advanced countries, is much less than that of agricultural industry. One of the reasons for such weak performance is supposed to be low productivity of factors of production (Gorg and Strobl, 2001). Many studies have emphasized the importance of labour productivity growth to increase real output and improve living standards (Steindel and Stiroh, 2001; Mahmood, 2008). However, enhancing productivity of workers in the manufacturing industries may be costly since it requires investment in education, training, knowledge, research and development.

Foreign enterprises may play their own role in human capital development in general and labour productivity in particular. When multinational companies decide to invest in developing countries, it is expected that they will bring capital and other intangible assets (Aitken and Harrison, 1999). In addition, the productivity of workers of the host country is expected to increase when they receive training or accumulate experience while working for multinationals. When these workers move to domestic firms, they bring some of the knowledge acquired from multinational enterprises (Cuyvers et al, 2008).

There is also another theoretical argument, which is also backed by empirical evidence, that the labour-augmenting effect of inward FDI exceeds the capital-augmenting effect. For example, Egger and Pfaffermayr (2001) confirm this for Austrian manufacturing industries. Spillover through labour productivity is also one of the main reasons why most developing countries offer generous incentives to attract foreign investment and it is important to empirically investigate whether this is the case or not. Accordingly, labour productivity is selected as a key variable to examine the effect of foreign presence on domestic firms in this study.

2.2 What is mentioned in theory?

The theoretical literature on foreign investment explains that multinational enterprises (MNEs) possess some firm specific advantages that allow them to compete successfully in a foreign environment. These firm specific advantages are not only constituted in the production technologies, but they may be also related to special skills in management, distribution, product design, marketing, and other linkages in the value chain, made up of brand names and trademarks (Vahter, 2004). The theory of FDI stresses generally the positive link between firm-specific knowledge based assets and the decision to invest in a foreign country (Kokko 1994: 2; Vahter, 2004).

While foreign firms invest in a given country expecting better returns, the host country in turn wishes to attract FDI as it is expected to yield several benefits to the local economy such as capital, government tax revenue, job creation for citizens, and technological transfer to local industries. Barba and Venables (2005) have classified the effect of foreign investment into product market effects, factor market effects and spillovers effects. The first two effects are often referred to as direct effects, while the third one is called indirect effects.

Foreign presence in a product market may improve the welfare of local consumers through increasing competition on the product price and quality (Cuyvers et al, 2008). However, it should be noted that the product market effects of FDI may have negative effect on local firms. For example, if the technological gap of production between MNEs and local enterprises is huge, foreign presence may crowd out local producers to reduce their sales or it may cause local firms to exit from the market. Theory on factor market effect of FDI, on the other hand, predicts that foreign investment will continue until the point where factor prices are equalized across countries (Barba and Venables, 2005).

It is usually argued that, the most important benefit from FDI to the host country is the gains from the so called 'spillover effects' (Ramirez, 2006). According to Vahter (2004), MNCs have better technological advantage that makes them to be more competitive than the domestic enterprises in the host country. Through various methods, the presence of foreign firms can improve the performance of domestic firms and other foreign affiliates. Gorg and Greenaway (2004) explain that, whatever the source of return to international enterprises, the only way in which indigenous firms can gain benefits is if there are some forms of indirect externalities from MNEs.

In the literature, several channels are mentioned through which knowledge and technology can spillover from foreign linked firms to domestically owned firms in host economies (Aitken and Harrison, 1999; Gorg and Greenaway, 2004; Lui, et al, 2001; Cuyvers L. et al, 2008). The following are some of the main ways that are supposed to boost productivity of firms in the host country via spillovers from TNCs:

- imitation from foreign enterprises is the classic transmission mechanism for new products and processes
- enforcing domestic firms to increase their managerial efforts, to adopt better marketing techniques, and to use resources efficiently to stay competitive
- job training to employee in a given industry and knowledge shifts with skilled labor to local enterprises
- creating business linkage with firms that are potential suppliers of intermediate goods or buyers of final products of MNEs
- introducing new know-how by demonstrating up-to-date technologies and information to local firms

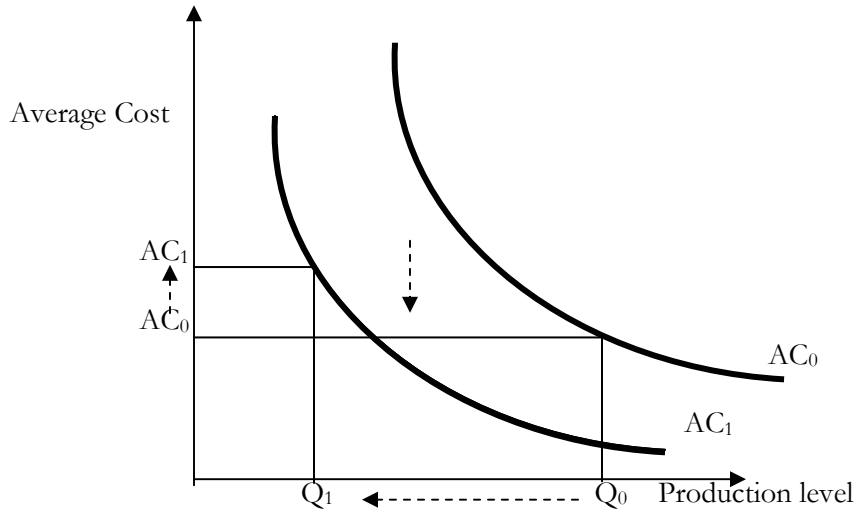
The argument of imitation effect states that the exposure of modern technologies by foreign subsidiaries to domestic firms may induce the latter to update their own production methods introduced by the former. Aitken and Harrison (1999) indicate that, in some cases, domestic firms may increase their productivity of factors by simply observing the nearby foreign firms. According to Gorg and Greenaway, any upgrading to local technology deriving from imitation could result in a spillover, with consequent benefits for the productivity of local firms.

The other channel of technology transfer may be through labor turnover from foreign to domestic firms or direct training provision by MNCs to workers of local enterprises. When employees previously trained by foreign firms change employment and move to domestic firms, they bring with them specific technological know how, managerial knowledge and expertise (Cuyvers et al., 2008). When the presence of foreign firms creates new demand for local firms to supply intermediate goods or services to them, more workers in local firms may get technical skill from foreign presence, which may lead to product improvements.

The presence of foreign owned subsidiaries may benefit the host economy through backward and forward linkages. Since MNCs may purchase intermediate inputs from domestic suppliers, spillovers may take place when foreign firms are imposing higher product quality standards and delivery reliability (Cuyvers et al., 2008). In order for domestic suppliers to deliver quality inputs, MNCs might provide technical assistance or transfer technological know-how to them. Transnational corporations may also improve the productivity of local enterprises through forward linkage by supplying quality output at fair price.

However, it should be noted that domestic firms may also be negatively affected by the presence of foreign subsidiaries. This may happen when local enterprises are unable to compete with their foreign counterparts in input and output markets. For instance, Aitken and Harrison (1999) provide a graphical explanation of the manner in which foreign presence may reduce the productivity of domestic firms. As shown in figure 2.1, foreign enterprises may transfer technology to local firms and the average cost curve of local firms may shift downward. However, with lower marginal cost of production, foreign firms can make local firms non-competitive in product market. Thus, production of local firms will decrease from Q_0 to Q_1 and average cost of production will increase from AC_0 to AC_1.

Figure 2.1
The effect of foreign presence on production level and cost of production



Source: Aitken and Harrison (1999)

Aitken and Harrison, therefore, conclude that if the impact due to a decline in demand is large enough, net productivity may drop even if foreign firms generate technology spillovers. However, such types of negative effect from foreign firms may happen if only domestic and foreign firms compete with one another in the same market (Cuyvers et al., 2008). Overall, the theoretical literature concludes that the benefits generated by inward FDI outweigh the costs of foreign presence. Once they have set up subsidiaries, foreign firms may be unable to prevent some of the benefits of their advantages from spilling over to indigenous firms (Gorg and Greenaway, 2004).

2.3 What is found empirically?

Although the theoretical literature suggests that the presence of FDI is likely to raise the productivity of domestic firms, the empirical evidence does not confirm this unanimously. The findings may be divided into two groups - one group which concludes that FDI always improves the productivity of domestic firms, and the other which argues that the impact of FDI is unclear or even negative for developing countries.

Gorg and Greenaway (2004) note that the investigation of FDI spillover effects was started by Caves (1974), Globerman (1979) and Blomström (1986) using data for Australia, Canada and Mexico, respectively among others[2]. Caves was the first to suggest the idea that FDI boosts the productivity of domestic firms after analyzing the effect of FDI on manufacturing industries in Canada and Australia (Kien, 2008). According to his finding, FDI improves the resource allocation of local firms through competition effect in the price of products in Australia. The empirical study by Egger and Pfaffermayr (2001) shows that

[2] Different empirical studies of knowledge spillover face the fundamental problem to measure knowledge flows directly because knowledge spillovers are difficult to quantify. The most common approach to deal with this problem is to relate performance changes of potential recipient firms empirically to the presence of FDI in the industry (Meyer, and Sinani, 2009).

the transfer of production know-how improves the overall productivity of FDI receiving firms and to some extent also that of the other firms due to spillovers in Australia.

Following Caves, a large number of studies have been undertaken in both developed and developing countries, indicating positive spillover effects of FDI[3]. For instance, Globerman (1979) confirms that the labor productivity of domestic firms is positively correlated with the presence of FDI in Canada. Similarly, a study on Mexico study by Blomström (1986) suggests that foreign presence in an industry improves structural efficiency of the industries. The most important source of spillover efficiency in this country is found to be competitive pressure induced by the foreign firms.

Although a large number of studies mainly conclude that the impact of FDI on the productivity of domestic firms is clear and positive, other empirical analysis display that this may not be the case for all countries (Kien, 2008). For instance, Aiken and Harrison (1999) found negative spillover effects from foreign investment in Venezuela. They also confirmed that the gains from foreign investment appear to be entirely captured by joint ventures. Knonings (2001) and Vahter (2004) in emerging market economies such as Bulgaria, Romania, Poland, Estonia and Slovenia also showed negative impact of FDI on local firms. Similarly, Haddad and Harrison (1993) concluded that foreign presence has no significant effect on local labour productivity in Morocco because technology gaps inhibited FDI spillovers from foreign to local firms.

Several other empirical studies in transition economies also report evidence of unfavorable effects from multinationals on productivity of domestic firms (Gorg and Greenaway, 2004). One of the reasons for negative spillovers may be attributed to the competition effect of foreign investment. Even if competition may actually be one of the channels through which positive spillovers are transmitted, there may be negative effects on some firms at least in the short run. Aitken and Harrison (1999) and Konings (2001), for instance, stated that foreign firms can reduce the productivity of domestic firms through competition effects. Multinationals may have lower marginal costs due to some firm specific advantages, which allow them to attract demand away from domestic firms.

So far, there is limited empirical work on the effect of foreign investment on the productivity of domestic firms in Sub-Saharan Africa. The evidence that does exist provides a mixed picture. Gorg and Strobl (2005) find that firms which are run by owners who worked for multinationals in the same industry prior to opening up their own firm are more productive than other domestic firms using panel data from 1991 to 1997 in Ghana. Using time series data covering the period 1956–2003 from South Africa, Fedderke and Romm (2006) find that foreign and domestic capital complements in the long run, but FDI crowds-out domestic investment in the short run. In contrast, Bezuidenhout (2009), shows that there is a negative relationship between FDI and economic growth using panel in the Southern Africa Countries from 1990 to 2005. Compared to Fedderke and Romm, the result of Bezuidenhout study is more convincing in the sense that they takes into account unobserved time variant and time invariant factors using Generalized Method of Moments (GMM) estimation approach.

In general, unlike the theoretical agreement, empirical studies provide mixed outcomes regarding the benefits of foreign investment for local firms. Kien (2008) also argues that the

[3] The most extensive list of empirical study of productivity spillover from FDI including methodology, type of data used and results cab be found for a quite large number of countries from Cuyvers L. et al (2008) and Gorg, H. and Greenaway, D. (2004).

magnitude of spillovers varies across the level of technology, the capital intensity of industries, and availability of skilled labor in domestic. However, it should also be noted that the techniques of estimation, geographic and time differences are among the reasons for the variation of the results. In addition, ignoring unobserved time, firm, and industry specific factors may also affect findings (Egger and Pfaffermayr, 2001). This study aims to use data from a region where research on this topic is limited and to improve over existing literature by using data and methods that are less susceptible to econometric concerns.[4].

2.4 Foreign Direct Investment policy in South Africa

South Africa has implemented a number of policies and provided different incentives to attract foreign direct investment. After political change from the apartheid regimes in 1994, the new government adopted outward looking policies that aimed to attract foreign capital (IGD, 2005). The government has continually stressed the importance of FDI for economic growth, and undertaken progressive transformation and liberalization of the economy. The privatization programme in 1997, for instance, showed a clear move away from the past protectionist policies (UNCTAD, 2006).

The investment climate has been improved along a number of dimensions in recent years. Interest rates have declined and exchange rate controls have been gradually removed (Rusike, 2007). In 1998, prime interest rate in South Africa was 23.5 percent and then trended downwards to about 12 percent in 2008 (SSA, 2010). After 1995, South Africa has applied a macro economic policy of floating exchange rate system and significant progress has been made in allowing domestic investors to diversify a portion of their assets abroad (UNCTAD, 2006). In order to stimulate investment and foster sustainable industrial development, an industrial policy called Spatial Development Initiatives (SDIs), was introduced in 1996 (Moeti, 2005). An Investment Climate Survey by Clarke et al. (2008) also shows that South African firms face cheap power supply. The average share of electricity in manufacturing costs is below 3 percent and this is considerably lower than corresponding cost shares in a number of competing economies. The corruption rate of the country is also low. For example, South Africa ranked 124 from the list of 178 countries sorted from most to least corrupt countries by the Transparency International Corruption Perception Index for 2010 (TI, 2010). Similarly, the burden of regulation is not excessive. According to IGD (2010), senior managements of manufacturing firms in South Africa spend an average of 10 percent of their time dealing with regulatory officials and regulations, which is less predatory regulatory regime than a number of middle-income countries.

