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# Foreign Direct Investment and Firm Level Productivity in Kenyan Manufacturing: A Panel Data Analysis

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***Abstract***: This paper uses panel data to examine the effects of foreign presence on firm level productivity in the Kenyan manufacturing industry employing "traditional" and "recent" methodologies using the production function framework. The results show that foreign firms dominated in virtually all the economic activities, including productivity performance. The analysis of productivity determinants using a technologically profound approach produced a statistically significant role played by foreign presence on firm level productivity, thus supporting the occurrence of spillovers. The paper argues that the use of productivity based methodologies largely masks the nature, actual processes and mechanisms through which spillovers occur. The paper, therefore, advocates a "paradigm shift" in the spillover analysis techniques and recommends a broader approach with particular emphasis on technological innovations which takes into consideration learning, capability building and innovation.

***Keywords***: FDI, foreign presence, spillovers, productivity, technological innovation

***JEL classifications***: F2, L1, L6, O1, O3

## 1. Introduction

Foreign Direct Investment (FDI) is perceived to play an important role in a host country's economic growth and development process (Dunning, 1993, 1994; Lall, 1980, 1987). As a result, countries are forced to liberalize their investment regimes in order to create a favourable climate for inward foreign investment. FDI in technically backward countries can spur industrial development by playing a supportive or complementary role to local investment or by acting as a stable source of capital. It is noted to be a more stable source of capital in comparison to other forms of private capital, such as debt and portfolio equity flows. Given that technologically underdeveloped countries lag behind the world technology frontier, FDI could equally serve to improve host countries' industrial capability development effort and their competitiveness by acting as a medium through which international diffusion of skills, knowledge, technology and innovations from technically advanced countries could take place (Rasiah and Gachino, 2005; UNCTAD, 2005; Gachino, 2006a, 2006b).

On the other hand, however, there is always the possibility that FDI out-compete local firms, forcing them out of the market (Lall and Streeten, 1977). FDI could also be static in that it operates in low level technological capabilities, and thus fails to nurture development of industrial capability in a host country (Frank, 1973; Amin, 1977). If unregulated, FDI can assume much control, for instance, in market power, especially when the bargaining and regulatory capabilities of a government in a host country are weak. This tends to confer undue advantages to FDI, for instance, over inputs such as finance and skilled personnel. All these would have negative ramifications for the entry, growth and development of the local firms.

The purpose of this paper is to contribute to this debate in the context of countries located in sub-Saharan Africa (SSA) where, despite the existence of voluminous literature on FDI and spillovers in other regions of the world (especially developed and advanced developing countries), not much is known on the subject. In this regard, Kenya, a country deemed to have relatively high FDI levels, is taken as the case study country. The existing FDI literature on SSA, though still meagre, focusses on different aspects of FDI with most of it concentrating on motives and determinants of FDI inflow (Asiedu, 2002; Fedderke and Aylit, 2006). Other studies concentrate on performance, investment climate and policy reforms to attract FDI inflow (Asiedu, 2004; Sekkat, 2007; Dupasquier and Osakwe, 2006; Rasiah and Gachino, 2005). More *ad hoc* studies related to the above include those done by UNIDO, OECD, CSAE and the World Bank under its Rural Programme for Enterprise Development (RPED).

As noted, these studies do not actually examine FDI from the spillover occurrence perspective. It should further be pointed out that all the outlined studies notwithstanding, we are yet to witness well-grounded empirical studies due to lack of sound and appropriate data. Analysis undertaken in this paper is expected to provide a suitable platform for comparative purposes from the perspective of technologically underdeveloped countries that are characterized by extremely fragile economies riddled with underdeveloped markets operated by firms with low capacity, all of which make them un-competitive globally.

This paper uses firm level panel data to examine whether technological spillovers occur in the Kenyan manufacturing industry by determining the impact of foreign presence on local firms' performance based on the productivity approach. The influence of firm size and technological gap (absorptive capacity) in the spillover process will be equally examined. Insights drawn from early contributions based on Caves (1974) as well as recent methodological developments, such as those by Aitken and Harrison (1999), will be taken into consideration to enable broad comparisons of the paper's findings. The use of this approach will provide a wider set of results for comparison with existing studies which have so far remained inconclusive in terms of effect, direction and magnitude of spillover occurrence.

Several factors make Kenya an interesting case for the current study. First, apart from a few case studies, hardly any empirical studies exist on FDI and spillovers. Some of the notable case studies include early works by Kaplinksy (1978), Swainson (1980), Langdon (1981) and Gerschenberg (1987). Some recent studies have been undertaken by Lall and Pietrobelli (2002), Rasiah (2004a, 2004b), Rasiah and Gachino (2005) and Gachino (2006b). Second, Kenya is among the countries which enjoyed early inward FDI that was largely local market-oriented and trade-related (Jorgensen, 1975; Vaitsos, 1978; Swainson, 1980). FDI is perceived to have contributed to the country's creation of a comparative advantage in Kenya's manufacturing compared to other countries in the region. This, however, needs to be ascertained empirically. Third, Kenya is currently making structural changes aimed at industrializing the country by the year 2020 (Kenya Government Economic Survey, 1997). Insights from this study will consolidate our understanding of the role FDI could play in the industrial development process.

The paper is organized as follows: Section 2 presents the theoretical review, data description and the estimation techniques used in this study. Section 3 examines the comparative behaviour of foreign and locally owned firms based on the descriptive characteristics derived from the panel data. This involves a detailed and in-depth analysis of panel sample characteristics. The next section traces the effect of foreign presence on firm level productivity using the panel data estimation technique. The same section also examines how the productivity approach is used to examine whether firm size and technological gap influence spillover occurrence in locally owned firms. Section 5 presents a summary of the discussion, and emerging criticisms. Finally, section 6 presents the author's conclusion and recommendations.

## 2. Theory, Data and Estimation Technique

This section presents a discussion of the productivity approach in spillover analysis, outlining the existing disjuncture in this. The data and estimation techniques are also discussed.

### *2.1 Theoretical Review: The Productivity Approach Revisited*

Most studies examining spillovers from FDI have been largely based on the productivity approach pioneered by Caves (1974), who presented the first systematic production function framework examining FDI spillovers. According to Caves, technological spillovers included all aspects resulting from the presence of MNCs in a host country which increases the productivity efficiency of locally owned firms. In his perspective, spillovers occurred since an MNC cannot capture all quasi rents due to its productive activities or to the removal of distortions by the subsidiary's competitive pressure.

Caves attempted to measure, directly, the impact of foreign presence on labour productivity in the Australian manufacturing domain employing simple cross sectional analysis. His hypothesis was that a large presence of MNC subsidiaries in an industry would in the long run induce higher technical efficiency, and speed up the transfer of technology to competing domestic firms. According to his study, foreign presence was characterized by positive technological spillovers which enhanced technical efficiency of the domestic firms, thus raising their productivity (see Rasiah, 2006).

Since Caves' pioneering work, a plethora of empirical studies conceptualizing spillovers in terms of productivity gains, and reporting similar findings, have emerged (Koizumi and Kopecky, 1977; Globerman, 1979; Blomstrom and Persson, 1983; Kokko, 1996; Blomstrom and Sjoholm, 1999). A model by Koizumi and Kopecky (1977), built upon the standard model of long-term international capital movement, found that when foreign investment is made in a host country, technical knowledge is transmitted in the form of externalities or 'spillovers'.

Globerman (1979) investigated the spillover benefit to Canadian manufacturing industries and found a positive relationship between the labour productivity of local firms and foreign presence which was interpreted to mean occurrence of positive spillovers. Blomstrom and Persson (1983) used industry level data to investigate whether technical efficiency of Mexican firms derived from spillover efficiency could be associated with FDI. Spillovers of technical efficiency were found to exist which were explained to be responsible for local firms' increase in productivity. Using cross sectional analysis, Blomstrom and Sjoholm (1999) found similar results that foreign presence affected the productivity of local firms positively in Indonesia. Their study showed that foreign firms had a comparatively high level of labour productivity, and that intra-industry spillovers from foreign investment existed in the Indonesian manufacturing sector.

The last empirical example which we provide is based on the endogenous principle by Kokko (1996), who determined the effect of competition in the Mexican manufacturing industry by endogenizing both the activities of foreign and locally owned firms. Given the argument for joint determination due to interactions, Kokko used the simultaneous system of equations to capture contagion-type spillovers related to foreign presence as well as spillovers that were caused by competition. Due to the assumption of simultaneous interactions, three Stage Least Squares (3SLS) gave plausible results with more efficient and consistent estimates than the corresponding Ordinary Least Squares (OLS) estimates. An endogenous test showed positive results only when the industries characterized by enclaves were excluded. This finding compared to Kokko's (1994) results, where industries characterized by large foreign shares and large differences in labour productivity between foreign affiliates and domestic firms formed enclaves which crowded out domestic firms. Interestingly, results of the study supported both the hypotheses only when the sub-sample considered excluded enclaves (which were believed to be isolated preserves of foreign firms operations only). This study has a rather unique conclusion in that while past studies concluded that externalities were proportional to foreign presence, this study concludes that spillovers from competition are not determined by foreign presence alone, but rather by simultaneous interactions between foreign and locally owned firms. One policy conclusion from this study is the support it gives to the need for local technological capability development in host developing countries.