According to UNCTAD (2006), South African has engaged in different investment incentives for foreign businesses in the last 10 years. Measures include reducing import tariffs and subsidies, removing certain limits on hard currency repatriation and lowering the corporate tax rate on earning. In addition, except in finance and banking, foreign investors are allowed to have 100 per cent ownership (UNCTAD, 2006). According to IGD (2005), to create smooth connection between the administrative bodies and foreign investors, International Investment Council was also established in 1999.

[4] Potential biases in empirical literatures when estimating the effect of foreign presence on the productivity of domestic firms can be caused due to omitted variable biase, aggregation bias, selection bias, endogeneity of FDI, downward bias in standard errors Smarzynska, B. (2002) and Hale and Long (2007).

The Department of Trade and Industry (DTI) provides incentives through its Strategic Investment Program (SIP) and Foreign Investment Grant (FIG). SIP was introduced in November 2001 to support the development and competitiveness of specific industries by providing initial capital allowance from 50 % to 100 % depending on the qualifying points score (Babour, 2005). Similarly, under Foreign Investment Grant scheme, foreign investors receive a cash incentive if they invest in new businesses. The FIG provides up to a maximum of 15% cost recovery for foreign entrepreneurs to import new machinery and equipment (SADTI, 2008).

South Africa has also signed double tax agreements with quite a number of countries in Europe, Asia and United States (UNCTAD, 2006). Thus, foreign residents are taxed only in South Africa if they conduct business in this country. In addition, South Africa is one of the first signatories to most international conventions for protecting intellectual properties such as patents, trademarks, and industrial designs (SADTI, 2008). For example, the country ensures compliance with the Trade-Related Aspects of Intellectual Property agreement (TRIPs) of the World Trade Organization.

Capital invested in South Africa, as well as interest and profit, can be freely repatriated. Gelb (2005) stated that foreign firms are allowed to bid for public procurements. However, as part of the Government's policy to encourage local industry, preferential treatment is given for local enterprises to compare tenders. Similarly, there is 5 percent profit tax difference between foreign and domestic firms. Domestic companies are taxed at a rate of 30 per cent, while foreign companies are subject to 35 per cent taxation of their South African sourced profits (SADTI, 2008).

In relation to different investment incentive, FDI flow in South Africa increased from $1368.6 million dollar in 1994 to $1697.5 million dollar in 1998 (Rusike, 2007). According to UNCTAD report, the annual average FDI flow to the country from 2001 to 2005 was $ 6379.4 million and the stock of FDI as a percentage of GDP reached 29 percent in 2005. More recent figure from the World Investment Report 2010 shows that foreign capital inflow to the country has shown a bit slow growth mainly due to the financial crisis that hit almost every part of the world. For example, investment flow as a percentage of gross domestic formation was 9.7 percent and 8.9 percent in 2006 and 2009 respectively.

Despite encouraging trend in some industries, foreign investment in South Africa remains below the average for other comparable developing and emerging markets in Asia and Latin America (IGD, 2005). The size of consumer market and purchasing power of the population is small. The depreciation and volatility of the South African 'Rand' particularly after 2001 is also a disincentive to investment (Gelb, 2005). Furthermore, hidden costs and poor trade facilitation such as high transport costs, congestion and backlogs at major ports are among the major business problems in the country (UNCTAD, 2006).

The rate of crime and its related cost is also very high in South Africa (Clarke et al, 2008). Finally, HIV profile implies that many workers are at the highest risk of being HIV positive. It is believed that over 250,000 South Africans died due to AIDS in 2008 and prevalence is more than 15 percent among those between the age of 15 to 49 (SSA, 2010). Therefore, all these factors discourage investment in the country and need due attention by the government and other stakeholders.

Chapter 3

Meta-analysis from previous studies

The empirical literature review in the previous chapter showed that evidence on the relationship between foreign investment and productivity of local firms is mixed. This chapter explores some of the reasons that may be driving the empirical findings by using meta analysis.

3.1 Why Meta-analysis is needed in this study?

Despite considerable work, there is no consensus on whether FDI generates spillovers which may be captured by domestic industries in the host economy (Görg and Strobl, 2001; Diebel, and Wooster, 2010). The difference in empirical findings in this regard can be explained by structural differences among countries where the research has been conducted. However, as argued by Sinani and Meyer (2009), the outcomes of spillover analysis can also be affected by alternative methods in research design, methodology and data[5].

This study examines previous studies on the impact of foreign investment using meta-analysis[6] to identify how the characteristics of study may influence the possibility of observing spillovers. This helps to get some ideas about how carefully the research methodology of spillover effect analysis should be planned and this can be linked with the next chapters of the paper. Diebel, and Wooster (2010: 646) also argue that:

> Meta-analysis is particularly useful to identify cumulative findings that are expressed across the sample of studies and draw out patterns in the research that cannot be obtained from the review of any one single study.

While the meta analysis is useful in its own right, it will be used in this study to help identify estimation concerns and to adjust the research methodology in order to examine the robustness of our findings.

3.2 Evidence from aggregate t-statistics

Meta-regression requires aggregating the results of prior research into one test statistic that allows a researcher to draw a conclusion about the relation between two variables of interest. Following the approach of other studies in the area (such as that of Sinani and Meyer, 2009; Havránek and Iršová, 2010), this study also aggregate previous studies by focusing on a dimensionless variable, namely the t-statistic, which depends neither on the units of measurement nor on the spillover variable. Since the degrees of freedom in individual studies

[5] While the spillover effect is most likely heterogeneous across different industries, the worrying issue is that the results may be also systematically dependent on the methodology chosen (Havránek and Iršová, 2010).

[6] While meta-analysis has been frequently used in medical research, psychological and educational, its application in economics has been limited to a relatively small number of studies (Görg and Strobl, 2001). However, the number of studies in economics that applied Meta analysis is increasing. For example, Card and Krueger (1995) used the methodology to access the employment effects of minimum wages, Smith and Huang (1995) to examine the relationship between willingness to pay for reductions in air pollution and Meyer and Sinani (2009) applied the tool to examine the relation between multinational companies and productivity spillovers.

included in the sample for meta analysis are in hundreds and thousands, the t-statistics approximate to a standard normal distribution[7].

Since the same variance is assumed in the standard normal distribution, the aggregation of statistics can be computed as if several independent samples are taken from a given distribution (Greene, 2003). Thus, the combined t-statistics can be easily calculated by dividing the sum of absolute value of individual t-statistics over the square root of the number of observations in the sample as follow:

$$T_G = \frac{t_1 + t_2 + ...t_n}{\sqrt{n}} \qquad (1)$$

Where *t* is the t-statistics for the estimate of the spillover variable and *n is* the number of observations. The combined t-statistics is supposed to be a proxy for spillover from foreign presence on average.

Since the data for meta analysis in this study contains unequal number of observations taken from 30 previous papers, the aggregate t-statistics may be influenced by some studies contributing larger number of observations. To deal with this problem, Diebel, and Wooster (2010) propose alternative approach of computing combined t-statistics so that each study is equally represented. Therefore, this study also adds weights to the above aggregate t-statistics as shown below:

$$T_{GW} = \frac{w_1 t_1 + w_2 t_2 + ...w_n t_n}{\sqrt{\sum_{n=1}^{n} w_n^2}} \qquad (2)$$

In the notation, w_n represents the weight assigned to the n^{th} observation depending on how many observations in total were taken from a given study. Smaller weights are arbitrarily assigned to studies that contributed larger number of observations. For example, if a study contributes two observations, the weight employed for each observation is 0.5, while if a study contributes five observations, the weight employed is 0.2. Similarly, if only one observation is taken from a study, the corresponding weight is 1.

The sample for the meta analysis covered 30 different countries, which were selected randomly from the available FDI spillover studies. Almost all studies estimated several regressions and the total number of observations in the sample is 156. However, sixteen studies have exceptionally large t-statistics (more than 10) and ten studies have extremely low t-values (less than 0.003), which may affect the overall result and these outliers have been excluded from the sample. Therefore, the restricted sample contains 130 observations. For comparison purpose, however, the result of composite statistics generated in case of including and excluding outliers is reported in Table 3.3. Moreover, the aggregate t-statistics value is also computed using only one representative observation from each study. This representative observations have been selected by taking the median t-statistics in case if

[7] If the number of observations in each study is large, the t-statistic from each study has a standard normal distribution with mean 0 and variance 1. In other words, as the degrees of freedom goes to infinity, the t distribution goes to the standard normal distribution (Greene, 2003).

there was odd number of observations or by picking one of the two medians randomly in case of even number of observations.

The aggregate t-statistics for all studies in the sample is found to be statistically significant even after excluding outliers. As it is mentioned by Hoekman and Djankov (2000), a set of analyses with small t-statistics could be significant in aggregate even if there is no significant estimate in the individual analysis because the variance of the aggregate sample will be smaller than that of individual analysis. This implies that statistical tests based on the mean of aggregate t-statistics will be more powerful than individual t-statistics. However, as it is shown in the last column, the magnitude of significance dramatically reduced after excluding outliers. The descriptive statistics in Table 3.2 also shows that the mean value of t-statistics for full sample is more than that of the restricted sample.

In Table 3.3, the combined statistical test for different sub groups of studies is also given. For example, the use of panel data is associated with less statistically significant findings than that of cross-sectional data. This finding is consistent with our prior expectation because panel data is more helpful to follow the productivity of a firm or industry overtime and to control for the effect of temporary shocks (Gorg and Greenaway, 2004). Thus, the probability of getting significant spillover from FDI using panel data analysis is less compared to that of cross-sectional data.

With respect to the definition of foreign presence, capital share on average produces more statistically significant estimates than the use of employment share or output share. Furthermore, it seems that studies using firm level data are more likely to report insignificant results than that of industry level data, since the latter fail to control for firm specific factors that may be correlated with the decision of foreigners to invest in a given firm. Nevertheless, this finding is not robust in case of using all observations.

3.3 Evidence from parametric estimation

As mentioned above, several observations were taken from each study. This allows treatment of the sample as a panel data and to estimate alternative models such as fixed effect and random effect. It should be noted that fixed and random effect models for meta-analysis refer to assumptions regarding heterogeneity of the effect estimates and not to the common assumptions of variation across time and region in panel data studies (Diebel, and Wooster, 2010). Under fixed effect models, the effect size of a given variable is assumed to be homogenous across studies (Vevea and Hedges, 1998). On the other hand, random effect model assumes that each study has a different effect size. Field (2002) also argues that the assumption of fixed effect size in meta analysis is not justifiable for almost all real world data and applying the random effects estimates is probably more sensible[8].

In line with the above argument, random effect model was applied in this study for meta analysis purpose of previous researches. Panel dataset application also helps to control for the situation that the meta-analysis from being dominated if many observations were taken only from few studies (Havranek and Irsova, 2010). Therefore, the basic model used for this study is given as follow:

[8] The article by Field (2002) also describes further problems in using fixed-effects models on random-effects data

$$Y_{ij} = \beta_0 + \beta_1 spillovers\_measure + \beta_2 Foreign\_presence\_measure + \sum \beta_k \chi_{ij} + \varepsilon_{ij} \quad (3)$$

In the notation, Y_{ij} stands for the absolute value of t-statistics derived from the i^{th} regression in the j^{th} study. The dependent variable is explained by spillover measures of previous studies, how researchers defined foreign presence, and other vector of study characteristics *(X ij)*. β_0 represents random effects that control for the commonality and dependency of estimates within and across studies and ε_{ij} is the error term.

In addition to the random effect model, the result of ordinary least squares after correcting for heteroscedastic-autocorrelation problem is also reported for comparison. Furthermore, to identify some factors that may account for the economic significance or magnitude of spillover effects form FDI, a model similar to the one above is also estimated. The dependent variable in this case is the standardized coefficients of foreign presence measures in the previous studies. The explanatory variables, on the other hand, will be the same as those mentioned in the right direction of equation (3) above.

The dependent variable in spillover study is usually captured by performance indicators of a firm or an industry such as output (for instance see Aitken and Harrison, 1999; Konings, 2001), labor productivity (Vahter, 2004; Flores, 2007), and total factor productivity (Chuang and Lin, 1999; Villegas-Sanchez, 2009). This study incorporates two dummy variables to capture output and labour productivity proxies. In this case, total factor productivity measure of performance indicator is a reference dummy. It is also argued that the possibility of getting positive or negative spillovers from multinational companies might be affected by how foreign presence is defined. In our data set, researchers have measured foreign presence in an industry through the share of employment, share of capital, and share of output as shown Table 3.2. Thus, this study added two dummies for FDI measure: the share of capital and the share of output, while employment share was put aside as a reference dummy.

According to Görg and Strobl (2001), studies that use cross-section-data generate systematically larger significant spillover estimates compared to that of panel data studies. Panel data, on the other hand, can reduce such bias since following a firm over time helps to control for firm-specific effects that are time invariant and possibly correlated with foreign presence. Thus, our meta-analysis examines this concern by including dummy variable for cross-sectional studies. In addition, the aggregation level of spillover studies may also affect the estimates of FDI impact on local firms and this study also controlled for this variable. Industry-level studies are expected to generate higher levels of significance because industry level data fail to consider firm specific factors that can affect the flow of FDI and the possibility of spillovers (Sinani and Meyer, 2009).

Ceteris paribus, an increase in the sample size increases the absolute value of t-statistics and the possibility of getting significant spillover effect (Card and Krueger, 1995). Thus, the log of number of observations is also included. The spillover effects of foreign investment may also differ based on the type of recipient firms. For example, Feinberg and Majumdar (2001) find that presence of a foreign firm has a positive effect on other foreign companies but not on domestic firms in Indian pharmaceutical industry. In addition to the above variables, this study also includes a dummy variable for studies that have controlled for labour quality and Research & Development. According to Kathuria (2002), the spillover benefits from FDI are not automatic consequence of foreign presence, but they depend to a large extent on the capacity of local firms to invest in human capital and R&D activities to apply the spilled knowledge.

It is also argued that the benefit of spillover effect is positive and significant for Asian countries (Diebel and Wooster, 2010) and published papers tend to be more significant than that of working papers due to publication bias (Card and Krueger 1995; Sinani, and Meyer, 2009). Therefore, this study addresses such concerns by including dummy variables representing whether a given study included in the sample is coming from Asian countries and whether the paper is published in journal or not.

The result of meta-analysis on the magnitude of t-statistics is presented in Table 3.4. All estimates have been done after excluding the outliers that have exceptionally very large or very low t-statistics. The baseline estimates are given in column (1) and column (4). For robustness checking, however, different results for different specifications are also given.

As it can be seen from this result, an increase in the number of observations has significant and positive effect on the size of t-statistics. Intuitively, larger datasets may precisely measure the effects of different explanatory variables, and so additional degrees of freedom increase the likelihood of obtaining a significant impact (Diebel, and Wooster, 2010). Compared to cross-sectional study, panel data analysis provides less statistical significance, which is identical to the result from composite statistics above. On the other hand, spillover studies from Asian countries give more significant effect from foreign investment relative to other countries and regions. This may be related to the fact that most East Asian countries, particularly China, have shown tremendous success in terms of attracting foreign investment and thereby creating opportunities for development of their own domestic industries (Buckley, 2007).

Moreover, the magnitude of t-statistics can be influenced by how foreign investment is defined. It seems that representing foreign investment in terms of capital share increases the possibility of getting more significant result than that of employment share. The meta analysis also confirms that industrial level studies are more likely to find relatively strong spillover effects. This result is consistent with the finding of similar studies and it implies the importance of firm specific factors to acquire positive externalities from foreign firms (for example see Havránek, and Iršová, 2010; Diebel, and Wooster, 2010). The random effect estimate also show evidence that the spillover effect may be higher in case of using labour productivity as a dependent variable than that of the reference variable, total factor productivity. However, these results are not robust for alternative estimation technique.

The other variables, which are included in this estimation, are not systematically related with the magnitude of t-statistics. For instance, no support for publication bias argument is found and it seems that all studies get equal chance for publication without taking into account whether they find significant spillover effect or not. Similarly, this study shows no systematic relation between statistical significance value and whether the spillover recipients were only domestic firms or all firms (both domestic firms and foreign firms).

Table 3.5 presents the impact of different study characteristics on the coefficient of foreign presence measure. Unlike the t-statistical values, the size of observations does not affect the economic significance. On the other hand, the level of data aggregation appears to have impact on the magnitude of coefficients and it shows negative relation between economic significance and firm level data. In other words, the spillover estimates using industry level data may aggravate the actual effect of foreign firms on local firms since firm specific heterogeneity cannot be controlled in industry level data (Sinani, and Meyer, 2009). Conversely, the inclusion a variable for labor quality leads to positive impact on the magnitude of FDI spillovers and this implies failure to control for this factor may lead to omitted variable bias.

With respect to the foreign presence measures, the use of capital share is more likely to generate positive spillovers than the use of employment share. However, there is no any significant difference between the definitions of FDI as output share and employment share. Once again, the choice of labour productivity as a dependent variable can significantly increase the economics significance compared to that of total factor productivity. The other study design characteristics such as R&D dummy and whether spillover recipients are only domestic firms do not significantly affect the size of spillover effect. Similarly, this study found no evidence to argue that published papers and studies from Asian countries have larger economic significance.

The findings of meta analysis in this study is comparable to other researches. Almost all meta regressions conclude that research design and data characteristics partly explain the magnitude and significance of spillovers from FDI. For instance, they argue that cross-sectional and industry level studies are likely to find more spillover effects and the choice of the proxy for foreign presence is important, which is consistent with the finding in this study (fore instance see Sinani, and Meyer, 2009; Havranek and Irsova 2010). Moreover, similar to this paper, Diebel and Wooster (2010) also support the argument that studies from Asian countries tend to show strong significant effects. However, unlike other researches (such as Görg and Strobl, 2001; Diebel and Wooster, 2010), this study does not find any evidence for publication bias argument.

In general, while the spillover effect is probably diverse across different countries, both the combined t-statistics and the magnitude of coefficient estimates in the above meta analysis support the argument that the spillover effect analysis from FDI can be influenced by a given research method applied and variables controlled. In line with this argument, this study also examines the effect of foreign presence on labour productivity of South African local firms using different definition of FDI and examines the effect for both cross sectional and panel datasets. In addition, different sensitivity analyses have also been done to check whether results are robust to alternative specifications and models.

Chapter 4

Research Methodology and Description of Variables

This part of the paper explains the econometric models used to answer the research questions of the study with the intuition behind the selection of these models. In addition, it points out the main limitations of the methodology that may be a source of potential bias. Finally, it also provides information on the dependent and explanatory variables used in the models.

4.1 Empirical Approach

The economic growth and efficiency enhancing effect of foreign investment has been widely studied based on the concept of productivity (Zhou et al, 2002). One of the pioneering works that laid the foundation of this approach is Cave (1974). His study examined whether the benefits of FDI in the host counties of Canada and Australia. After that, several studies have been carried out both in developing and developed counties, such as Haddad and Harrison (1993) in Morocco, Aitken and Harrison (1999) in Venezuela, and Cheung and Lin (2003) in China. All these studies have used Gross Domestic Product at the macro level and total output of a firm at the micro level as major indicators to capture the effect of FDI on productivity, while capital and labour are used as input variables.

In this study, the Cobb-Douglas production function has been employed to obtain empirically testable results because of its realistic assumption of non-linear relationship between inputs and output in the production process. Therefore, the basic production function is specified as:

$$Y = AK^{\alpha}L^{(1-\alpha)} \qquad (1)$$

Where Y is value added, while K and L are capital and labour inputs used in production respectively. α and (1-α) are parameters of elasticity that shows the responsiveness of output production with respect to a unit amount of K and L used in the production respectively. A is a set of other variables such as R&D, FDI and labour quality that can affect the productivity of a firm. Since the main focus of this research is analyzing the effect of FDI on productivity of labour, the right hand side and the left hand side of equation (1) divided by labour input (L) to get:

$$\frac{Y}{L} = A\left(\frac{K}{L}\right)^{\alpha} \qquad (2)$$

Productivity of labour (as it is measured by value added per worker) is selected as a dependent variable in order to isolate the effect of FDI on capital intensity. As stated by Buckley et al (2007), investment by foreigners leads to an increase in domestic stock of capital and this in turn increases the production capacity of the firm. However, the return to capital by foreign investment is taken back abroad as payment to the owners. Thus, the growth enhancing effect of FDI in developing counties can be considered as noteworthy if the intangible assets of foreigners are left to domestic economy through technology transfer, improving managerial and labour skill. The concave form production function in equation (2) can be transformed to a linear function by taking a log on both sides:

$$Log(Y/L) = Log(A) + \alpha Log(K/L) \quad (3)$$

The left hand side of equation (3) is used as a proxy to labour productivity while the first term on the right hand side of the equation, as mentioned earlier, stands for a set of different factors that can affect productivity of labour. This term can be expanded as:

$$Log(A) = \beta_0 + \beta_1 FDI + \beta_i \sum \chi_i + \varepsilon \quad (4)$$

In equation (4), FDI stands for foreign presence in a given firm or industry. $\sum \chi_i$ is a set of other controlled variables and ε indicates the error term of the equation. By combining equation (3) and equation (4), the labour productivity equation can be respecified as:

$$y = \beta_0 + \beta_1 k + \beta_2 FDI + \beta_i \sum \chi_i + \varepsilon \quad (5)$$

Panel data analysis is more appropriate to investigate productivity spillovers from foreign investment (Sinani, and Meyer, 2009). It allows controlling for firm-specific effects that are time invariant and possibly correlated with foreign presence in the industry. Failure to control for such effects may lead to inconsistent estimates. Görg and Strobl (2001) also argue that studies using cross-section data systematically overestimate productivity spillovers coefficients as compared to panel data studies. Empirical analysis based on data without time dimension may lead to more positive spillovers since it does not control for possible reverse causality between FDI and productivity that may occur if foreign companies are being attracted initially to industries having higher level of productivity. In contrast, panel data studies usually generate negative or insignificant spillover effects, presumably because the reverse causality has been controlled for (Sinani and Meyer, 2009). If there are time invariant effects across different industries or firms that are not captured in the explanatory variables but which are correlated with the foreign presence variable, cross-sectional studies may produce inconsistent estimates of the spillovers effect from foreign presence. For instance, foreign investment may be affected by the initial productivity of firms or industries; however, the initial productive of firms or industries may be unobservable in a give empirical analysis. Application of panel data helps to control such reverse causality problem between productivity of local firms and foreign investment since such unobserved factors can be controlled by estimating models like fixed effects (Gorg and Greenaway, 2001). Using more than one period data also helps to reduce potential bias from some unobservable firm, industry and regional specific factors that may have correlation with those controlled variables (Gorg and Greenaway, 2004).

This study, therefore, relied on panel data found from the World Bank database. The survey contains firm level data for the years 2003 and 2007. Thus, the above equation can be rewritten in panel data representation as:

$$y_{ijt} = \beta_0 + \eta d07 + \beta_1 k_{ijt} + \beta_2 FDI_{jt} + \beta_i \sum \chi_{ijt} + \varepsilon_{ijt} \quad (6)$$

Where y_{ijt} denotes the log value added per employee for firm *i*, in industry *j*, and at time *t*. This dependent variable is regressed on time dummy variable for 2007 (*d07),* capital intensity per worker *(k_{ijt}),* foreign direct investment (FDI_{jt}) and vectors of other factors ($\sum \chi_{ijt}$). The time dummy variable for 2007 is included in the regression to capture the possible common aggregate shocks that can affect the productivity of all firms in the county under consideration. In addition, time dummy also interacted with the variable of *FDI* to analyze

the overtime change in the effect of foreign investment on labour productivity. This situation may happen if it takes some time for foreign firm specific advantages such as managerial ability and technology to spillover to domestic firms (Konings, 2001). ε_{ijt} is the composite error term containing both time variant and time invariant factors[9]. The time varying error, also called 'idiosyncratic error', changes over time and affects the dependent variable. To answer the research questions of this study, the variable of FDI in equation (6) is also classified into two to get:

$$y_{ijt} = \beta_0 + \eta_t 07 + \beta_1 k_{ijt} + \beta_2 FDI\_Firm_{ijt} + \beta_3 FDI\_Industry_{jt} + \beta_4 FDI\_Firm_{ijt} * FDI\_Industry_{jt} + \beta_i \sum \chi_{ijt} + \varepsilon_{ijt} \quad (7)$$

FDI_Firm refers to the share of foreign capital investment for firm *i* found in industry *j*. Positive coefficient on this variable is expected if foreign investment in a given firm increases the productivity of labour. *FDI_Industry*, on the other hand, indicates the participation of foreign investment in industry *j*. Positive sign on the coefficient of *FDI_Industry* is also expected as long as the productivity enhancing effect of FDI spillovers to domestic firms and other foreign firms found in the same industry with a given foreign company. As indicated by Aitken and Harrison (1999), the interaction term of the two variables is also generated to determine whether the effect of foreign presence on other foreign firms is different from that of domestic firms.

In addition, this study aims to examine whether the impact of foreign investment on labour productivity depends on location. If location matters on the productivity enhancing effect of foreign investment, it is expected that the coefficient on the proxy of regional foreign presence to be statistically significant. This estimation is important to examine whether foreign firms are attracted to areas where there are location specific advantages like access to raw materials, cheap labour, better infrastructure and for security reason. In addition, a number of firms may intentionally concentrate to a given location to benefit from 'agglomeration economies' in their backward and forward linkage in the input and output markets respectively. Moreover, FDI variable has been classified into fully owed foreign firm and joint venture in order to check if the labor enhancing effects from foreign investment vary depending on the type of foreign investment.

As mentioned earlier, the estimation result from equation (7) using simple pooled ordinary least square may not be unbiased and asymptotically consistent if there is correlation between the independent variables and other unobserved heterogeneous factors included in ε_{ijt}. This may happen due to different reasons; for example, the selection of foreign participation may depend on productivity of firms initially and hence not random. The availability of panel data helps to solve this problem partially since it allows making first difference in order to control for time constant unobserved industrial and firm heterogeneous characteristics (Wooldridge, 2002). For example, high quality management in a particular firm or government support to a given industry may be unobserved factors that may have effect on the productivity of enterprises.

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[9] The composite error term (ε_{ijt}) basically contains the following three parts:

$$\varepsilon_{ijt} = a_i + a_j + u_{ijt}$$

Where a_i, and a_j are unobserved time invariant firm and industry heterogeneities or Fixed Effects that can affect y_{ijt} respectively. u_{ijt} is often called idiosyncratic error or time-varying error that changes over time and affect y_{ijt}.

Mergers and Acquisitions (M&A) of foreign and local firms may also affect spillover effect analysis due to systematic selection bias. Foreign investors need to choose not only host countries but also their types of entry mode: greenfield and merger with or acquisition of an existing firm in the foreign country. The former sets up a new production facility, while the latter acquires a plant that is already under production (Hayakawa and Kimura, 2010). Before deciding to merge with their domestic counterparts, foreign companies consider different firm specific characteristics such as, technology intensity, production efficiency, the amount of investment, and international experience. Even if foreign subsidiaries are more productive than domestic firms, domestic firms may possess a location advantage, years of experience in the local market, and an ability to navigate the local institutional environment. Therefore, they may prefer to work with local firms though merger or acquisition.