Contrary to the studies analyzed, some less optimistic empirical firm level studies exist based on productivity (including total factor productivity) which suggest that the effects of foreign presence are not always beneficial to local firms in host countries. As will be shown, these studies seem to extend the original methodological tenets by considering issues such as spatial/regional dynamics, time and industry dynamics, and firm-level specificities (Haddad and Harrison, 1993; Kokko, Tansini and Zejan, 1996; Djankov and Hoekman, 1998; Aitken, Hanson and Harrison, 1997; Aitken and Harrison, 1999).

Haddad and Harrison (1993) utilized firm level panel data from an annual survey of all the manufacturing firms in Morocco. Their hypothesis was that when knowledge or new technology embodied in MNC firms is transmitted to local firms, it would result in higher productivity levels and growth rates for the local firms in sectors with a large foreign presence. The results, however, showed that foreign investment in the sector level was negative and statistically significant. The hypothesis that foreign presence accelerated productivity growth in domestic firms was thus rejected.

In a similar study, Kokko, Tansini and Zejan (1996) used plant level data to investigate the effects of foreign investment in the Uruguayan manufacturing industry. They found that foreign presence did not have any substantial impact on local productivity; hence there were no signs of spillovers. Extending their study to examine the impact of technology gap between local firms and foreign affiliates on local productivity, they observed that technological spillovers existed in the locally owned plants with small technology gaps, as opposed to locally owned plants whose big technology difference put them far behind the foreign affiliate's technology.

Aitken and Harrison (1999) used annual census data on over 4000 Venezuelan firms to measure the productivity effects of foreign ownership. Employing total factor productivity, the study found a positive relationship between foreign equity participation and firm performance implying productivity gains attributable to foreign equity participation. Surprisingly, the results showed that domestic firms in sectors with more foreign ownership were found to be significantly less productive than those in sectors with a smaller foreign presence – evidence of negative spillovers. This suggests that such negative spillovers could be a result of market stealing effect where foreign competition may have forced local firms to lower output, and thereby forego economies of scale. Nevertheless, adding up the positive own-plant effect and the negative spillovers on balance, the study found that the overall effect of FDI on productivity of the entire industry was positive, though extremely small.

Interestingly, all these studies seem to have something in common in that they presumably define a new generation of spillover studies, which attempts to advance the frontiers of our spillover understanding by extending the original approach. In doing so, these studies have refined their instruments and methodologies to address many issues such as national, locational, industry and firm-level specificities, scale, technological gap, trade orientation and demonstration effect variables. However, in this paper, we will argue that despite the considerable evolution demonstrated in estimation techniques of aggregate spillovers, relationships traced through underlying methodologies, whether traditional or recent, cannot be equated with actual spillovers due to their nature. Technological spillovers are complex and difficult to capture due to the uncertain, incomplete masterly and the tacit nature of technology. This is more so when spillover occurrence mechanisms, and firm and industry dynamics including institutional environment through which spillovers occur, are sparingly understood. It is against this background that this paper advocates for a paradigm change in spillover analysis if actual understanding of spillovers is to be achieved.

In light of this divergence in spillover analysis, this paper seeks to contribute to this debate by examining spillovers from FDI to local firms in the Kenyan context.[2] Contrary to the studies done in the past, we combine both "traditional estimations" and "new developments" approaches for comparison purposes. The latter will be conducted in line with recent studies such as Aitken and Harrison (1999). Accordingly, we will undertake panel data analysis, taking into consideration industry specificities (industry dummies) and time dynamics (time dummies). Panel data analysis is believed to be able to capture the dynamics of change because of inclusion of both cross-sectional and time series dimensions. Due to the limitation and nature of the data (observation required in the panel analysis), we will not be in a position to capture geographical location and other factors.

The panel data approach differs from the early contributions, which mainly use simplified cross sectional data which often resulted in spurious and biased results. Firm level panel data analysis is preferred for a number of reasons. First, it allows an investigation of domestic firms' productivity development over a long period of time. This is contrary to survey data which would have to rely on a specific data point, providing only a snapshot analytical scenario. Second, panel data analysis allows an investigation of spillovers controlling for other factors such as industry and time differences. As noted in Gorg and Strobl (2001) cross sectional data, in particular if they are aggregated at the sectoral level, fail to control for time-variant differences in productivity across sectors which might be correlated with, but not caused by, foreign presence. In such a case, the results obtained would be spurious and biased. If productivity in a given industrial sector is much higher than in others, MNCs might be attracted into the former, in which case a basic cross sectional analysis would produce a positive and statistically significant impact between the MNCs and productivity of the locally owned firms. According to the early contributors, Caves and his antecedents, these results would be interpreted as indicative of spillover occurrence even though MNCs were only attracted in the sector and were not necessarily responsible for the high productivity witnessed.

There is another set of spillover studies carried out using a snowballing methodology where local firms linked to foreign firms are traced and examined for production and technological linkages. Rasiah (1994, 1995, 2002a, 2002b) produced concrete evidence of spillovers through such an objective method. However, the capacity of researchers to amass the dataset to undertake this type of analysis is really difficult as it requires the direct participation of the firms to provide whatever links that they can remember. Furthermore, the quantitative as well as the qualitative effects from such links have to be included.

The assessment undertaken here also compares foreign and local firms, taking into consideration possible dynamics of the results obtained. Although Kenya is endowed with low levels of FDI at the national level, it has high foreign presence in the manufacturing industry. FDI accounted for 0.32% and 0.96% of Gross Fixed Capital Formation (GFCF) in 1994 and 1999 respectively.[3] Foreign firms accounted for 69.1% of manufacturing fixed capital formation in 1994, 66.2% in 1999 and 63% in 2001.[4] Results obtained would, therefore, enable a policy-relevant assessment of FDI's conduct and performance in a country that typifies most developing economies (countries in SSA are characterized by low levels of FDI inflows).

Also, it is commonly known that two distinct sets of "native" manufacturers exist in Kenya: Asians and indigenous Africans. Unfortunately, the official data base which we used did not categorize data by these two categories.

### 2.2 Data Description

The empirical data used in this paper comes from unpublished plant level data collected in an annual survey by the Ministry of Trade and Industry, Kenya.[5] The survey data enabled us to create a panel database for the period 1994-2001.[6]

However, despite the effort to construct a comprehensive panel database, it was extremely spotty: several firms had severe cases of missing data in certain years, either due to non-response or failure by firms to provide all the required data and/or information. One of the screening criteria for a firm to be included in this study was that the firm must have responded in all the years, and must have done so in almost all the required variables. Consequently, a balanced panel of 420 firms was created comprising firms that showed consistent time series responses to all the relevant questions over the period 1994-2001, making a panel with 3,360 observations.[7] The data set is fairly representative as it represents an average of 40%[8] for both manufacturing output and employment over all the years included in our sample. This representation provides a reasonably good level, justifying a meaningful policy relevant assessment of FDI's role in industrial development.

In this paper, firms with at least 10% of their nominal capital owned by foreigners are defined as foreign firms. All other firms will be regarded as locally owned firms.[9] This definition was adopted since the Kenyan national authorities also used the same benchmark. On the basis of this definition, about 175 firms were classified as foreign firms while the remaining 245 firms were defined as locally owned firms.

Similar to most economic analysis based on data from underdeveloped countries, this analysis was beset by a lack of suitable deflators for the data sets. Kenya is no different from most sub-Saharan African economies (poor and technically underdeveloped economy) where it is extremely difficult to identify relevant deflators to convert nominal data to constant prices. Data deflation is a necessary condition, especially in time series analysis, in order to remove data fluctuations that might exist due to inflationary effects over time in an economy. Hence, this paper uses the best option available.[10] Consequently, sales and capital investment values were deflated using a Gross Domestic Product (GDP) deflator (based on GDP price indices). The export values were deflated using export price indices for manufactured goods. The expenditure values of machinery and equipment were deflated using import price indices for these.

Another limitation with this data set is that the analysis conducted at 2-digit level ISIC[11] will be limited to only 9 sectors – even then one of the sectors will be dropped due to lack of FDI while two engineering sectors will be combined, leaving only 7 sectors for analysis.[12] In Kenya, the 2-digit level classifies the manufacturing industry into 9 sectors; 3-digit classifies it into about 28 sectors, while 4-digit level classifies it into 58 sectors. It is impossible to undertake panel analysis at 3-digit or 4-digit as this reduces firms to only a few in each ISIC and would therefore not suffice for the intended panel analysis.