When the main source of foreign investment flow to a given country is through Mergers and Acquisitions (M&A) rather than greenfield investment, our regression estimate may be associated with the reverse causality problem, where foreign investment mainly merge with or acquire domestic firms which have better productivity. In this case, firm level data analyses that are limited to domestic firms may yield spillovers from FDI that are biased downward if cherry-picking[10] is present. According to Hale and Long (2007: 7)

> Because of the 'cherry–picking' phenomenon, when foreign investors choose to invest in the firms that are a priori more productive, it is notoriously difficult to show empirically the productivity effects of foreign ownership.

Differencing the data is important to control for potential endogeneity attributed to selection bias of M&A if foreign investors are attracted to more productive industries (Hale and Long, 2007). Since two years panel dataset is available for this study, first difference model can be estimated as:

$$\Delta y_{ijt} = \beta_1 \Delta k_{ijt} + \beta_2 \Delta FDI\_Firm_{ijt} + \beta_3 \Delta FDI\_Industry_{jt} + \beta_4 \Delta FDI\_Firm_{ji} * FDI\_Industry_{jt} + \beta_i \sum \Delta \chi_{ijt} + \Delta \varepsilon_{ijt} \quad (8)$$

The estimation of labour productivity in this paper has been done using alternative types of models and after controlling for several variables to avoid spurious and wrong conclusions between the variables of interest, FDI and productivity of labour. This is important since different econometric models have their own advantages and disadvantages for analysis of a given dataset. Thus, it is helpful to check the robustness of FDI impact on labour productivity for different estimation techniques and model specifications.

Pooled Ordinary Least Square (Pooled OLS) was estimated after the necessary adjustment was done to control for possible heteroskedasticity problem. According to Wooldridge (2003), if random samples are drawn at each time period, pooling cross-sectional data increases the sample size and gives more precise estimates and test statistics will be more powerful. In addition, certain key variables can be interacted with time dummies to see how they have changed overtime. In line with this argument, the variables that indicate foreign investment participation are interacted with time dummy for 2007 to check whether the effect of foreign investment on labour productivity has been changed between 2003 and 2007.

[10] Cherry–picking implies that foreign capital flows to firms having higher total factor of production intially. Therefore, the productivity distribution of the firms that remain domestic after FDI inflow is upper–truncated (Hale and Long, 2007).

However, it is known that pooled OLS is associated with several limitations and sole reliance on this model may lead to raise the concern of potential bias[11]. Javorcik (2004) argues that the standard errors of OLS regressions estimated from micro level data are usually underestimated and failing to take into account this affect the statistical significance of the variables of interest. Moreover, OLS estimates may be inconsistent in spillover effect analysis if productivity shocks have an effect on the input factors employed in the firm (Konings, 2001). Therefore, in order to deal with some of the shortcoming of pooled estimates and to avoid misleading econometric results, alternative models namely fixed effect and random effect models are also estimated in this study. Using panel dataset in empirical studies is becoming more common for policy analysis because of its desirable characteristics of controlling for unobserved fixed effects of individuals, firms, regions (Wooldridge, 2002). Fixed effect estimate is also important to control for potential selection bias or endogeneity problem that may occur if foreign investment goes to the most productive local firms and industries (Konings, 2001).

The basic difference between fixed effect and random effect models lies in the assumption invoked for treating unobserved time invariant factors. In contrast to the fixed effect model, random effect model assumes that the unobserved firm and industrial Fixed Effects are uncorrelated with each of the explanatory variables in all time periods. If the assumption of random effect model holds, first difference transformation will eliminate Fixed Effects and thereby result in inefficient estimates (Wooldridge, 2002). The Hausman specification test has been employed to compare FE and RE estimates.

However, it should be noted that the empirical strategy in this study cannot solve all issues that are raised in the analysis of factor productivity. Fixed effect estimation is appropriate if we have enough variation among the key variables of interest in the data (Wooldridge, 2002). The t-difference test shows that there is limited variation in FDI share overtime in the World Banks Enterprise survey, as presented in Table 5.7. Thus, it is difficult to depend on the panel data estimates in this case. Moreover, there may be time variant unobservable variables that cannot be solved by first differencing but can be a source of potential bias (Görg and Strobl, 2001). Since only two years of panel data is available, the study could not deal with these concerns exhaustively using alternative and potentially more reliable estimation techniques such as two-stage least squares (2SLS) and system generalized methods of moments (SYS-GMM).

4.2 Description of Variables

In the succeeding part of the chapter, the dependent variable and different explanatory variables, which are controlled in the empirical estimation, are briefly described.

4.2.1 Dependent variable:

Value added per worker is used as a proxy for labour productivity. For some level of capital and other factors, it is believed that a firm with a higher added value per employee is more

[11] One possible problem of pooled estimation is that it is based on the assumption that samples from a given population are drawn randomly at different point of time but this may not be the case in reality. There may be also unobservable time constant and time variant factors that have correlation with the other explanatory variables simple ordinary least square estimates. Moreover, composite error terms may be serially correlated across time. Thus, pooled OLS gives biased and asymptotically inconsistent estimates due to omitted variables (Wooldridge, 2002).

efficient or productive than another firm having less value added per worker (Zhou et al, 2002). As stated by Mahmood (2006), labor productivity is a reasonable indicator of technical efficiency because it shows the relationship between output and labour input within the firm or the industry, and it reflects the changing pattern of factor use.

4.2.2 Independent variables:

Capital intensity is measured by the ratio of fixed capital to the number of workers in the firm. The more machinery used by workers, the higher the expected marginal productivity of labour. Buckley (2007) argues that controlling for capital intensity is important in the impact analysis. Foreign participation in the equity of a firm increases the stock of capital and enhances the production capacity of the firm. Therefore, it is necessary to control for capital stock in order to isolate the productivity effect associated with the asset of the firm from that of other spillover effects of foreign presence.

Three variables are included in the above regression model to represent *foreign investment* in South Africa. The first one, f*oreign presence in a given firm,* stands to show whether a given firm in the country has at least 10 percent equity share by foreigners. If foreign ownership has the desirable impact on labour productivity of a given plant, we should expect positive and significant coefficient on this variable. The second term f*oreign presence in a given industry*, on the other hand, indicates foreign investment made in a given industry and it is measured by the percentage of subscribed capital owned by foreign investors in the industry. The final term is an interaction term created from above two variables for the purpose of investigating whether the impact of foreign participation affects other fully foreign owned firms or joint ventures in different ways compared to that of domestic firms or not.

Labour Quality is the ratio of the number of skilled production workers to the number of workers in each firm. Labour quality represents the average skill or educational level of labour force in a given organization (Buckley, 2007). According to Globerman (1979), labour productivity in domestically owned plants is influenced by the educational background and experience of workers.

Firm Age is controlled to measure the production and business experience of the firms. Controlling for the age of the factory is necessary since the productivity of the firm might be changed due to accumulation of marketing and production experience overtime (Javorcik, 2004).

Firm Size is a dummy variable to measure the production capacity of a firm in a given industry and it is measured by the number of employees in a given firm. Based on the World Bank Enterprise Survey classification, if the number of employees is between 5 and 19, a firm is called small size firm, whereas medium firms have from 20 to 99 employees. Finally, larger firms are those firms having at least 100 employees.

Time dummy for year 2007 is also included to capture for the possibility that labour productivity can be changed with time due to common aggregate shocks in production or unobserved time varying factors. In other words, the coefficient on time dummy variable is used to represent the change in the dependent variable for the reasons that are not captured in the explanatory variables (Wooldridge, 2002).

Industry concentration is also known as *Market concentration* and is used to measure the degree of competition in each industry. Blomstrom and Perssion (1983) noted that two industries with the same technical efficiency may show different value added per employee because of a monopoly situation in one of the industries. Moreover, according to the main orthodox economics, FDI changes industrial concentrations and monopoly power of domestic firms

and contributes to market transformation into perfect competition (Elmas and Degirmen, 2009). Therefore, the Herfindahl index (*H*) will also be used as a proxy of industrial concentration in this study. The H-index is computed as:

$$H = \sum_{i=n}^{n} \left(\frac{x_{ij}}{X_j} \right)^2$$

Where x_{ij} is the total revenue of i^{th} firm in the industry j and X_j is the total revenue of industry j in a given year. However, it should be noted that Herfindahl index only helps to measure competition from domestic market or suppliers but it cannot capture competition from the international market. Some researchers propose the rate of effective protection/ERP - import duties, tariffs or other trade restrictions - as a proxy to measure the degree of openness to foreign competition in a particular industry (for instance see Sjöholm, 1999; Kohpaiboon, 2006). However, the World Bank Enterprise Surveys panel datasets does not provide such information at the industry level and we fail to control for international competition in this study.

Research and Development is represented as the ratio of investment expenditure in a given period of time that is allocated for innovation or to purchase patent right to improve the technological capability and efficiency in production. It is expected that firms that spend more investment for research and development purpose have more productivity of labour.

Chapter 5

Data and Descriptive Statistics

This study is based on firm level unbalanced dataset collected in South Africa. The source of data, sampling methodology applied, and some descriptive statistics are given in this chapter. In addition, the justification why attrition bias may not be a serious problem in the data is also provided.

5.1 Data Description

This paper uses a comprehensive unbalanced panel dataset drawn from surveys of South African enterprises. The data was collected as part of the World Bank regional program on enterprise development in 2003 and 2007. The World Bank Enterprise Survey (WBES) uses standardized survey instruments and a uniform sampling methodology to minimize measurement error and to yield data that are comparable across the world economies.[12]

The survey provides establishment level information for 603 firms in 2003 and 1057 firms in 2007. From the total observations, 85 firms are joint ventures[13] (firms with at least 10 percent foreign investment share but less than 100 percent) and 166 firms are fully foreign owned firms (100 percent owned by foreigners) as shown in Table 5.1. These firms were selected based on simple stratified sampling from a list of all registered enterprises located in Johannesburg, Cape Town, Port Elizabeth, and Durban regions (WBES, 2008). To select firms for surveying, first districts and specific zones of each district were randomly selected from the target regions. Then, all firms in the specific zones were listed down and finally individual firms were selected at random from the list based on the number of firms in each specific zone compared to the total sample size needed from all zones.

The World Bank Enterprise Survey of South African enterprises contains a number of variables such as year of firm establishment, location, ownership status, number of employees, inputs used and output produced among other things. Therefore, this dataset can provide the basic information to analyze the relation between labour productivity of domestic firms and foreign investment.

The concentration of firms in general and the distribution of foreign investment in particular vary among industries as presented in Table 5.2 and Table 5.3. For example, there is relatively more investment by fully foreign owned firms in some industries such as garment, fabricated metal, and retail as shown in Table 5.3. Similarly, the share of joint venture investment by foreign and domestic investors is relatively larger in chemical, fabricated metal and food. However, no foreign investment has been made in service, basic metals, and other services. Similar to that of industrial distribution, the share of foreign investment also varies from region to region. According to SADTI, about 54 percent of all manufacturing industries of South Africa are concentrated at Johannesburg and the

[12] The Enterprise Surveys are mainly designed to provide panel data sets to pinpoint how and which of the changes in the business environment affect firm-level productivity over time and across countries, the Enterprise Survey Initiative has made panel data a top priority (World Bank, Understanding the questionnaire, 2008).

[13] According to the world bank classification of firms based on ownership status, a given firm can be considers as a foreign firm if foreign companies or investors have at least 10 percent capital share (Understanding the questionnaire, 2008).

surrounding area in 2008. The other large agglomerations of firms found in Durban & Pietermaritzburg (11.32 percent), Port Elizabeth (7.9 percent) and Cape Town (5.98 percent). Figure 4.1 also depicts that most domestic and foreign firms are located in Johannesburg. This implies that domestic and foreign investors are attracted by some regional specific factors such as infrastructure condition, access to market of Johannesburg or firms are deliberately concentrated to this location to take advantages from 'agglomeration economy' in backward and forward linkages from each other.

The descriptive statistics in Table 5.5 suggests that both fully foreign owned firms and Joint ventures have higher labor productivity compared to that of domestic firms. The two-sample t-test for equality of value added per labour shows that these differences are statistically significant at 1 percent level. This is consistent with the theoretical argument that foreigners have tangible and intangible assets that make them to be more productive than their domestic counterparts in developing countries.[14]

The correlation estimations among the key variables in Table 5.6 also show positive relation between foreign capital share and labour productivity within a firm. This indicates that foreigners, through training and using modern technologies, increase the productivity of their workers. However, we found negative relation between foreigner presence in a given industry and labour productivity of firms in 2003. In addition, even if we got positive relation between the two variables using the 2007 data, the magnitude is small compared to that of foreign presence at a given firm. The interaction term of these variables is positive for all types of data arrangements. This implies that the spillover impact of a foreign firm on other foreign firms is different from that of domestic firms. Moreover, the mean value equality test between foreign capital share and labour productivity for 2003 and for 2007 shows that there is no difference in foreign equity share overtime while there is significant difference in labour productivity, as shown in Table 5.7 and Table 5.8 respectively.

In terms of labour quality, foreign companies have less number of skilled workers on average compared to that of local firms. However, the difference test statistic shows that the share of skilled labour force in domestic firms is not statistically different from fully foreign owned firms. Thus, it seems that foreign firms are not affecting local firms negatively through attracting skilled labour force, but by using different methods such as modern technology and training, they make the productivity of their workers more than that of domestic firms.