*Empirical Analysis: A Panel Data Estimation Technique*

Panel data estimation technique is used here to examine the direct contribution and impact of foreign presence on firm level productivity in Kenyan manufacturing. Besides controlling factors that impinge on productivity, we also control for time dynamics and industry specificities. The task therefore is to come up with an empirical specification that enables modelling of time effects and variations in sector characteristics across sectors. In order to model all these aspects together, we start with a general illustration of our panel data as follows:

$$Y_{it} = \alpha_i + \sum_{j=1}^{k} \beta_{ij} X_{ijt} + \varepsilon_{it} \qquad (1)$$

where $i = 1, 2, \ldots.., n$ denotes a cross sectional unit (a firm), and $t = 1, 2, \ldots..,$ $T$ denotes a given time period. Thus $Y_{it}$ is the value of the dependent variable for firm $i$ at period $t$ and $X_{ijt}$ is the value of $j^{th}$ non-stochastic explanatory variable for firm $i$ at period $t$. The random error term $\varepsilon_{it}$ is assumed to have a mean of zero, $E(\varepsilon_{it}) = 0$, and a constant variance, $E(\varepsilon_{it}) = 0$ and $\beta_{ij}s$ are unknown response coefficients to be modeled.

The above framework can be generalized into two basic frameworks – Fixed Effects (FE) and Random Effects (RE) models. The two are different in the way the constant is taken and interpreted. In the FE model $\alpha_i$ is captured as the group specific constant term. The assumption in the model is that differences across units can be captured in differences in the constant term and thus $\alpha_i$ is an unknown parameter to be estimated. On the other hand, the RE approach specifies $\alpha_i$ as group specific disturbance, similar to $\varepsilon_{it}$. The residual term for random effects can then be expressed as: $\mu_{it} = \vartheta_i + \varepsilon_{it}$. The component $\vartheta_i$ is the random disturbance characterizing the $i^{th}$ observation, and is constant through time.

As indicated above, several effects across industries would be expected to correlate with independent variables. For instance, food-processing, being one of the most productive and dynamic sectors in Kenya, would be expected to attract high FDI and thus have higher foreign presence than other sectors in the manufacturing industry. As a result, an empirical modelling that treats such scenario more explicitly would be required. We do this by including dummies in our panel model specified in equation (1) above,

$$Y_{it} = \alpha_i + \sum_{j=1}^{k} \beta_{ij} X_{ijt} + DUMMY_i + DUMMY_t + \varepsilon_{it} \quad (2)$$

where $DUMMY_i$ represents sectoral[13] dummies considered at 2-digit ISIC level. $DUMMY_t$ represents annual time dummies over the specified panel period 1994-2001.

We consider equation (2) as the basis for empirical estimations to examine the impact of foreign presence on productivity. Given the nature and the limited amount of data we are dealing with, it was deemed important to conduct several estimates for the purpose of checking consistency, validity and robustness of the estimated results across different techniques. Hence, the model was subjected to preliminary estimation which included fixed effects, random effects and Generalized Least Squares (GLS) estimations. Preliminary estimations using Hausman Specification (HS) analysis indicated that RE had more efficient results compared to the FE model. Hence, the study adopted GLS and RE model. Very comparable results were estimated by the two techniques.

The GLS technique allows for heteroscedasticity and correlation to be modeled across panels. The technique also allows for autocorrelation within panels to be modeled, in which case the structure with no autocorrelation, correlation parameter common for all the panels, or a unique correlation parameter for each panel can be modeled separately (Green, 2002; Stata, 2003). In the current scenario, GLS will be estimated allowing for heteroscedasticity and assuming no autocorrelation.[14] Estimation of heteroscedasticity indicated no serious problem with regard to this heteroscedasticity since all estimates easily passed the White (1980) test for heteroscedasticity.

Random effects model can be estimated based on Maximum Likelihood (ML) or GLS. Our estimations were based on the latter and were thus performed assuming homoscedasticity and no autocorrelation. Given the advancement in modelling panel data, it is also possible to make estimations allowing for autocorrelation. However, no significant differences in the results were obtained.

The test for possible statistical correlation showed that none of the independent variables posted high and significant correlation.

## 3. Comparative Behaviour of Foreign and Locally Owned Firms

The sections below present an analysis of foreign participation at both manufacturing industry and sectoral level. A key issue this paper seeks to address is the level of MNC participation when identifying the sectors of the Kenyan Manufacturing industry where MNC activities are most concentrated. This issue can be addressed by looking at shares of significant trends in the panel data. Are the MNCs located equally in all the sectors and sub-sectors, or are they just present in a few selected sectors? If the latter is the case, is it possible to identify them? Could it be true that sectors with high foreign presence levels are also the most dynamic sectors, meaning that they are characterized by high levels of technology related characteristics such as physical and human capital investment, value added and productivity of labour or raw materials? To answer these questions, it is pertinent to begin by conducting a general trend analysis on the basis of key economic indicators.

### *3.1 Comparing Foreign and Locally Owned Manufacturing Firms*

Participation of MNCs in the manufacturing industry was examined by comparing their relative shares with those of locally owned firms[15] on the basis of major manufacturing characteristics, which were in turn examined using key manufacturing indicators such as value added (VAD) and labour productivity (VADL) (see Table 1). Other indicators included factors of production such as capital (KALF), raw material (RMAT) and employment (EMPT). Indicators of human capital and processing capability considered included skilled labour (SKILL) and machinery and equipment (TECHN), respectively. Both output sales (TSALES) and exports sales (EXPTS) were taken as indicators of firm market performance while capacity utilization (CAP) was taken as an indicator of internal firm performance. Table 1 presents the computed percentage shares of both foreign and locally owned firms.

According to the shares computed, foreign firms had higher shares than locally owned firms in virtually all the variables considered. Foreign firms appeared to literally dominate Kenyan manufacturing with over 50% in all the variables throughout the panel period 1994-2001. Taking for instance capital, value added and output sales, the data showed that foreign shares remained relatively high, with above 70% in the entire period 1994-2000. Employment shares remained above 60%, suggesting that MNCs were the largest employers, and larger in size than locally owned firms (if employment is considered an indicator of firm size). Another interesting finding was that apart from consumption of raw materials whose foreign share remained constant (between 67-70%) for both 1994 and 2001, shares of all the other variables demonstrated a declining trend over the period. Contrarily, Table 1 showed that all the variables except raw materials shares and capacity utilization of locally owned firms had increased over the same period.

Two reasons could account for this interesting phenomenon: first, the increase in variable shares could demonstrate that domestic firms were gradually "catching up" with foreign firms in the period. Second, the process could be explained by the disappearance (closures and relocations) of some of the MNC subsidiaries as a result of worsened conditions of doing

Table 1: Firm trends in the panel data sample, percentages based shares, Kenya, 1994-2001

| | 1994 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | | 2001 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | Loc | For | Loc | For | Loc | For | Loc | For | Loc | For | Loc | For | Loc | For | Loc | For |
| RMAT | 32 | 68 | 31 | 69 | 32 | 68 | 32 | 68 | 33 | 67 | 30 | 70 | 32 | 68 | 32 | 68 |
| KALF | 24 | 76 | 22 | 78 | 28 | 72 | 29 | 72 | 28 | 72 | 27 | 73 | 30 | 70 | 30 | 70 |
| EMPT | 30 | 70 | 39 | 61 | 35 | 65 | 36 | 64 | 37 | 63 | 39 | 61 | 40 | 60 | 40 | 60 |
| SKILL | 36 | 64 | 37 | 64 | 38 | 62 | 38 | 62 | 38 | 62 | 37 | 64 | 41 | 59 | 42 | 58 |
| VAD | 18 | 82 | 22 | 78 | 23 | 77 | 17 | 83 | 25 | 76 | 25 | 75 | 28 | 73 | 27 | 74 |
| VADL | 41 | 59 | 37 | 63 | 47 | 53 | 55 | 45 | 53 | 47 | 50 | 50 | 54 | 46 | 54 | 46 |
| TSALES | 24 | 76 | 26 | 74 | 27 | 74 | 27 | 73 | 28 | 72 | 27 | 73 | 29 | 71 | 29 | 71 |
| EXPTS | 32 | 68 | 31 | 69 | 29 | 71 | 33 | 67 | 33 | 67 | 36 | 64 | 36 | 64 | 35 | 65 |
| TECHN | 41 | 59 | 40 | 60 | 42 | 58 | 48 | 52 | 61 | 39 | 48 | 52 | 50 | 50 | 49 | 51 |
| CAP | 62 | 65 | 62 | 63 | 62 | 64 | 62 | 63 | 62 | 63 | 61 | 62 | 62 | 62 | 62 | 62 |

Key: Loc: Local firms; For: Foreign firms. Other acronyms remain as defined in section 3.1.
Source: Computed from Kenya (various issues).

business that characterized the economy in the 1990s when the country witnessed massive institution, infrastructure and government failures. Lack of incentives and support systems led to high cost of operations, resulting in economic stagnation. Annual growth rates computed for all variables further confirmed that foreign firms had a decline in the period 1994-2001, despite their continued dominance in terms of shares (Appendix 1). Locally owned firms enjoyed positive growth rates in value added (2.9%), labour productivity (2.2%), skilled labour (2%), machinery and equipment (0.8%), and total employment (1%) in the same period.[16]

This interesting observation seemed to demonstrate a sort of catching up phenomenon by the locally owned firms. A plausible task was then to try and discern whether FDI spillovers played any role in their catching up process. The decline in the growth of FDI's activities could be attributed to the restructuring undertaken to face the newly emerging environment characterized by external competition and entry of new domestic firms. During this period, the country was still grappling with SAPs, namely liberalization and export orientation. The country was no longer favoured by donors, including multinational financing organizations, leading to reduced financial aid. The situation was further aggravated by the continued weakening of institutions, infrastructural decay and poor economic governance.