Since multinational companies are usually coming to developing countries with better technology and skill of business, they do not spend much money to get quality certificates (Tong and Hu, 2003). Table 5.5 also supports the argument that domestic firms put more effort on innovation to get recognition at international level than that of foreigners. The Herfindahl index, on the other hand, reveals that the competition among domestic firms at local market is more than that of international enterprises. Thus, the competition among small size but large number of domestic firms is high, while multinational companies engage selectively in some industries that require large initial investment and thereby enjoy low level of competition.

[14] Fore instance, Dunning (1988) argued that one of the reason why foreign direct investment occur is due to the fact that multinational corporations have firm specific intangible assets such as technology, brand name, benefits of economies of scale, that can make them competitive everywhere.

5.2 Testing for the possibility of attrition bias in the data

In case of unbalanced panel data analysis, it is important to consider for the possibility of attrition bias that may happen due to lack of information for some observations in the second and subsequent waves. According to Miller and Hollist (2007), attrition of sample represents a potential threat of bias if those firms that drop out are systematically different from those firms that remain in the study. However, if sample attrition over time is random or if there is no unique characteristic among dropping out observations, there will be no attrition bias. The only problem in this case is the sample in the panel data decreases in size between waves of data collection

In the World Bank Enterprise Survey, data from 412 firms was collected only in 2003. Similarly, 866 firms were included only in 2007 survey but were not included in the 2003 survey. However, this does not mean that there is entry and exit of firms. For instance, 633 (73.1 %) firms included only in the 2007 survey actually started operating before 2003 but the 2003 survey did not include them. Therefore, there is no reason to suspect that new firms systematically entered in some industries.

Similarly, the 2007 dataset did not contain information for 412 firms which were included in 2003 not because they exited from their respective industry but the survey failed to incorporate them – potentially due to non-systematic reasons. To confirm this, a test for attrition bias was conducted. The simplest way of detecting attrition bias is to estimate a probit model in which the dependent variable takes the value one for firms that dropped out of the sample after the first wave and zero otherwise (Baulch and Quisumbing 2010). Based on this argument, probit model for observations included in 2003 survey but dropped out in 2007 data was estimated in this study. As it can be seen from Table 5.9, almost all important variables of the study such as labour productivity, capital to labour ratio and foreign investment share are not significantly related to those firms dropped out in 2007 survey. Therefore, there is no evidence of systematic dropping out of firms in dataset used in this study.

Chapter 6

Empirical Findings and Discussion

This part of the paper presents and discusses different results found using the empirical approach described in chapter four. It starts by analyzing the relation between labour productivity and foreign presence at a firm and industry levels. Then, it examines the spillover effect of FDI for alternative ownership status and analyzes whether the impact is geographically limited. Finally, it provides different sensitivity tests to check the robustness of earlier findings.

6.1 Productivity of labour in foreign firms

The impact of foreign investment on labour productivity in this study is estimated using different specifications and estimation techniques. The meta analysis in chapter three shows that FDI spillover analysis can be influenced by a given research method and the type of variables controlled. Thus, this study takes into account this fact and contains different estimates to examine whether the results are sensitive to specification choice.

Table 6.1 shows the effect of foreign investment on labour productivity for all firms. The first two columns in this Table contain the results based on cross-section data for 2003 and 2007. These estimates control for the possibility of heteroskedasticity by using robust standard errors, which are given in parentheses.

As shown in column 1, the simple OLS estimate for 2003 cross-sectional data provides evidence of positive impact from foreign presence on labour productivity. This result is statistically significant at 10 percent level. The 2007 data set also shows the importance of FDI in terms of increasing labour productivity at firm level. Similarly, estimates based on pooled data indicate a positive relation between foreign presence and productivity of labour within the firm. It should also be noted that the estimation in column 3 controlled for a 2007 time dummy to account any aggregate shock in labour productivity that is not caused by explanatory variables (see Wooldridge, 2002). According to the pooled OLS estimate, labour productivity is higher by 0.59 percent in the firm with 10 percentage points more foreign share of investment.

In addition, the time dummy is interacted with key variables to see if the effect of foreign presence on productivity of labour has changed between 2003 and 2007 in column 4 of Table 6.1. There is no significant change overtime from productivity enhancing effect of foreign subsidiaries on their workers. The result in column (5) further includes regional dummies in order to control for any regional specific factors which may influence foreign presence and productivity of labour. The main variable of interest in this estimation, foreign presence at firm level, is still positive and significant. In general, the ordinary least square estimates support the argument that foreign firms improve the productivity of their workers.

In order to control for unobservable firm and industry heterogeneity, fixed effect and random effect models are estimated as shown in column (6) and column (7) respectively. The Hausman test supports the use of fixed effect specification over that of random effect. The panel data estimates do not show any effect as compared to OLS – this may be because of controlling for unobserved heterogeneity may render it insignificant. This inconsistency may also occur due to limited temporal variation in the key variables. Wooldridge (2002) argues that fixed effect estimation requires enough variation in the explanatory variables to give consistent results. However, the dataset used for this analysis does not have much

variation in foreign investment over time. The mean value equality test between foreign capital share for 2003 and that of 2007 confirms that there is no difference in foreign equity share overtime while there is significance difference in labour productivity, as shown in Table 5.7 and Table 5.8 respectively. Thus, it is difficult to rely on the result of ether fixed effect or random effect estimates in this case.

6.2 The spillover effect of foreign investment

The other key interest of this study is to look at the impact of foreign investment in industry, which captures the spillover effects from one multinational company on other enterprises. As shown in table 6.1, the effect of foreign presence on labour productivity at industrial level is not significant. Controlling for time and regional dummies does not change the result. It should be noted, however, that the spillover effect variable in Table 6.1 was estimated for all firms without differentiating domestic firms from foreign firms. Similarly, the interaction term created between foreign presence at firm level and foreign presence at industry level does not show evidence when one foreign subsidiary affect the productivity of other multinational enterprises different from that of local firms.

Table 6.2 provides the effect of foreign presence on labour productivity of domestic firms only. As shown in column (1) and column (2), the spillover effect of foreign subsidiaries on labour productivity in local firms is not significant in either 2003 or 2007. Pooling the two years dataset together or controlling for regional dummies do not change the finding. The fixed effect and random effect estimates on column (5) and (6) respectively also provide the same result. In this analysis, the share of foreign capital in a given industry was used as a proxy for foreign presence. However, the meta analysis of prior studies shows that the definition of foreign presence may systematically affect the possibility of getting spillover. Therefore, an alternative analysis has been done by defining FDI in terms of employment share and output/sale share in Table 6.7 but the result is still robust. Thus, there is no evidence of either positive or negative spillover effects from FDI on domestic enterprises. This finding is also identical to the result of meta analysis, which shows the possibility of getting spillover effect from FDI is less for research designs that depends on firm level and panel data.

The lack of spillover effect from foreign investment to local firms may be attributed to a number of factors, including limited business relation between foreign companies and domestic firms. As noted by Haddad and Harrison (1993), foreign presence may not have significant effect on local labour productivity if technology gaps inhibit FDI spillovers from foreign to local firms. In other words, the spillover benefits from FDI are not automatic consequence of foreign presence, but they depend to a large extent on the capacity of local firms to invest in human capital and R&D activities to apply the spilled knowledge (Kathuria, 2002). Moreover, competition effect among firms producing similar type of products discourages diffusion of technology and other intangible assets from foreign subsidiaries (Aitken and Harrison, 1999). This may happen if foreign firms mainly produce for domestic market so they do not want to transfer their firm specific advantages to other competitor firms in the same industry.

6.3 Does the ownership status of FDI matter?

The flow of foreign investment into a given country can be in the form of greenfield investment or through M&A with the existing local firms and the spillover effects may be different depending on the type of ownership. For example, Aitken and Harrison (1999)

found that foreign presence benefit joint ventures while negatively affecting the productivity of domestically owned plants in Venezuela.

This study also classifies foreign presence into fully foreign owed subsidiaries and joint ventures and it separately compares their effect on domestic firms. Fully foreign owned firms have 100 percent foreign equity share, while joint ventures include firms owned by both domestic and foreign investors. Following the definition by the World Bank investment classification, joint ventures in this study have at least 10 percent but less than 100 percent foreign equity share (WBES, 2008).

The ownership classification estimates are presented in Table 6.3. In all cases, no relation is found between foreign presence and labour productivity in domestically owned firms. Both joint ventures and fully foreign owned firms do not have significant impact on local firms. This finding is similar to the result found without dividing FDI based on ownership status in column (2) and (6) of the same Table. Therefore, our earlier conclusion is robust even after classifying foreign investment based on ownership status. However, there is some difference in the magnitude and sign between random effect and fixed effect estimates. A Hausman test supports the use of fixed effect estimates over random effects.

6.4 Searching for spillover at regional level

The specifications above consider foreign investment in each industry at the national level. However, this method may not capture a situation if foreign investment generates benefits only for domestic firms located nearby. Aitken, and Harrison (1999) noted that FDI spillover may not be observed when foreign presence is measured at national level because the benefit in some regions may be too small to offset the negative effect in other locations of the country. Despite this fact, most empirical studies do not differentiate between national and local foreign investment.

There are different explanations to argue that spillover effects are strong when foreign companies and domestic plants are located near to each other. When trained workers leave foreign subsidiaries to work in domestic firms, or when they demonstrate a product, process, or marketing system previously unknown to domestic owners, the benefits are likely to be captured first by neighboring domestic firms, and may gradually spread to other domestic firms. Audretsch (1998) supports the idea that geographical proximity is important for knowledge spillovers as technology is vague, difficult to codify, and often only serendipitously recognized. In other words, technological transmission costs are assumed to increase with distance between foreign and domestic firms.

The geographic aspect of FDI spillovers has been investigated by a few researchers and the evidences so far show mixed outcomes that differs from country to country. For example, Aitken and Harrison (1999), using firm level data form Venezuela, fail to find positive spillovers from multinationals to domestic enterprises located in the same region, though they find negative spillovers from multinationals located in the same industry at the country level. On other hand, Girma and Wakelin (2007) showed positive spillovers from FDI to domestic firms located in the same region and industry in UK. From industrial level data analysis, Tong and Hu (2003) also confirmed the geographical limit of FDI spillovers on local firms in China.

To check for the possibility that technology is transferred at regional level among South African firms, this study also includes a proxy variable for regional foreign presence. As long as domestic firms located in the same area with foreign firms are benefited from spillover, positive coefficient on regional FDI variables is expected. However, if foreign firms are

attracted to some regions because of regional specific advantages such as infrastructural differences or local agglomeration economies, the coefficient on regional foreign investment indicator may overestimate the spillover effects.

Aitken and Harrison argue that wage of skilled labour and energy price for all industries in a given region help to capture regional rather than industry specific factors. Therefore, the real wage for skilled workers is used as a representative for location specific benefits in this study. Furthermore, fixed effect model is also applied to control for unobserved time invariant regional specific factors that may affect productivity of labour or that may have correlation with controlled explanatory variables.

The estimation result for labour productivity after including regional foreign investment share is presented in Table 6.4. In this analysis, the spillover effect was estimated for all firms without differentiating based on ownership status. The OLS estimates give some evidence that foreign investment affects the productivity of labour in plants where they have capital share but not at industrial level. The coefficient of regional industry foreign presence (*FDI_Industry_Region*), on the other hand, shows negative spillovers. Since this estimation is regressed for all firms, this may happen due to competition effect among all firms for resource and market in a given region. On the other hand, the interaction term between foreign presence at a plant level and foreign presence at regional level is not statistically significant.

Table 6.5 shows the regional spillover effect of foreign subsidiaries on domestic firms only. Despite the addition of regional foreign investment, the coefficients on country wide industry foreign investment (*FDI_Industry*) remains statistically insignificant, which is again identical to those reported in Table 6.2. Similarly, we also fail to find the spillover effect at regional level and the result is robust for different specifications and estimation methods. Therefore, it seems that domestic firms do not benefit from transnational companies through labour productivity at both national and regional level. This finding can be explained by either local firms have weak integration with foreign companies or the movement of trained labour force from multinational enterprise to domestic firms is low.

In the above estimates, the presence of foreign companies at a given location was measured as the share of foreign investment in the region. Alternatively, the interaction term between industrial foreign investment and regional dummies are also created to assess whether there is regional difference in the spillover effect. The pooled OLS estimates of this interaction terms are presented in the last column of Table 6.5. It seems that the productivity enhancing effect of foreign investment is less in Cape Town region compared to that of the reference region, Johannesburg. However, we could not estimate fixed effect model due to insufficient observations when the industry share of foreign investment is further segregated into each region.

6.5 Further sensitivity analysis

As shown in the meta analysis section, the empirical findings from spillover effect studies may be systematically related to the specific research method employed. Thus, it would be quite relevant to see whether the results from the basic estimations above are robust for different specifications and this part presents the findings from alternative sensitivity analysis.

6.5.1 The issue of endogeneity

The estimates from basic OLS may suffer from the endogeneity problem if one or more of the explanatory variables and the unobserved factors are correlated. Similarly, the results may not be consistent if productivity of labour and foreign investment share in a given firm affect each other simultaneously.

Therefore, it is useful to instrument foreign investment indicators by alternative variables that have relation with FDI but not with labour productivity equation. Using the lagged values of the variables can be one possible solution to deal with the endogeneity concern (Wooldridge, 2002). Girma and Wakelin (2007) stated that, in addition to controlling for the possibility of endogeneity problem, using the lagged value of foreign investment helps to allow for sometime to realize productivity gain from potential spillovers. But more valid and reliable instruments in WBES data are not available since the panel data is only for two years. The alternative option in this case is at least to use the FDI values in 2003 as instruments for that of 2007.