### *3.2 Comparing Foreign and Locally Owned Firms by Industrial Sectors*

In this section a further comparison between foreign and locally owned firms is undertaken by manufacturing sectors. A prior examination of foreign presence at the sectoral level done following Aitken and Harrison (1999) showed that only three manufacturing sectors had high FDI levels: food, beverages and tobacco (ISIC 31); chemical, petroleum and plastics (ISIC 35); and machine and engineering industry (ISIC 37). These results implied that FDI was highly concentrated in only a few sectors. It is therefore interesting to investigate whether MNC activities were also concentrated in a similar pattern.

Comparison of shares computed at the two-digit level indicated that foreign firms still dominated in virtually all the economic activities considered. The three sectors with high levels of foreign presence, that is, food, beverages and tobacco; chemicals, petroleum and plastics; and machine and engineering, were specifically unique in that foreign firms had over 60% in all the variables (Table 2), making the three sectors the most dominated by FDI as well as their activities. While foreign shares remained above 70% for value added, it remained above 50% for labour productivity in the three sectors identified. Over time, the capital share of locally owned firms tended to increase, albeit slightly, in chemicals, petroleum and plastics, and machine and engineering. Although foreign firms were virtually the largest employers

Table 2: Trends in the panel data sample, percentages based on annual averages, Kenya, 1994-2001

| | ISIC 31 | | ISIC 32 | | ISIC 33 | | ISIC 34 | | ISIC 35 | | ISIC 36 | | ISIC 37 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Loc | For | Loc | For | Loc | For | Loc | For | Loc | For | Loc | For | Loc | For |
| **1994** | | | | | | | | | | | | | | |
| RMAT | 43 | 57 | 26 | 74 | 81 | 19 | 16 | 84 | 43 | 57 | 5 | 95 | 42 | 58 |
| KALF | 32 | 68 | 20 | 80 | 98 | 2 | 11 | 89 | 12 | 88 | 55 | 45 | 23 | 77 |
| EMPT | 38 | 62 | 32 | 68 | 53 | 47 | 24 | 76 | 46 | 54 | 41 | 59 | 39 | 61 |
| SKILL | 32 | 68 | 32 | 68 | 55 | 45 | 18 | 82 | 41 | 59 | 38 | 62 | 35 | 65 |
| VAD | 11 | 89 | 25 | 75 | 73 | 27 | 20 | 80 | 28 | 72 | 36 | 64 | 10 | 90 |
| VADL | 21 | 79 | 82 | 18 | 70 | 30 | 43 | 57 | 46 | 54 | 62 | 38 | 18 | 82 |
| TSALES | 20 | 80 | 25 | 75 | 78 | 22 | 18 | 82 | 34 | 66 | 17 | 83 | 19 | 81 |
| EXPTS | 30 | 70 | 53 | 47 | 0 | 100 | 7 | 93 | 31 | 69 | 7 | 93 | 32 | 68 |
| TECHN | 38 | 62 | 22 | 78 | 48 | 52 | 52 | 48 | 37 | 63 | 66 | 34 | 35 | 65 |
| **1996** | | | | | | | | | | | | | | |
| RMAT | 45 | 55 | 29 | 71 | 76 | 24 | 15 | 85 | 44 | 56 | 4 | 96 | 19 | 81 |
| KALF | 23 | 77 | 20 | 80 | 98 | 2 | 11 | 89 | 12 | 88 | 39 | 61 | 37 | 63 |
| EMPT | 38 | 62 | 37 | 63 | 51 | 49 | 20 | 80 | 48 | 52 | 35 | 65 | 18 | 82 |
| SKILL | 33 | 67 | 41 | 59 | 53 | 47 | 19 | 81 | 44 | 56 | 59 | 41 | 36 | 64 |
| VAD | 10 | 90 | 29 | 71 | 83 | 17 | 54 | 46 | 26 | 74 | 22 | 78 | 15 | 85 |
| VADL | 22 | 78 | 88 | 12 | 81 | 19 | 58 | 42 | 37 | 63 | 22 | 78 | 31 | 69 |
| TSALES | 20 | 80 | 29 | 71 | 79 | 21 | 40 | 60 | 34 | 66 | 14 | 86 | 17 | 83 |
| EXPTS | 31 | 69 | 44 | 56 | 28 | 72 | 10 | 90 | 25 | 75 | 2 | 98 | 14 | 86 |
| TECHN | 42 | 58 | 23 | 77 | 49 | 51 | 49 | 51 | 38 | 62 | 44 | 56 | 49 | 51 |

Table 2 (continued)

| | ISIC 31 | | ISIC 32 | | ISIC 33 | | ISIC 34 | | ISIC 35 | | ISIC 36 | | ISIC 37 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Loc | For | Loc | For | Loc | For | Loc | For | Loc | For | Loc | For | Loc | For |
| **1998** | | | | | | | | | | | | | | |
| RMAT | 45 | 55 | 26 | 74 | 79 | 21 | 15 | 85 | 43 | 57 | 5 | 95 | 19 | 81 |
| KALF | 20 | 80 | 20 | 80 | 98 | 2 | 10 | 90 | 17 | 83 | 45 | 55 | 34 | 66 |
| EMPT | 39 | 61 | 33 | 67 | 55 | 45 | 23 | 77 | 44 | 56 | 35 | 65 | 22 | 78 |
| SKILL | 35 | 65 | 41 | 59 | 56 | 44 | 21 | 79 | 34 | 66 | 52 | 48 | 39 | 61 |
| VAD | 11 | 89 | 24 | 76 | 82 | 18 | 40 | 60 | 31 | 69 | 28 | 72 | 17 | 83 |
| VADL | 20 | 80 | 93 | 7 | 85 | 15 | 37 | 63 | 32 | 68 | 43 | 57 | 38 | 62 |
| TSALES | 20 | 80 | 25 | 75 | 81 | 19 | 34 | 66 | 37 | 63 | 17 | 83 | 18 | 82 |
| EXPTS | 37 | 63 | 14 | 86 | 30 | 70 | 8 | 92 | 36 | 64 | 28 | 72 | 18 | 82 |
| TECHN | 41 | 59 | 26 | 74 | 48 | 52 | 89 | 11 | 43 | 57 | 48 | 52 | 48 | 52 |
| **2000** | | | | | | | | | | | | | | |
| RMAT | 43 | 57 | 27 | 73 | 81 | 19 | 13 | 87 | 43 | 57 | 4 | 96 | 19 | 81 |
| KALF | 27 | 73 | 20 | 80 | 98 | 2 | 10 | 90 | 17 | 83 | 45 | 55 | 32 | 68 |
| EMPT | 42 | 58 | 24 | 76 | 53 | 47 | 24 | 76 | 51 | 49 | 35 | 65 | 30 | 70 |
| SKILL | 39 | 61 | 33 | 67 | 58 | 42 | 20 | 80 | 49 | 51 | 54 | 46 | 39 | 61 |
| VAD | 11 | 89 | 36 | 64 | 82 | 18 | 61 | 39 | 31 | 69 | 20 | 80 | 24 | 76 |
| VADL | 22 | 78 | 92 | 8 | 79 | 21 | 69 | 31 | 34 | 66 | 48 | 52 | 36 | 64 |
| TSALES | 21 | 79 | 31 | 69 | 82 | 18 | 42 | 58 | 37 | 63 | 12 | 88 | 21 | 79 |
| EXPTS | 41 | 59 | 65 | 35 | 79 | 21 | 7 | 93 | 30 | 70 | 15 | 85 | 28 | 72 |
| TECHN | 42 | 58 | 27 | 73 | 49 | 51 | 77 | 23 | 41 | 59 | 44 | 56 | 47 | 53 |