The estimation result for all firms and only for domestic firms in 2007 using IV estimation techniques is presented in Table 6.6. For comparison purpose, however, the corresponding OLS result is also given only for panel dataset. As it can be seen from the first column, there is no relation between foreign presence and labour productivity within the firm. However, positive and significant relation is found between foreigner capital share in a firm and its labour productivity when the IV model is estimated using the lagged value of FDI variables as instrument. On the other hand, the coefficients of OLS and IV estimates that indicate foreign presence at industry level does not show any relation between foreign presence and labour productivity in local firms and other foreign firms. So once again, we can conclude that there is no spillover effect to local firms due to foreign presence at industrial level.

6.5.2 What if the definition of foreign presence is changed?

According to the findings from meta-analysis in chapter three, the way in which foreign presence indicator variable is defined may affect the level of statistical significance and magnitude of coefficients in the spillover analysis. Havránek, T and Iršová, Z (2010) also suggest that it is important to check the results on various proxies of FDI and to explain possible different outcomes if there are. In line with this argument, sensitivity analysis about the effect of foreign presence was done using proxies of employment share and output share or sale share of foreigners[15] in a given industry.

The result of these two alternative definitions of foreign presence, using employment share and sale share of foreign companies in each industry, is given in Table 6.7. Simple OLS using across sectional data, pooled OLS, and fixed effect estimates are employed by exploiting the panel nature of the data. Both employment share and sale share proxies of foreign presence reinforce our pervious finding that domestic firms are unlikely to get benefit from foreign companies. The lack of either positive or negative spillover effect can happen due to lower horizontal linkage between local and foreign companies found in the same industry or limited capacity of local firms to effectively utilize the spillovers due to

[15] Since the total amount of output production for 2003 and 2004 in World Bank's Enterprise Surveys panel datasets is not given, we alternatively use the share of sale in each industry by foreign companies as a proxy for our definition of foreign presence. Other studies such as that of Kathuria (2002) and Bosco (2001) also define foreign presence in terms of sale share.

technological gap. However, as shown in chapter two, compared to other parts of developing countries in Asia and Latin America, the size of foreign investment in South Africa is still very small and it may be too early to conclude that there is no intra-industry spillover effect.

6.5.3 The cost of labour and other raw materials

The effect of foreign investment on productivity of domestic establishments is usually analyzed in the literature based on the quantity of labour, capital and technology used in production. However, there are a number of other factors that can affect the productivity of a given firm in addition to just these inputs. For example, Hale, and Long (2008) argued that the price of labour, capital, and energy are among the important factors that may explain the optimal mix of production inputs. Therefore, this study also controls for the effect of wage and cost of other inputs to check whether these variables are omitted from the above estimations.

Since wage rate and other material prices are not found in the World Bank Enterprise Surveys datasets, total amount of annual salary paid per labour and other material cost incurred per labour were used as a proxy for prices of factors. Table 6.8 shows what happened to the effect of foreign subsidiary after controlling for prices of inputs. Adding these variables do not change our previous finding that there is neither positive nor negative spillover effect from foreign investment on labour productivity of local firms.

Even if our conclusion about the absence of spillover from FDI is still robust, it seems that controlling for wage and other material costs is necessary. This study shows significant relation between factor costs and productivity of labour implying the need to control for input prices in the analysis of spillovers.

6.5.4 Does plant size matter?

Some researchers also argue that the spillover effect from FDI can vary depending on the size of plants in the industry (for instance see Aitken and Harrison, 1999; Sjöholm, 1999). According to World Bank classification of firms, if the number of employees is between 5 and 19, a firm is called small size firm. Whereas, medium size firms contain from 20 to 99 employees and large firms are those firms having at least 100 employees.

The result for alternative pooled OLS estimates, which is done according to the size of plants, is presented in Table 6.9. In addition, for comparison purpose, the corresponding estimation result without classifying firms based on size is also given in the same Table. As shown from the coefficients of spillover measuring variables, there is no relation between foreign presence and labour productivity of domestic firms irrespective of the size of plants.

However, the dataset could not allow running alternative regression models such as fixed effect and random effect for comparison due to lack of enough variation among the important variables when the data is divided according to the size of firms.

Chapter 7

Conclusion

The impact of Foreign Direct Investment (FDI) on domestically owned firms in developing countries has attracted substantial academic and policy attention. A popular belief is that there is a substantial positive link between foreign investment and domestic enterprises with FDI providing access to advanced technologies and other intangible assets that can spillover into local manufacturing industries. Some skepticism, however, remains and centers on the adverse effect of foreign companies which may lead to shrinking market shares or complete exit of domestic firms (Ofosu and Waldkirch, 2008). There is also ample evidence which shows that the growth enhancing effects of FDI on the host economy varies across countries.

Recently, a number of studies have examined the spillover effects of foreign presence on local industries in different countries (Görg and Strobl, 2001). However, little is known so far about the effects of multinational companies operating in African countries on local firms and this research sought to fill this gap.

Using firm level data from South African manufacturing industries, this study examined the impact of foreign investment on labour productivity within a firm and on local firms. OLS estimates using cross-sectional data for 2003 and 2007 years showed a positive and significant impact of foreign presence within firms. Similarly, estimates based on pooled data for two years also indicate a positive relation between foreign presence and productivity of labour within the firm. However, this result is not replicated for alternative estimates of fixed effect and random effect. Since the temporal change in foreign investment between 2003 and 2007 is found to be very small, it is difficult to rely on fixed effect and random effect estimates. The instrumental variable model for 2007 cross-sectional data reinforces the result of ordinary least square estimates and reveals a positive relationship between foreign investment and labour productivity at firm level. So it seems that foreign firms improve the productivity of their workers through training and other techniques. This finding is also consistent with the common argument that foreign firms usually engage in more on-the-job training for their own advantage compared to domestic firms (Cuyvers et al, 2008).

On the other hand, neither positive nor negative spillover effect from FDI on local firms is found through horizontal linkage. Classifying the ownership status into joint ventures and fully foreign owned firms does not change the result. Unlike many studies in the area, this research also checks whether the spillover effect of foreign investment is geographically limited. The finding shows no spillover effect taking place even at regional level and the result is again robust to different specifications and estimation techniques. Therefore, domestic firms do not experience any gains in labour productivity which may be ascribed to transnational companies.

The lack of spillover effect at both national and regional level may be attributed to a number of factors including limited horizontal linkage between multinationals companies and domestic firms. As noted by Haddad and Harrison (1993), foreign presence may not have significant effect on local labour productivity if technology gaps inhibit the transfer of spillovers from foreign to local firms. In addition, foreign firms may have restricted spillovers to domestic firms due to competition effect especially if they are producing for local markets (Aitken and Harrison, 1999). This finding is also identical to the conclusion made in meta analysis that the possibility of identifying spillover effects from FDI is less for

studies which rely on firm level and panel data. Studies that use cross-section data generate systematically larger significant spillover estimates compared to that of panel data studies (Görg and Strobl, 2001). Due to the possibility of controlling for firm level unobserved heterogeneity, panel data analysis of spillover effects are potentially more convincing than corresponding estimates based on cross-section data.

The meta analysis based on previous work shows that different research design characteristics such as the definition of foreign presence and the time dimension of data may systematically affect the possibility of observing spillover from FDI. Initially, the share of foreign capital in a given industry was used as a proxy for foreign investment in this study. Alternatively, the spillover impact was also analyzed by defining FDI in terms of employment share and sale share. However, regardless of the measure used, there appears to be no relation between foreign investment and labour productivity in local firms. Similarly, classifying firms into small size, medium size and large size did not change the result of the basic model. Therefore, the findings from different sensitivity analyses are robust.

Currently, South Africa has committed itself to improving its investment climate and the government has continually undergone progressive transformation and liberalization to encourage foreign investment (UNCTAD, 2006). Due to this effort, there has been an increase in the annual foreign investment flow and total capital stock owned by multinational companies. However, this study found no spillover effect from foreign firms to domestic firms. It seems that little attention is paid to optimize the benefit that can be achieved from foreign investment. This finding also implies the need to create an environment that facilitates the transfer of some benefits from foreign firms to domestic firms.

It should be noted, however, that the findings from this micro level data analysis should be taken carefully. First, this study is based on a small sample size. So, it may not be valid to draw generalizations about the whole country. Second, our definition of spillover effects from FDI through labour productivity is restricted to productivity gains that can be achieved by intra-industry linkage. Other potential productivity gains through backward and forward linkages have not been analyzed. The data set is limited to two years and this restricts the possibility of applying generalized methods of moments (GMM) which may potentially yield more credible results. Some of these concerns will be addressed in future efforts when the next waves of World Bank Enterprise Survey datasets become available.

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Appendix

Table 3.1
List of previous research papers used in the Meta analysis

	Researchers (year)	Country	Years of study	Type of Paper	Type of Data	Aggregation Level
1	Aitken & Harrison(1999)	Venezuela	1976-1989	Journal article	Panel	firm
2	Aslanoglu(2000)	Turkey	1993	Journal article	Cross_se	Industry
3	Batra etal(2003)	Malaysia	1985-1995	Working paper	Panel	firm
4	Björk(2005)	Chile	2000	Working paper	Cross_se	firm
5	Blomström & Persson(1983)	Mexico	1970	Journal article	Cross_se	Industry
6	Bwalya(2005)	Zambia	1993-1995	Journal article	Panel	firm
7	Chuang & Lin(1999)	Taiwan	1995-2000	Journal article	Cross_se	firm
8	Cuyversetal (2008)	Cambodia	2000	Working paper	Cross_se	firm
9	Damijan,etal.(2003).	Slovakia	1994-1998	Working paper	Panel	firm
10	Djankov & Hoekman(2000)	CzechRepublic	1992-97	Working paper	Panel	firm
11	Haddad & Harrison(1993)	Morocco	1985-1989	Journal article	Panel	firm
12	Kathuria(2002)	India	1975/76-1988/89	Journal article	Panel	firm
13	Kee,H.L.(2005).	Bangladesh	2004	Working paper	Panel	firm
14	Kein(2008)	Brazil	2005	Working paper	Cross_se	firm
15	Kokkoetal(2001)	Uruguay	2005	Journal article	Cross_se	Industry
16	Kolasa(2008)	Poland	1996-2003	Working paper	Panel	firm
17	Konings(2001)	Romania	1987-1994	Working paper	Panel	firm
18	Konings(2001)	Bulgaria	1993-1997	Working paper	Panel	firm
19	Lui,etal(2001)	China	1996, 1997	Journal article	Panel	Industry
20	Lutzand & Talavera(2004)	Ukraine	1998, 1999	Journal article	Panel	firm
21	Marinand & Bell(2006)	Argentina	1992–1996	Journal article	Panel	firm
22	Ofosu & Waldkirch	Ghana	1992-1998	Working paper	Panel	firm
23	Rattsø & Stokke(2003)	Thailand	1975-1996	Journal article	Panel	Industry
24	Sgard(2001)	Hungary	1992-1999	Working paper	Panel	firm
25	Sjöholm (1999)	Indonesia	1980, 1991	Journal article	Cross_se	firm
26	Smarzynska (2002)	Lithuania	1996-2000	Working paper	Panel	firm
27	Thuy (2005)	Vietnam	1995-2002	Working paper	Panel	Industry
28	Vahter (2004)	Slovenia	1994–2000	Working paper	Panel	firm
29	Vahter (2004)	Estonia	1996–2001	Working paper	Panel	firm
30	Yudaeva etal(2003)	Russia	1992-1997	Working paper	Panel	firm

Source: Own estimation based on data collected from empirical studies about FDI spillovers

Table 3.2
Descriptive statistics for variables included in the meta analysis

Variable	For full sample size			For restricted sample		
	Observations	Mean	Standard Error	Observations	Mean	Standard Error
t-statistics	156	3.559782	5.744924	130	2.046238	1.3443
Magnitude of Coefficient	156	.4820615	1.108505	130	.4286131	1.143338
No of observations	156	14208.44	23243.79	130	14405.6	24929.8
Labour productivity	156	.3589744	.4812446	130	.3846154	.4883863
TFP	156	.1923077	.3953828	130	.1384615	.3467199
Output	156	.4487179	.498965	130	.4769231	.5013994
Employment share	156	.2115385	.4097145	130	.2384615	.4277913
Capital share	156	.5	.5016103	130	.4538462	.4997913
Output share	156	.2884615	.454506	130	.3076923	.4633239
Cross section	156	.25	.4344073	130	.2153846	.4126792
Panel	156	.7179487	.4514474	130	.7846154	.4126792
Industry level	156	.1538462	.3619632	130	.1615385	.3694506
Firm Level	156	.8461538	.3619632	130	.8384615	.3694506
Publication	156	.6474359	.4793071	130	.6307692	.4844634
Transitional country	156	.6410256	.4812446	130	.6538462	.4775834
Developing country	156	.3589744	.4812446	130	.3461538	.4775834
Labour quality	156	.3461538	.4772751	130	.3461538	.4775834
R&D Dummy	156	.3012821	.4602926	130	.2461538	.4324357
Spillover for all firms	156	.4102564	.4934643	130	.4538462	.4997913
Spillover for domestic firms	156	.5897436	.4934643	130	.5461538	.4997913

Source: Own estimation based on data collected from empirical studies about FDI spillovers

Table 3.3
Aggregate t-statistics estimates of spillover effect of foreign direct investment

	Using median t-statistics from each study		All observations		Excluding outliers		Weighted All observations		Weighted Excluding outliers	
	T_G	N	T_G	N	T_G	N	T_W	N	T_W	N
All studies	21.90	30	44.46	156	23.33	130	28.53	156	16.63	130
Type of data										
Cross-section	20.01	8	34.70	39	18.75	28	24.75	39	14.76	28
Panel	18.35	22	25.52	117	18.61	102	17.82	117	13.51	102
Foreign presence as a share of:										
Employment	10.04	6	15.56	33	12.92	31	14.12	33	9.45	31
Capital	18.10	16	38.97	78	13.95	59	21.00	78	12.39	59
Output	8.12	8	18.15	45	13.74	40	13.58	45	11.43	40
Level of Aggregation:										
Firm	6.70	24	13.80	132	7.10	109	10.19	132	6.99	109
Industry	7.68	6	12.87	24	9.95	21	11.34	24	7.23	21