Table 2 (continued)

| | ISIC 31 | | ISIC 32 | | ISIC 33 | | ISIC 34 | | ISIC 35 | | ISIC 36 | | ISIC 37 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Loc | For | Loc | For | Loc | For | Loc | For | Loc | For | Loc | For | Loc | For |
| **2001** | | | | | | | | | | | | | | |
| RMAT | 42 | 58 | 26 | 74 | 80 | 20 | 18 | 82 | 41 | 59 | 4 | 96 | 19 | 81 |
| KALF | 27 | 73 | 22 | 78 | 98 | 2 | 9 | 91 | 16 | 84 | 45 | 55 | 32 | 68 |
| EMPT | 42 | 58 | 25 | 75 | 54 | 46 | 26 | 74 | 50 | 50 | 35 | 65 | 30 | 70 |
| SKILL | 40 | 60 | 36 | 64 | 60 | 40 | 22 | 78 | 47 | 53 | 54 | 46 | 39 | 61 |
| VAD | 11 | 89 | 31 | 69 | 83 | 17 | 53 | 47 | 30 | 70 | 20 | 80 | 26 | 74 |
| VADL | 21 | 79 | 93 | 7 | 80 | 20 | 75 | 25 | 29 | 71 | 48 | 52 | 49 | 51 |
| TSALES | 20 | 80 | 28 | 72 | 81 | 19 | 43 | 57 | 35 | 65 | 12 | 88 | 22 | 78 |
| EXPTS | 40 | 60 | 63 | 37 | 79 | 21 | 7 | 93 | 27 | 73 | 15 | 85 | 25 | 75 |
| TECHN | 38 | 62 | 29 | 71 | 56 | 44 | 76 | 24 | 39 | 61 | 43 | 57 | 47 | 53 |

Key: Loc: Local firms; For: Foreign firms. Other acronyms remain as defined in section 3.1.
Source: Computed from Kenya (various issues).

in all the manufacturing sectors, employment shares in food, beverages and tobacco seemed to increase for locally owned firms from 38% to 42% in the period 1994-2001. Taking employment level as a proxy of firm size, foreign firms were bigger in size than locally owned firms in the three sectors. Foreign firms tended to increase their shares of raw material consumption over the period.

On human capital, an equally interesting observation emerged where the level of skill shares tended to increase in all the three sectors for locally owned firms (see Table 2). Similarly, domestic firms seemed to be raising their processing capability in chemicals, petroleum and plastics and in machine and engineering. Their shares appeared to increase from 37% to 39%, and 35% to 47%, respectively, during the period (Table 2). Nevertheless, foreign firms still remained the largest employers of skilled labour force in most of the sectors. Indicators of firm market performance showed that shares of domestic firms tended to increase for chemicals, petroleum and plastics and machine and engineering from 34% to 35% and 19% to 22%, respectively, for the same period (Table 2). An increase in export shares for domestic firms was only registered in food, beverages and tobacco from 30% to 40% for the period 1994-2001.

Interestingly, sectoral analysis tends to arrive at a conclusion similar to that obtained earlier in the context of the whole industry analysis: that locally owned firms tended to be gradually catching up with foreign firms based on their observed rising shares in the study period. We put this in a better context by confirming it further using sectoral growth rates computed for both foreign and locally owned firms in the period 1994-2001. What is also noteworthy is that in terms of growth rates, domestic firms performed better than foreign firms as they recorded positive growth rates in more variables than foreign firms did (see Appendix 1).

Also, for this purpose we examined the statistical significance of differences in means of productivity indicators using T-tests. The approach used here differs from Haddad and Harrison's (1993) in that more productivity indicators were used for consistency checks, and instead of just computing ratios we undertook direct comparisons using a two tailed T-test statistical analysis. For firm productivity, we used the following indicators: value added, labour productivity, and productivity of raw materials. Two intensities were computed to enrich further the comparisons, i.e., capital intensities and skill intensities.

Appendix 2 reports the T-test results comparing productivity of performance of foreign and locally owned firms. As an example, in column three, the value of -7.337 for food, beverages and tobacco was statistically significant at 1%. Also, in column seven the value -6.625 for food, beverages and tobacco was statistically significant at 1%. The two examples suggest that mean value added and skill intensities for foreign firms were both significantly higher than that of locally owned firms. These results confirmed that foreign firms were empirically more productive than locally owned firms with all the indicators used in food, beverages and tobacco and in chemicals, petroleum and plastics. In all the cases the T-values produced were statistically significant at 1%, 5% and 10%.

From the above discussions, several distinctions must be addressed when examining the effect of FDI on productivity using Kenya's manufacturing data: *First*, foreign presence was relatively high in only a few sectors, and not evenly distributed across the manufacturing industry. These sectors were food, beverages and tobacco; chemicals, petroleum and plastics; and machine and engineering. *Second*, on the basis of the variables examined, FDI's activities were highly concentrated in the same three sectors, that is, where foreign presence was the highest. *Third*, based on the same indicators, foreign firms dominated in the three sectors. T-tests showed that foreign firms were more productive than domestic firms. *Fourth*, in terms of growth rates calculated, locally owned firms performed better than foreign firms suggesting they were gradually catching up. Nevertheless, foreign firms still dominated, controlling most of the manufacturing activities.

## 4. Effect of Foreign Presence on Firm Level Productivity

A major objective of this paper is to empirically determine the role of foreign presence on Kenya's manufacturing industry on firm level productivity. This is done by examining total factor productivity. The empirical procedure is outlined below.

### *4.1 Firm Level Productivity*

Departing from the assumption that technology skills, knowledge and technology embodied in foreign owned firms are transmitted to the domestic firms, it is pertinent to assume that such can result in increased productivity performance. We therefore begin analysis by specifying a general form of the production function, assuming a production function of the Cobb-Douglas type where a firm's output is presented by say $Y_{it}$ which depends on three input factors: capital $K_{it}$, labour $L_{it}$ and raw materials $M_{ijt}$. Such a production function can be specified as follows:

$$Y_{ijt} = A_{ijt} F(K_{ijt}, L_{ijt}, M_{ijt}) \tag{3}$$

where $i$ denotes the firm, $j$ the industry and $t$ the year; all the properties of production function are assumed to hold.[17] In the recent past, use of a production function approach has been increasingly adopted in determining FDI's impact on firm level productivity (Haddad and Harrison, 1993; Aitken and Harrison, 1999). Following Lucas (1988), labour $L_{it}$ force can also be categorized into skilled (SKILL) and unskilled (UNSKILL) workers. Thus, equation 3 above becomes:

$$Y_{ijt} = A_{ijt}F(K_{ijt}, SKILL_{ijt}, UNSKILL_{ijt}, M_{ijt}) \quad (4)$$

In the above specification $Y_{ijt}$ is total production where $A_{ijt}$ is the total factor productivity, which is assumed to vary across firms and sectors, and fluctuate with time. According to this specification the output production changes only if the inputs into production change. A lot of significance is usually attached to $A_{ijt}$ as an indicator of certain components in a firm; all demonstrating the levels of existing skill, usefulness of knowledge, firm-level capabilities and other characteristics. Such characteristics include managerial capabilities and organizational competence, inter-sector transfer of resources, R&D, increasing returns to scale, embodied technical progress, market widening, institutional/infrastructure improvement and diffusion of technology. Hence, taking the log level specification of equation 4 and incorporating an error term $\mu_{ijt}$, yields:

$$LogY_{ijt} = LogA_{ijt} + \beta_1 LogK_{ijt} + \beta_2 LogSKILL_{ijt} + \beta_3 LogUNSKILL_{ijt} + \beta_4 LogM_{ijt} + \mu_{ijt} \quad (5)$$

where $\mu_{ijt} = \alpha_{ijt} + \vartheta_{ijt}$. This is the standard random effects model as explained above. The analysis undertaken will examine the impact of foreign investment on all firms in Kenya and then on domestic firms separately. Although $A_{ijt}$ can be decomposed into various determinants as mentioned, for simplicity, we decompose it into a few components which allow us to include FDI related variables and important dummies as shown in equation 6 below. Since the scope of this study does not include investigating the TFP drivers, no detailed decomposition of TFP drivers will be undertaken.

$$LogA_{ijt} = \beta_3 PART_{ijt} + \beta_4 FORPS_{ijt} + \beta_5 DUMMY_{ijt} + \beta_6 DUMMY_{ijt} \quad (6)$$

where $PART_{ijt}$ is foreign ownership at firm level, $FORPS_{ijt}$ is foreign presence at sector level, and $DUMMY_{ijt}$ and $DUMMY_{ijt}$ are dummy variables for sector and time respectively. These two dummies are important in controlling for the industry specificities and inter temporal fluctuations. All the standard traditional models failed to control for these phenomena, primarily due to data constraints. Hence, results of such studies were based only on cross-sectional data at a particular point in time. Combining equation (5) and (6) yielded the following estimating equation:

$$LogY_{ijt} = \beta_0 + \beta_1 LogK_{ijt} + \beta_2 LogSKILL_{ijt} + \beta_3 LogUNSKILL_{ijt} + \beta_4 LogM_{ijt} + \beta_5 PART_{ijt} + \beta_6 FORPS_{ijt} + \beta_7 DUMMY_{ijt} + \beta_8 DUMMY_{ijt} + \mu_{ijt} \quad (7)$$

Since equation 7 is a typical double-log specification, the estimated coefficient parameters will basically be output performance elasticities. In this estimation, the dependent variable $Y_{ijt}$, is output performance proxied by the value added for each firm. Capital was proxied by value of capital investment $K_{ijt}$. Labour force was classified into skilled $SKILL_{ijt}$ and unskilled $UNSKILL_{ijt}$ workers and both of them were measured in absolute numbers for each firm. Raw material was proxied by the value of raw materials consumed $M_{ijt}$ by each firm. Both industry dummy $DUMMY_j$ and time dummy $DUMMY_t$ were included to capture various fluctuations due to non-observable sectoral and time effects.

All the estimated coefficients for the factor inputs (capital, skill, unskilled and raw materials) were expected to be positive and significant, while the expected sign for the foreign presence coefficient both at firm and sector level was expected to be either positive or negative. A positive sign coefficient would suggest a positive impact, or in other words, productivity enhancing influence of foreign presence in Kenya's manufacturing. A negative sign, on the other hand, would mean a negative impact.

A positive impact would imply that foreign firms contributed positively to the productivity growth through technology transfer from foreign firms, knowledge, skills and other forms of spillovers. On the contrary, negative impact would imply that domestic firms in Kenyan manufacturing do not benefit from foreign presence. It could also imply that foreign firms in Kenya operate in seclusion or in clusters which might be characterized by high concentration, and perhaps with high technology gaps between foreign and locally owned firms that do not permit such spillover benefits to occur. It could also be the case that foreign firms have established few vertical and horizontal linkages with domestic firms, hindering steady flow of knowledge, techniques and other spillovers to the local firms.

The nature and level of employment in the foreign firms could also be another inhibiting factor. For instance, employment in raw material seeking environment is not expected to result in much acquisition of knowledge and skills since this involves low value added activities. Similarly, employment at low level cadres only is not likely to result in acquisition of much knowledge and skills. Finally, industry and time dummies were included to capture the non-observable sectoral and time effects: these were expected to be significant. The results of the estimated model 7 are presented in Tables 3 and 4.

Table 3 presents the GLS and RE results of all the firms included in the panel sample. For each of the econometric techniques used, the model estimation was repeated three times. The first estimation excluded dummies, the second included only time dummies while the last included both time and industry dummies. Based on the three econometric techniques, the coefficient estimated for foreign presence at the sector level were positive and statistically highly significant when no dummies were included. A similar trend was witnessed when only time dummies were included. The coefficient estimated with time dummies only and with no dummies was the same 0.004 with GLS and was significant at 1%. Similarly, results of random effects were highly comparable and consistent with no dummies and with only time dummies included. The results obtained without any dummies supported those of the early contributors suggesting that an increase of 100% in foreign presence results in an increase of 0.4 percentage points in firm productivity.

Interestingly, when time and industry dummies are included, the coefficients obtained in all the cases decreased substantially in magnitude and were insignificant. Coefficients of 0.003 and 0.002 were obtained with GLS and RE, respectively, and these were statistically insignificant. This confirms that results obtained without dummies and with industry dummies are not robust in the context of the two estimation techniques employed. This also implies that the effect of foreign presence on firm productivity is reduced when sectoral dummies are considered. These results are in support of recent methodological developments in spillover analysis (Haddad and Harrison, 1997; Aitken and Harrison, 1999). Since industry differences are important and ought to be taken into consideration, we are inclined to support these results. However, it must be emphasized that more work is needed employing different techniques and case studies.

With regard to foreign presence at the firm level, very consistent and comparable results were obtained with the two estimation techniques. However, the coefficients tended to change their statistical significance with all dummies included. The estimated coefficient without dummies was 0.002 with both GLS and RE, which was highly significant at 1%. Similarly, the coefficient estimated with industry dummies was 0.002 with both GLS and RE and significant at 5%. This implies that an increase of 100% in foreign presence at the firm level would result in increased productivity by about 0.2% when industry dummies are included. These results suggest that foreign participation at the firm level plays a positive and significant role towards firm productivity in Kenya's manufacturing sector.

Table 3: Foreign presence on firm level productivity, panel regression estimates for all firms, Kenya, 1994-2001

| Variable | GLS | GLS | GLS | Rand. eff. | Rand. eff. | Rand. eff. |
|---|---|---|---|---|---|---|
| LKALF | 0.134*** | 0.133*** | 0.133*** | 0.144*** | 0.143*** | 0.144*** |
| *Capital* | (0.012) | (0.012) | (0.012) | (0.012) | (0.012) | (0.012) |
| LRMAT | 0.539*** | 0.537*** | 0.537*** | 0.544*** | 0.541*** | 0.545*** |
| *Raw material* | (0.017) | (0.017) | (0.017) | (0.017) | (0.017) | (0.018) |
| LSKILL | 0.527*** | 0.526*** | 0.541*** | 0.543*** | 0.543*** | 0.559*** |
| *Skilled labour* | (0.022) | (0.022) | (0.022) | (0.022) | (0.022) | (0.023) |
| LUNSKILL | 0.394*** | 0.394*** | 0.392*** | 0.383*** | 0.383*** | 0.380*** |
| *Unskilled labour* | (0.019) | (0.019) | (0.019) | (0.019) | (0.019) | (0.019) |
| PART–FNS | 0.002*** | 0.002*** | 0.002** | 0.002*** | 0.002*** | 0.002** |
| (***Firm-level***) | (0.0007) | (0.0007) | (0.0007) | (0.0008) | (0.0008) | (0.008) |
| FORPS | 0.004*** | 0.004*** | 0.003 | 0.004*** | 0.004*** | 0.002 |
| (***Sector-level***) | (0.001) | (0.001) | (0.005) | (0.001) | (0.001) | (0.005) |
| Constant | 1.774*** | 1.868*** | 1.844*** | 1.682*** | 1.782*** | 1.739*** |
| | (0.121) | (0.138) | (0.331) | (0.126) | (0.144) | (0.328) |
| R squared | | | | 0.59 | 0.59 | 0.59 |
| *Time Dummies* | NO | YES | YES | NO | YES | YES |
| *Industry Dummies* | NO | NO | YES | NO | NO | YES |
| F-Test | | | | | | |
| Log Likelihood | -4785.69 | -4779.93 | -4769.63 | | | |
| Wald-Test for GroupWise | 4089.65 | 4116.15 | 4163.01 | 4109.99 | 4127.03 | 4168.84 |
| Heteroscedasticity | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| No. of observations | 2875 | 2875 | 2875 | 2875 | 2875 | 2875 |

Notes: Standard errors are presented in parentheses.
*, **, *** represent 10%, 5% and 1% levels of significance respectively.
Source: Computed from Kenya (various issues).

All the other independent variables had the expected results with a high degree of statistical significance at 1% even when time and sectoral dummies were included (Table 3). Capital had a coefficient of 0.13 with GLS and 0.14 with RE, implying that a firm increases its capital by 100%, and was likely to increase its productivity by between 13 and 14 percentage points. Capital is important as one of the main drivers of production. With time and sectoral dummies included, the estimated coefficients for raw material was 0.54 with GLS and 0.55 with RE. The estimated results for skilled labour were 0.56 with RE and 0.54 with GLS. Skilled labour is important for firm innovation and to drive production activities. In the case of unskilled labour, a coefficient of 0.38 was obtained with RE and 0.39 with GLS. Unskilled labour is also necessary for productivity, especially in technically backward countries like Kenya where production activities primarily involve low value addition.

Table 4 presents the results for only the domestic firms. The results based on foreign presence at the sector level were positive and significant, suggesting that Kenyan firms benefited from an increase in foreign presence. However, these findings further confirmed the results discussed above. The results obtained with and without taking industry differences into consideration were completely different. The results obtained without dummies compared to those obtained with time dummies included in the two estimation techniques. With GLS, foreign presence had a coefficient of 0.0024, which was statistically significant at 5%. With time dummies, the coefficient was 0.0024 and significant at 10%. With RE, a similar coefficient, 0.002, was obtained which was near significant at 10%. All these estimates suggest that an increase of FDI presence at the sector level by 100% would increase productivity output in domestic firms by between 0.20 and 0.24 percentage points. We emphasize that these results are in line with traditional models (Standard productivity models estimated ignoring aspects such as industry, time and locational effects).

Results estimated with time and industry dummies included were not significant, confirming the findings produced above. Once again, the results supported recent development proponents of spillover analysis. As strongly argued in this paper, the methodological approach considered seems to largely determine the outcome of the spillover analysis. Since we support the argument that for spillovers to occur, a more complex approach is needed incorporating many factors systematically, and as such, it is tempting to support these findings. However, we choose not to, and emphasize that extra work is required employing alternative analytical techniques including a reconceptualization of spillovers.

All the other independent variables had the expected results, and were positive and significant at 1% when time and sectoral dummies were included.