Source: Own estimation based on data collected from empirical studies about FDI spillovers

Table 3.4
The effect of FDI spillover study characteristics on the magnitude of statistical value

Study Characteristics	Ordinary Least Square estimates			Random Effect Estimates		
	(1)	(2)	(3)	(4)	(5)	(6)
No of observation	0.222***	0.241***	0.240***	0.244***	0.261***	0.265***
	(0.0625)	(0.0556)	(0.0581)	(0.0817)	(0.0775)	(0.0795)
panel	-1.071**	-0.809*	-0.809*	-0.908***	-0.748**	-0.740**
	(0.423)	(0.475)	(0.478)	(0.314)	(0.316)	(0.319)
asia_dumy		0.944***	0.944***		0.732**	0.725**
		(0.293)	(0.293)		(0.314)	(0.317)
is_published			0.00908			0.0732
			(0.233)			(0.224)
labour_productivity	-0.0891	0.203	0.206	0.633*	0.718**	0.766**
	(0.294)	(0.269)	(0.272)	(0.356)	(0.353)	(0.360)
output	-0.0413	0.102	0.103	0.455	0.513	0.566
	(0.351)	(0.358)	(0.354)	(0.427)	(0.411)	(0.423)
capital_share	1.180***	0.979***	0.979***	1.340***	1.132***	1.133***
	(0.281)	(0.287)	(0.289)	(0.284)	(0.290)	(0.293)
output_share	0.733**	0.366	0.366	0.858**	0.561	0.553
	(0.341)	(0.339)	(0.341)	(0.393)	(0.388)	(0.399)
developing	0.433	-0.0903	-0.0900	0.753*	0.334	0.360
	(0.344)	(0.401)	(0.402)	(0.406)	(0.415)	(0.424)
firm_level	-0.682**	-0.683**	-0.682**	-1.027***	-0.913***	-0.921***
	(0.310)	(0.283)	(0.287)	(0.260)	(0.257)	(0.259)
R&D dummy	0.260	0.116	0.116	0.532	0.372	0.385
	(0.381)	(0.397)	(0.398)	(0.396)	(0.372)	(0.382)
Labour quality	0.416	0.732*	0.730*	0.232	0.513	0.489
	(0.350)	(0.392)	(0.399)	(0.414)	(0.402)	(0.416)
domestic_only	-0.0785	0.229	0.228	-0.184	-0.00315	-0.0266
	(0.290)	(0.319)	(0.320)	(0.272)	(0.273)	(0.277)
constant	0.517	-0.0541	-0.0590	-0.205	-0.584	-0.690
	(0.882)	(0.941)	(0.939)	(1.010)	(0.976)	(1.016)
Observations	130	130	130	130	130	130
R-squared	0.348	0.400	0.400			

Source: Own estimation based on data collected from empirical studies about FDI spillovers

Note:

(a) This meta regression is estimated after excluding outliers

*(b) ***, ** and * denote statistical significance at 1%, 5% and 10% levels respectively.*

(c) Heteroskedasticity consistent standard errors are given in parenthesis

Table 3.5
The effect of FDI spillover study characteristics on the magnitude of coefficients

Study Characteristics	Ordinary Least Square estimates			Random Effect Estimates		
	(1)	(2)	(3)	(4)	(5)	(6)
No of observations	0.0548	0.0231	0.00357	0.0345	0.0251	0.0184
	(0.0651)	(0.0573)	(0.0467)	(0.0854)	(0.0885)	(0.0873)
panel	-0.338***	-0.385***	-0.357***	-0.243**	-0.247*	-0.248**
	(0.111)	(0.105)	(0.109)	(0.114)	(0.134)	(0.123)
asia_dumy		0.459*	0.169		0.312	0.128
		(0.244)	(0.185)		(0.678)	(0.656)
is_published			0.650*			0.530
			(0.364)			(0.439)
labour_productivity	1.007**	0.808*	1.054**	0.681**	0.642**	0.582***
	(0.472)	(0.415)	(0.513)	(0.319)	(0.326)	(0.237)
output	-0.985**	-0.912**	-0.910**	-0.374	-0.355	-0.449
	(0.452)	(0.428)	(0.406)	(0.316)	(0.318)	(0.319)
capital_share	0.608**	0.169*	0.321*	0.758	0.615**	0.689*
	(0.307)	(0.098)	(0.189)	(0.552)	(0.304)	(0.397)
output_share	0.0349	-0.182	-0.118	0.0895	-0.0693	-0.0227
	(0.159)	(0.246)	(0.232)	(0.602)	(0.705)	(0.659)
developing	0.215	-0.0576	0.444*	0.084	0.856	1.041
	(0.164)	(0.226)	(0.266)	(0.496)	(0.720)	(0.697)
firm_level	-0.411***	-0.425***	-0.339***	-0.531***	-0.377***	-0.477***
	(0.168)	(0.171)	(0.142)	(0.225)	(0.156)	(0.201)
R&D dummy	-0.0697	-0.188	-0.0427	-0.109	-0.187	-0.0355
	(0.236)	(0.274)	(0.210)	(0.464)	(0.505)	(0.493)
Labour quality	0.208***	0.148**	0.105***	0.384**	0.289***	0.187***
	(0.067)	(0.075)	(0.042)	(0.179)	(0.114)	(0.077)
domestic_only	0.324	0.344	0.306	0.0205	0.0279	0.0337
	(0.236)	(0.243)	(0.213)	(0.215)	(0.217)	(0.216)
constant	0.691	0.410	0.481	-0.544	-0.546	-0.261
	(0.765)	(0.679)	(0.677)	(1.106)	(1.124)	(1.097)
Observations	156	156	156	156	156	156
R-squared	0.257	0.268	0.314			

Source: Own estimation based on data collected from empirical studies about FDI spillovers

Note:
*(a) ***, ** and * denote statistical significance at 1%, 5% and 10% levels respectively.*
(b) Heteroskedasticity consistent standard errors are given in parenthesis

Table 5.1
The distribution of firms by ownership status

year	Joint Ventures	Domestic firms	Fully foreign owned firms	Total
2003	44	489	70	603
2007	41	920	96	1057
Total	85	1409	166	1660

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Table 5.2
Industrial distribution of firms included in the WB Enterprise Survey

	2003		2007		Total Sample	
Industry	N	Share	N	Share	N	Share
Textiles Industries	24	0.04	15	0.01	39	0.02
Garments	35	0.06	108	0.10	143	0.09
Chemicals	46	0.08	83	0.08	129	0.08
Plastics and rubber	32	0.05	22	0.02	54	0.03
Non metallic product	22	0.04	8	0.01	30	0.02
Basic metals	22	0.04	2	0.00	24	0.01
Fabricated metal prod	52	0.09	110	0.10	162	0.10
Machinery and equipment	34	0.06	34	0.03	68	0.04
Electronics	31	0.05	22	0.02	53	0.03
Construction	21	0.03	16	0.02	37	0.02
Other Services	21	0.03	26	0.02	47	0.03
Food	43	0.07	122	0.12	165	0.10
Wholesale	20	0.03	13	0.01	33	0.02
Retail	23	0.04	229	0.22	252	0.15
Hotels and restaurant	21	0.03	65	0.06	86	0.05
Transport	21	0.03	2	0.00	23	0.01
Information Technology	20	0.03	4	0.00	24	0.01
Other manufacturing	115	0.19	176	0.17	291	0.18
Total	603		1057		1660	

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Table 5.3
Distribution of Foreign and Domestic Firms included in 2007

Industry	Joint Ventures		Domestic Firms		Fully Owned Foreign Firms	
	N	Share	N	Share	N	Share
Textiles Industries	1	0.02	13	0.01	1	0.01
Garments	1	0.02	96	0.10	11	0.11
Chemicals	7	0.17	66	0.07	10	0.10
Plastics and rubber	2	0.05	20	0.02	0	0.00
Non metallic product	0	0.00	7	0.01	1	0.01
Basic metals	0	0.00	2	0.00	0	0.00
Fabricated metal prod	5	0.12	88	0.10	17	0.18
Machinery and equipment	2	0.05	28	0.03	4	0.04
Electronics	2	0.05	19	0.02	1	0.01
Construction	1	0.02	15	0.02	0	0.00
Other Services	1	0.02	23	0.03	2	0.02
Food	8	0.20	101	0.11	13	0.14
Wholesale	1	0.02	12	0.01	0	0.00
Retail	2	0.05	210	0.23	17	0.18
Hotels and restaurant	2	0.05	60	0.07	3	0.03
Transport	0	0.00	2	0.00	0	0.00
Information Technology	0	0.00	3	0.00	1	0.01
Other manufacturing	6	0.15	155	0.17	15	0.16
Total	41		920		96	

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Table 5.4
The distribution of firms by ownership and regions in 2007

Region	Joint Ventures		Domestic Firms		Fully Owned Foreign Firms		Total	
	No.	Share	No.	Share	No.	Share	No.	Share
Johannesburg	33	0.80	611	0.66	75	0.78	719	0.68
Cape Town	2	0.05	136	0.15	7	0.08	145	0.14
Port Elizabeth	1	0.03	60	0.07	5	0.05	66	0.06
Durban	5	0.12	113	0.12	9	0.09	127	0.12
Total	41		920		96		1,057	

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Table 5.5
Summary statistics of main firm variables

VARIABLES	Domestic Firms			Joint Ventures			Fully Foreign Firms		
	N.obs	Mean	S.D.	N.obs.	Mean	S.D.	N.obs	Mean	S.D.
Log(value added)	1389	18.22251	4.673828	83	21.80849	4.105796	160	19.8713	5.240143
Log(value added per labour)	1386	14.72901	3.69606	83	16.61705	3.612985	160	15.61692	3.995722
Log (Fixed capital)	948	17.1941	4.425116	70	19.62498	4.595249	122	19.06486	4.517874
Log (Fixed capital per labour)	946	13.29279	3.781602	70	14.42562	4.278395	122	14.17076	3.804643
Log (labour)	1400	3.491325	1.561199	86	5.168397	1.457552	165	4.285043	1.908131
Share of skilled Labour	1047	.4363847	.2987331	77	.331409	.2073249	135	.4338717	.2369678
Firm_size	1389	.0094546	.0700034	83	.0476448	.1752151	160	.0119566	.0681539
RD_Dummy	1299	1.69361	.461171	86	1.267442	.4452209	151	1.410596	.4935791
H_index	1408	.3949026	.2723546	86	.3447684	.2756047	166	.3308915	.2520422
Firm_age	1407	21.39019	56.5916	86	37.32558	29.05753	166	25.92771	23.01846

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Note:

(a)The two-sample t test of equality of value added per labour between domestic firms and fully foreign owned firms gave Pr(|T| > |t|) = 0.0000. This implies that there is statistically significant difference between the labour productivity between domestic and foreign firms. And the same result is also found for the test between domestic firms and joint ventures.

(b) The two-sample t test of equality of labour quality between domestic firms and fully foreign owned firms gave Pr(|T| > |t|) = 0.9251. This implies that there is no statistically significant difference in labour qualities based on ownership.

Table 5.6
The correlation between Labour productivity and foreign presence indicators

VARIABLES	*LLProd*		
	In 2003 year	In 2007 year	For the pooled datasets
FDI_Firm	0.1797	0.0903	0.0995
FDI_Industry	-0.1302	0.0256	0.1641
FDI_Firm FDI_Industry*	0.1489	0.0596	0.1275
N	572	1023	1595

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Table 5.7
The mean value equality test between FDI 2003 and FDI 2007

	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
FDI_2003	191	15.32984	2.465872	34.07903	10.46584	20.19384
FDI_2007	191	18.36649	2.654114	36.68058	13.13118	23.6018
Combined	382	16.84817	1.810704	35.38989	13.28794	20.40839
diff		3.03665	3.622823		10.15994	4.08664
(P-value)		(0.4024)				

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Notes:

(a) The equality test between foreign capital shares at firm level in 2003 and 2007 is done to see whether there is enough variation or overtime change in foreign investment..

(b) The null hypothesis test of Ho: diff = 0 at degrees of freedom equal to 380 gives Pr(T > t) = 0.4024. Therefore, we accept the null hypothesis that there is no much difference in the equity share of foreigners over time.

(c) Since this result shows the mean difference in foreign investment over time in not change significantly, out inference based on differencing the data such as fixed effect and random effect should be considered carefully. In other words, the estimation power of these models are basically depends on the overtime variation in the variables included in the model but in this estimation we don't have much variation.

Table 5.8
The mean value equality test between Labour productivity in 2003 and 2007

	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
LP_2003	191	13.07329	.0684279	.9456921	13.06352	13.08306
LP_2007	191	19.91385	.1101908	1.474253	19.89812	19.92958
Combined	382	16.49357	.1752889	3.42599	16.14892	16.83822
diff		6.84056	.0093854		6.822106	6.859014
(P-value)		(0.0000)				

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Table 5.9
Attrition Probit test result for the missed observations in 2007

VARIABLES	Sample Attribution test
Labour productivity	-0.348
	(0.266)
FDI share	0.300
	(0.636)
Capital per labour	0.150
	(0.119)
Labour quality	1.748**
	(0.705)
R&D Dummy	-0.366
	(0.386)
Firm age	0.0127
	(0.00838)
Firm_size	83.05
	(82.82)
Constant	7.246
	(4.887)
Observations	318

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Notes:
*(a) *** denotes statistical significance at 10 percent level.*
(b) Heteroskedasticity consistent standard errors are given in parenthesis.