Table 4: Impact of foreign presence on firm level productivity, panel regression estimates for domestic firms, Kenya, 1994-2005

| Variable | GLS | GLS | GLS | Rand. eff. | Rand. eff. | Rand. eff. |
|---|---|---|---|---|---|---|
| LKALF | 0.103*** | 0.103*** | 0.111*** | 0.113*** | 0.113*** | 0.123*** |
| *Capital* | (0.014) | (0.014) | (0.014) | (0.015) | (0.15) | (0.148) |
| LRMAT | 0.607*** | 0.605*** | 0.620*** | 0.602*** | 0.600*** | 0.629*** |
| *Raw material* | (0.021) | (0.021) | (0.021) | (0.021) | (0.215) | (0.022) |
| LSKILL | 0.528*** | 0.527*** | 0.533*** | 0.532*** | 0.532*** | 0.539*** |
| *Skilled labour* | (0.027) | (0.027) | (0.027) | (0.028) | (0.025) | (0.028) |
| LUNSKILL | 0.421*** | 0.421*** | 0.433*** | 0.408*** | 0.4084** | 0.427*** |
| *Unskilled labour* | (0.024) | (0.024) | (0.025) | (0.026) | (0.026) | (0.026) |
| PART–FNS | – | – | – | – | – | – |
| (***Firm-level***) | | | | | | |
| FORPS | 0.0024** | 0.0024* | 0.0012 | 0.002 | 0.002 | 0.001 |
| (***Sector-level***) | (0.001) | (0.001) | (0.006) | (0.001) | (0.001) | (0.007) |
| Constant | 1.641*** | 1.697*** | 1.257*** | 1.640*** | 1.691*** | 1.129** |
| | (0.156) | (0.178) | (0.436) | (0.162) | (0.185) | (0.448) |
| R squared | | | | 0.57 | 0.58 | 0.59 |
| *Time Dummies* | NO | YES | YES | NO | YES | YES |
| *Industry Dummies* | NO | NO | YES | NO | NO | YES |
| F-Test | | | | | | |
| Log Likelihood | -2716.76 | -2712.42 | -2693.19 | | | |
| Wald-Test for GroupWise | 2357.94 | 2376.49 | 2468.16 | 2246.32 | 2253.86 | 2367.47 |
| Heteroscedasticity | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| No. of observations | 1671 | 1671 | 1671 | 1671 | 1671 | 1671 |

Notes: Standard errors are presented in parentheses.
*, **, *** represent 10%, 5% and 1% levels of significance respectively.
Source: Computed from Kenya (various issues).

Capital had a coefficient of 0.11 with GLS and 0.12 with RE, meaning that if a firm increases its capital by 100%, it was likely to increase its productivity by between 11 and 12 percentage points. With time and sectoral dummies included, the estimated coefficients for raw material was 0.62 with GLS and 0.63 with RE. This suggests that if a firm increases its raw material consumption by 100% it was likely to increase its productivity by between 62 and 63 percentage points. The estimated coefficient for skilled labour was 0.53 with GLS and 0.54 with RE. In the case of unskilled labour, a coefficient of 0.43 was obtained with both GLS and RE. In all these cases the results were consistent and as expected.

### *4.2 Effect of Foreign Presence on Firm Productivity using Scale*

Earlier estimations conducted pooled the firms together without considering the variation that could arise due to firm size differences. In this section, we analyse the impact of foreign presence on firm level productivity by scale orientation. The influence of scale on spillover occurrence can either be positive or negative. For industries involved with economies of scale, a minimum efficiency scale is involved, and in such a case, scale would influence productivity (Pratten, 1971; Scherer, 1973, 1980).

On the contrary, due to the importance of flexibility offered by scope, small firms are likely to perform better in specific industries (Sabel, 1989). By the same rationale, large firms by virtue of their size are likely to enjoy economies of scale when they undertake mass production of goods and services. As the firm grows and production units expand, its position to operate on reduced costs increases. These firms enjoy technical economies as they can acquire advanced expensive machinery and equipment. They also enjoy managerial economies in that a firm gets better placed to organize its administration by undertaking proper division of labour based on specialization. Chain of command is established leading to improved techniques for production and distribution. This is in line with Adam Smith's emphasis of labour and specialization (Smith, 1776). Financial economies of scale are those whereby large firms can borrow at lower rates than small firms. Marketing economies of scale are when a large firm is in a better position to spread the cost of its advertisement in national television, radio and local dailies across a large level of output. R&D economies refer to when a firm is able to develop new and better products. Similarly, as articulated by Alfred Marshall (1920), large firms are better placed to enjoy from existing external economies of scale, such as existing local skilled labour force and existing specialized support system (for example, suppliers of parts or services).

In order to account for the size factor, all the firms in the sample were considered at three levels. The first level included all firms in the sample, the second included domestic firms while the last level included foreign firms. Each level was then classified into two groups "small firms" and "large firms". Firms employing less than 138 people were classified as "small firms" while firms employing 138 or more were classified as "large firms".

The estimated results of foreign impact on firm level productivity based on the size orientation were consistent and robust. The results of all the variables included were as expected; statistically significant with appropriate signs of the estimated coefficients. Their interpretation follows the above section, which provided sufficient evidence that they all the variables contributed positively to the productivity of the firms. So, in the current analysis we concentrate on interpreting the results estimated with foreign presence alone. For all small firms, estimation by GLS produced a coefficient of 0.004 which was statistically significant at 1% without dummies included. Results estimated for RE without dummies were near significant at 10%. With dummies included the results estimated were not significant for both GLS and RE. On the contrary, results estimated for all large firms were more robust without dummies. The coefficients estimated were positive 0.016 and 0.017 for GLS and RE, respectively, and were both significant at 1%. These results showed that for large firms, FDI spillovers contribute positively to the firms' productivity.

As in the above, with dummies included, the results were not significant. Two interesting conclusions emerged: first, results obtained with large firms are more robust than those obtained from the small firms, implying that large firms in the Kenyan manufacturing industry are more likely to benefit from spillover occurrence than the small firms. This proves that the effect of foreign presence is influenced by size. However, the empirical evidence is not very strong in support of that and more analysis in the form of further studies needs to be done. Second, results estimated without inclusion of dummies are more robust than those obtained with dummies. Results obtained without dummies tend to support results obtained by the early contributors, while results obtained with dummies included support results observed with recent developments in the productivity analysis. This compares well with the results obtained above.

Results obtained for large domestic firms were more robust than those obtained for small domestic firms. While results estimated for small domestic firms were not significant, results of large firms were positive and statistically significant at 5%. The estimated coefficients by GLS and RE were 0.013 and 0.019, respectively. The results showed that for large domestic firms, FDI spillovers contribute positively to the firms' productivity. As stated above, results obtained with dummies included supported results observed with recent developments in the productivity analysis.

Table 5: Impact of foreign presence on firm level productivity by scale panel regression estimates for all firms by scale, Kenya

| Variable | All Small Firms | | | | Small Domestic Firms | | | |
|---|---|---|---|---|---|---|---|---|
| | GLS | GLS | Rand. eff. | Rand. eff. | GLS | GLS | Rand. eff. | Rand. eff. |
| LKALF | 0.129*** | 0.130*** | 0.134*** | 0.134*** | 0.088*** | 0.096*** | 0.089*** | 0.101** |
| *Capital* | (0.012) | (0.120) | (0.013) | (0.013) | (0.014) | (0.014) | (0.015) | (0.013) |
| LRMAT | 0.558*** | 0.560*** | 0.571*** | 0.572*** | 0.605*** | 0.618*** | 0.608*** | 0.631*** |
| *Raw material* | (0.019) | (0.019) | (0.019) | (0.019) | (0.022) | (0.022) | (0.023) | (0.023) |
| LSKILL | 0.510*** | 0.512*** | 0.508*** | 0.508*** | 0.528*** | 0.517*** | 0.522*** | 0.510*** |
| *Skilled labour* | (0.026) | (0.017) | (0.027) | (0.027) | (0.032) | (0.032) | (0.033) | (0.034) |
| LUNSKILL | 0.377*** | 0.373*** | 0.354*** | 0.352*** | 0.425*** | 0.431*** | 0.412*** | 0.422*** |
| *Unskilled labour* | (0.023) | (0.023) | (0.024) | (0.024) | (0.029) | (0.030) | (0.031) | (0.031) |
| FORPS | 0.004*** | 0.001 | 0.002 | 0.001 | 0.002 | 0.002 | 0.0012 | 0.002 |
| (***Sector-level***) | (0.001) | (0.005) | (0.002) | (0.005) | (0.001) | (0.007) | (0.001) | (0.007) |
| Constant | 1.873*** | 1.901*** | 1.888*** | 1.871*** | 1.763*** | 1.310*** | 1.794*** | 1.256*** |
| | (0.135) | (0.333) | (0.161) | (0.351) | (0.171) | (0.461) | (0.179) | (0.480) |
| R squared | | | 0.49 | 0.50 | | | 0.51 | 0.52 |
| *Time & Industry Dummies* | NO | YES | NO | YES | NO | YES | NO | YES |
| Log Likelihood | -3656.45 | -3640.98 | | | -2231.97 | -2214.76 | | |
| Wald-Test for | 2320.62 | 2380.22 | 2120.27 | 2216.64 | 1545.17 | 1617.52 | 1428.28 | 1495.99 |
| GroupWise Heter. | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| No. of observations | 2258 | 2258 | 2258 | 2258 | 1389 | 1389 | 1389 | 1389 |