Table 6.1
The effect of foreign direct investment on labour productivity for all firms

VARIABLES	(1) OLS 2003	(2) OLS 2007	(3) Pooled OLS With time Dummy	(4) Pooled OLS With time Interaction Terms	(6) Fixed Effects	(7) Random Effects
FDI_Firm	0.596**	0.367**	0.495***	0.539*	-1.356	0.426
	(0.293)	(0.176)	(0.162)	(0.300)	(0.869)	(0.352)
FDI_Industry	-0.199	0.00246	-0.105	-0.216	2.608	-0.0250
	(0.321)	(0.143)	(0.139)	(0.328)	(3.133)	(0.373)
FDI_Firm FDI_Industry*	-0.550	-0.950**	-0.679*	-0.516	0.998	-1.183
	(0.694)	(0.430)	(0.382)	(0.719)	(2.441)	(0.908)
*FDI_Firm*y07*				-0.0954		
				(0.358)		
FDI_Industry y07*				0.137		
				(0.330)		
FDI_Firm FDI_Industry y07*				-0.312		
				(0.849)		
Observations	472	650	1,122	1,122	326	326
R-squared	0.270	0.295	0.935	0.935	0.911	

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Notes:

*(a) ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.*

(b) Heteroskedasticity consistent standard errors are given in parenthesis.

(c) In addition to capital, the above estimates control for firm and industry specific factors such as labour quality, export share of production, firm size, firm age, industrial competition level, research and development indicator

(d) The Hausman test of difference between fixed effect estimates and random effect estimates give Prob>chi2 = 0.0000. Thus, the model gives preference for fixed effect model over that of random effect model and this is an indication that some of the dependent variables may be corrected with unobserved time invariant variables.

Table 6.2
The effect of foreign direct investment on labour productivity in domestic firms only

VARIABLES	(1) OLS 2003	(2) OLS 2007	(3) Pooled OLS With Time	(4) Pooled OLS With time Interaction Terms	(5) Fixed Effects	(6) Random Effects
FDI_Industry	-0.146	0.00484	-0.0809	-0.170	5.555	-0.0116
	(0.347)	(0.147)	(0.145)	(0.348)	(5.566)	(0.384)
FDI_Industry y07*				0.107		
				(0.343)		
Observations	380	556	936	936	252	252
R-squared	0.220	0.251	0.934	0.934	0.920	

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Notes:

*(a) ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.*

(b) Heteroskedasticity consistent standard errors are given in parenthesis.

(c) In addition to capital, the above estimates control for firm and industry specific factors such as labour quality, export share of production, firm size, firm age, industrial competition level, research and Development indicator.

(e) The Hausman test of difference between fixed effect estimates and random effect estimates give Prob>chi2 = 0.0000. Thus, the model gives preference for fixed effect model over that of random effect model and this is an indication that some of the dependent variables may be corrected with unobserved time invariant variables.

Table 6.3
The effect of Joint Venture and Fully foreign Owned on labour productivity in domestic firms

VARIABLES	(1) Pooled OLS	(2) Pooled OLS	(3) Fixed Effects	(4) Random Effects	(5) Fixed Effects	(6) Random Effects
FDI_Joint venture	0.103	--	-3.884	0.471	--	--
	(0.439)	--	(10.94)	(0.735)	--	--
FDI_Fully owned	-0.265	--	27.54	-0.0635	--	--
	(0.243)	--	(22.62)	(0.390)	--	--
FDI_Industry	--	-0.230	--	--	5.555	-0.0116
	--	(0.248)	--	--	(5.566)	(0.384)
Observations	252	252	252	252	252	252
R-squared	0.929	0.929	0.921		0.920	

Source: Own calculation based on World Bank Enterprise Surveys panel datasets for 2003/07

Notes:

*(a) ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.*

(b) Heteroskedasticity consistent standard errors are given in parenthesis.

(c) In addition to capital, the above estimates control for firm and industry specific factors such as labour quality, export share of production, firm size, firm age, industrial competition level, research and Development indicator.

(d) The Hausman test of difference between fixed effect estimates and random effect estimates for column (5) and Column (6) gave Prob>chi2 = 0.0000. Thus, the model gives preference for fixed effect model over that of random effect model and this is an indication that our estimated models may be corrected with unobserved time invariant variables. So we cannot confidently argue that OLS estimates are consistent in this case.

Table 6.4
The effect of foreign direct investment on labour productivity at regional level for all firms

VARIABLES	With out regional dummy		With regional dummy	
	Pooled OLS	FEF	Pooled OLS	Fixed Effects
FDI_Firm	0.569**	-1.124	0.554**	-0.496
	(0.223)	(0.898)	(0.221)	(0.743)
FDI_Industry	-0.124	2.394	-0.104	1.901
	(0.141)	(3.144)	(0.140)	(2.589)
FDI_Industry _Region	0.105	0.685	0.0385	0.410
	(0.141)	(0.557)	(0.153)	(0.468)
FDI_Firm FDI_Industry*	-0.633	2.506	-0.642	1.949
	(0.415)	(2.739)	(0.412)	(2.256)
*FDI_Firm *FDI_Industry _Region*	-0.263	-2.000	-0.221	-2.395*
	(0.610)	(1.601)	(0.598)	(1.319)
Observations	1,122	326	1,122	326
R-squared	0.935	0.913	0.935	0.941

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Notes:

*(a) ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.*

(b) Heteroskedasticity consistent standard errors are given in parenthesis.

(c) In addition to capital, the above estimates control for firm and industry specific factors such as labour quality, export share of production, firm size, firm age, industrial competition level, research and development indicator

(d) In all case the hasman difference test between random effect and fixed effect model give preference for fixed effect

Table 6.5
The effect of foreign direct investment on labour productivity at regional level for only domestic firms

VARIABLES	With out regional dummy		With regional dummy		With regional interaction terms
	Pooled OLS	Fixed Effects	Pooled OLS	Fixed Effects	Pooled OLS
FDI_Industry	-0.104	6.445	-0.0933	3.331	0.142
	(0.147)	(5.561)	(0.147)	(3.777)	(0.174)
FDI_Industry _Region	0.126	0.839	0.0904	0.0817	--
	(0.143)	(0.567)	(0.156)	(0.416)	--
*FDI_Iindusty *Cape_Town*	--	--	--	--	-0.280
	--	--	--	--	(0.345)
*FDI_Industry *Durban*	--	--	--	--	-0.664***
	--	--	--	--	(0.256)
FDI_Industry Port_Elizabeth*	--	--	--	--	-0.0447
	--	--	--	--	(0.223)
Observations	1,122	326	1,122	326	556
R-squared	0.935	0.913	0.935	0.941	0.258

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Notes:

*(a) ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.*

(b) Heteroskedasticity consistent standard errors are given in parenthesis.

(c) In addition to capital, the above estimates control for firm and industry specific factors such as labour quality, firm size, firm age, industrial competition level, R&D

(e) In all case, the hasman difference test between random effect and fixed effect model give preference for fixed effect model therefore the random effect estimated are not given.

Table 6.6
The effect of foreign presence on labour productivity for only panel data; sensitivity test

VARIABLES	For all firms using 2007 data		Only for domestic firms using 2007 data	
	OLS	IV	OLS	IV
FDI_Firm	0.317	0.940**	--	--
	(0.262)	(0.426)	--	--
FDI_Industry	-0.286	-0.220	-0.284	-0.257
	(0.281)	(0.322)	(0.292)	(0.295)
*FDI_Firm*FDI_Industry*	-0.00354	-0.450	--	--
	(0.645)	(0.817)	--	--
Observations	179	179	135	135
R-squared	0.257	0.218	0.237	0.237

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Notes:

*(a) ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.*

(b) Heteroskedasticity consistent standard errors are given in parenthesis.

*(c) Instrumented variables are FDI_Firm FDI_Industry FDI_Firm*FDI_Industry and instrumental variables are lagged value of these variables in 2003.*

(d) In addition to capital, the above estimates control for firm and industry specific factors such as labour quality, export share of production, firm size, firm age, industrial competition level, research and Development indicator.

(e) The Durbin–Wu–Hausman test for endogeneity for the key variables gaves that the residual of these variables are jointly related with labour productivity, Prob > F = 0.0125. Therefore, there is evidence that foreign investment is endogenous in the labour productivity equation and the need to instrument it by alternative variable. However, we used due only the lag value of FDI variables due to lack of appropriate IVs in the data set.

Table 6.7
The effect of foreign direct investment on labour productivity in domestic firms only: sensitivity test

VARIABLES	Employment Share				Sale share			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
	OLS 2003	OLS 2007	Pooled OLS 07	Fixed Effects	OLS 2003	OLS 2007	Pooled OLS 07	Fixed Effects
Foreign presence	-0.187	-0.0256	-0.104	-0.0535	0.787	-0.0807	-0.273	0.428
	(0.336)	(0.133)	(0.134)	(0.345)	(0.899)	(0.434)	(0.404)	(0.892)
Observations	380	556	936	252	380	556	936	252
R-squared	0.220	0.251	0.934	0.920	0.221	0.251	0.934	0.921

Source: Own calculation from World Bank Enterprise Surveys datasets for 2003/07

Notes:

*(a) ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.*

(b) Heteroskedasticity consistent standard errors are given in parenthesis.

(c) In addition to capital, the above estimates control for firm and industry specific factors such as labour quality, export share of production, firm size, firm age, industrial competition level, research and Development indicator.

Table 6.8
The effect of foreign investment on the productivity labour in domestic firms after controlling for factor prices: sensitivity analysis

VARIABLES	(1) Pooled OLS Without controlling for input cost	(2) Pooled OLS Including Wage	(3) Pooled OLS Including Wage and other material costs	(4) Fixed Effects Without controlling for input cost	(5) Fixed Effects After controlling for wage
FDI_Industry	-0.0809	0.0634	0.0573	5.555	-0.606
	(0.145)	(0.100)	(0.0601)	(5.566)	(5.044)
Wage		0.858***	0.473***		0.677***
		(0.0317)	(0.0476)		(0.0764)
Material costs			0.409***		0.241**
			(0.0372)		(0.0899)
Observations	936	928	743	252	192
R-squared	0.934	0.967	0.981	0.920	0.991

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Notes:

*(a) ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.*

(b) Heteroskedasticity consistent standard errors are given in parenthesis.

(c) In addition to capital, the above estimates control for firm and industry specific factors such as labour quality, export share of production, firm size, firm age, industrial competition level, research and Development indicator.

Table 6.9
The effect of foreign investment on the productivity labour in domestic firms based on the size of plants: sensitivity analysis

VARIABLES	(1) Pooled OLS Small plants	(2) Pooled OLS Medium plants	(3) Pooled OLS Large plants	(4) Pooled OLS All plants
FDI_Industry	0.0812	0.134	-0.172	-0.0809
	(0.273)	(0.200)	(0.352)	(0.145)
Observations	207	237	112	936
R-squared	0.314	0.294	0.280	0.934

Source: Own calculation based on World Bank Enterprise Surveys datasets for 2003/07

Notes:

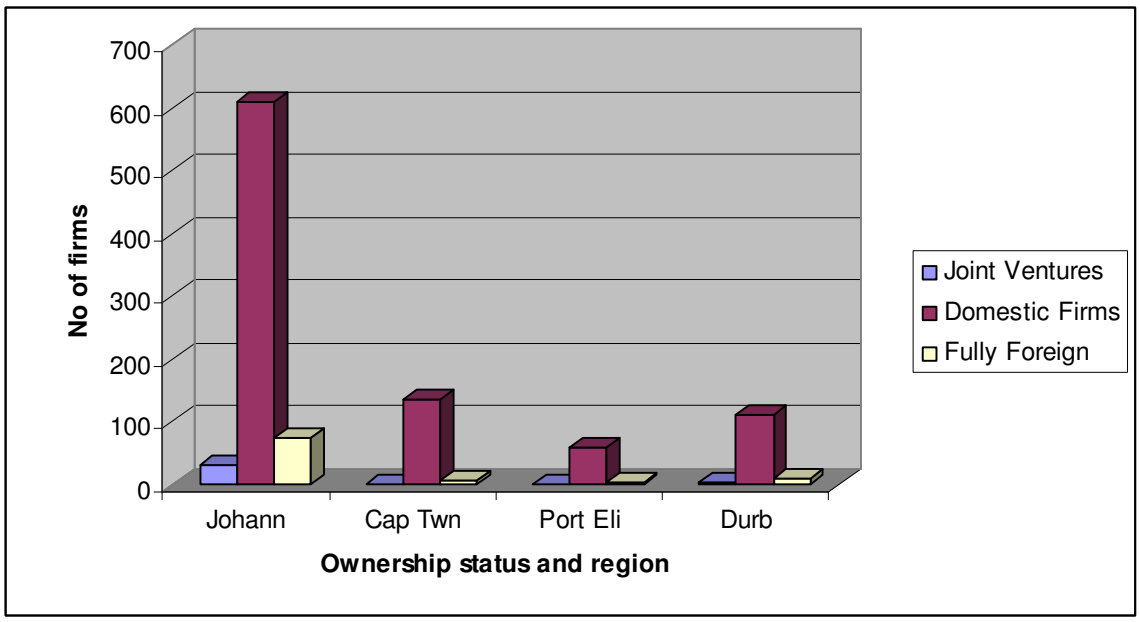
*(a) ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.*

(b) Heteroskedasticity consistent standard errors are given in parenthesis.

(c) In addition to capital, the above estimates control for firm and industry specific factors such as labour quality, export share of production, firm age, industrial competition level, and Research & Development indicator.

(d) Due to lack of enough number of variation in the key variables when the data is divided based on plant size, we couldn't use alternative models such as fixed effect and random effect models to check the robustness of the Pooled OLS results that we found from column (1) to (4).

Figure 5.1
The distribution of Firms by ownership and regions in 2007



Source: Own drawing based on World Bank Enterprise Surveys datasets for 2003/07