Table 5 (continued)

| Variable | All Large Firms | | | | Large Domestic Firms | | | |
|---|---|---|---|---|---|---|---|---|
| | GLS | GLS | Rand. eff. | Rand. eff. | GLS | GLS | Rand. eff. | Rand. eff. |
| LKALF | 0.237*** | 0.212*** | 0.212*** | 0.178*** | 0.303*** | 0.271*** | 0.314*** | 0.278*** |
| *Capital* | (0.028) | (0.028) | (0.032) | (0.033) | (0.042) | (0.049) | (0.045) | (0.052) |
| LRMAT | 0.472*** | 0.408*** | 0.472*** | 0.408*** | 0.511*** | 0.484*** | 0.528*** | 0.494*** |
| *Raw material* | (0.039) | (0.038) | (0.042) | (0.044) | (0.061) | (0.067) | (0.063) | (0.072) |
| LSKILL | 0.490*** | 0.491*** | 0.544*** | 0.518*** | 0.229** | 0.226** | 0.232** | 0.211*** |
| *Skilled labour* | (0.056) | (0.057) | (0.059) | (0.061) | (0.096) | (0.098) | (0.104) | (0.110) |
| LUNSKILL | 0.384*** | 0.314*** | 0.368*** | 0.296*** | 0.227*** | 0.222*** | 0.201*** | 0.188*** |
| *Unskilled labour* | (0.054) | (0.047) | (0.048) | (0.050) | (0.063) | (0.069) | (0.067) | (0.074) |
| FORPS | 0.016*** | 0.005 | 0.017*** | 0.003 | 0.013** | -0.001 | 0.019** | -0.003 |
| (***Sector-level***) | (0.003) | (0.012) | (0.005) | (0.013) | (0.006) | (0.014) | (0.007) | (0.018) |
| Constant | 0.822* | 2.588*** | 0.778*** | 3.024*** | 2.249* | 3.466*** | 1.819*** | 3.666*** |
| | (0.443) | (0.877) | (0.601) | (0.940) | (0.942) | (1.200) | (1.001) | (1.453) |
| R squared | | | 0.40 | 0.44 | | | 0.37 | 0.43 |
| *Time & Industry Dummies* | NO | YES | NO | YES | NO | YES | NO | YES |
| Log Likelihood | -1096.33 | -1038.41 | | | -458.04 | -435.55 | | |
| Wald-Test for GroupWise Heter. | 710.03 | 730.29 | 461.05 | 470.01 | 166.39 | 475.71 | 158.83 | 200.22 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| No. of observations | 624 | 624 | 624 | 624 | 282 | 282 | 282 | 282 |

Notes: Standard errors are presented in parentheses.
*, **, *** represent 10%, 5% and 1% levels of significance respectively.

Source: Computed from Kenya (various issues).

### *4.3 Effect of Foreign Presence on Firm Productivity using Technology Gap*

To examine the impact of foreign presence on firm productivity by technology gap orientation, firms were classified into low and high technology gap. These were determined following Smarzynska's (2002) approach as the percentage difference between the productivity of the average foreign firm in the sector and each individual firm. Any firm with more than the industry average would be regarded as a firm with a small technology gap. Except for foreign presence, results estimated for all other variables were as expected. Table 6 shows that results of GLS and RE methods estimated for all firms in the low technology gap category, without inclusion of dummies, produced comparable results: 0.006 and 0.005 for GLS and RE, respectively, with both significant at 1%. These results compared well to those of the early contributors. Results obtained with dummies included were not significant and thus comparable to those obtained with recent developments to the literature on empirical spillover.

Contrarily, results obtained with the high technology gap were somewhat amazing. When all firms were considered, the coefficients of foreign presence produced without dummies remained positive but became insignificant. From the perspective of early contributors, these results could be interpreted to mean that high technology gap does not favour spillover occurrence. Similar to the above, results estimated with dummies included were not statistically significant.

In the perspective of early contributors, these results failed to support high technology gap requirements for spillovers, suggesting that a relatively low technology gap was inevitable for spillovers to occur in the Kenyan context. This observation differs from Findlay's (1978) conjecture that a relatively wide gap created the necessary pressure for change in the developing country. A similar school of thought was forged by Abramovitz' (1986) seminal contribution in his catching up model whereby countries lagging behind were in a position to generate more growth, but only if their social capabilities were sufficiently developed.

The observation is in support of low technology gap advocates (Cantwell, 1989; Kokko, 1994; Kokko, Tansini and Zejan, 1996; Sjoholm, 1999). When technology gaps are too large they usually require inputs of far more sophisticated machinery embedded in wider systems of, for example, control and quality, that takes years to acquire through high levels of training and other forms of human capital development. Therefore, the wider the technology gap, the less likely that a locally owned firm could make such a jump without either a foreign partner or a huge amount of public sector support (for example, in terms of knowledge, technology assistance and finance).

Table 6: Impact of foreign presence on firm level productivity by technology gap, panel regression estimates by technology gap, Kenya

| Variable | Low Technology Gap (All Firms) | | | | Low Technology Gap (Domestic Firms) | | | |
|---|---|---|---|---|---|---|---|---|
| | GLS | GLS | Rand. eff. | Rand. eff. | GLS | GLS | Rand. eff. | Rand. eff. |
| LKALF | 0.123*** | 0.122*** | 0.137*** | 0.137*** | 0.060*** | 0.066*** | 0.084*** | 0.096** |
| *Capital* | (0.013) | (0.014) | (0.014) | (0.014) | (0.017) | (0.017) | (0.018) | (0.018) |
| LRMAT | 0.524*** | 0.523*** | 0.526*** | 0.528*** | 0.574*** | 0.587*** | 0.580*** | 0.605*** |
| *Raw material* | (0.020) | (0.020) | (0.020) | (0.021) | (0.023) | (0.024) | (0.024) | (0.025) |
| LSKILL | 0.574*** | 0.588*** | 0.598*** | 0.614*** | 0.557*** | 0.563*** | 0.560*** | 0.567*** |
| *Skilled labour* | (0.026) | (0.026) | (0.026) | (0.027) | (0.031) | (0.031) | (0.033) | (0.033) |
| LUNSKILL | 0.371*** | 0.371*** | 0.345*** | 0.344*** | 0.378*** | 0.387*** | 0.359*** | 0.374*** |
| *Unskilled labour* | (0.022) | (0.022) | (0.022) | (0.022) | (0.027) | (0.028) | (0.029) | (0.029) |
| FORPS | 0.006*** | 0.004 | 0.005*** | 0.003 | 0.003** | 0.001 | 0.003* | 0.0003 |
| (***Sector-level***) | (0.001) | (0.012) | (0.001) | (0.011) | (0.001) | (0.015) | (0.001) | (0.014) |
| Constant | 1.833*** | 1.943*** | 1.738*** | 1.883*** | 2.048*** | 1.873*** | 1.941*** | 1.674*** |
| | (0.138) | (0.759) | (1.467) | (0.704) | (0.177) | (0.904) | (0.185) | (0.864) |
| R squared | | | 0.59 | 0.60 | | | 0.57 | 0.58 |
| *Time & Industry Dummies* | NO | YES | NO | YES | NO | YES | NO | YES |
| Log Likelihood | -3357.957 | -3342.03 | | | -1922.63 | -1906.80 | | |
| Wald-Test for GroupWise Heter. | 3020.52 | 3103.00 | 2903.65 | 2960.07 | 1652.17 | 1723.93 | 1557.24 | 1633.65 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| No. of observations | 2033 | 2033 | 2033 | 2033 | 1195 | 1195 | 1195 | 1195 |

Table 6 (continued)

| Variable | High Technology Gap (All Firms) | | | | High Technology Gap (Domestic Firms) | | | |
|---|---|---|---|---|---|---|---|---|
| | GLS | GLS | Rand. eff. | Rand. eff. | GLS | GLS | Rand. eff. | Rand. eff. |
| LKALF | 0.167*** | 0.167*** | 0.163*** | 0.163*** | 0.174*** | 0.174*** | 0.165*** | 0.162*** |
| *Capital* | (0.021) | (0.021) | (0.021) | (0.022) | (0.023) | (0.023) | (0.025) | (0.025) |
| LRMAT | 0.604*** | 0.605*** | 0.608*** | 0.608*** | 0.679*** | 0.682*** | 0.702*** | 0.710*** |
| *Raw material* | (0.033) | (0.033) | (0.034) | (0.034) | (0.042) | (0.042) | (0.044) | (0.045) |
| LSKILL | 0.420*** | 0.421*** | 0.422*** | 0.425*** | 0.436*** | 0.447** | 0.434** | 0.452*** |
| *Skilled labour* | (0.042) | (0.042) | (0.042) | (0.043) | (0.054) | (0.055) | (0.057) | (0.058) |
| LUNSKILL | 0.466*** | 0.469*** | 0.477*** | 0.477*** | 0.630*** | 0.624*** | 0.661*** | 0.650*** |
| *Unskilled labour* | (0.038) | (0.038) | (0.038) | (0.039) | (0.055) | (0.055) | (0.057) | (0.058) |
| FORPS | 0.002 | 0.004 | 0.002 | 0.004 | -0.0005 | 0.005 | -0.0007 | 0.004 |
| (***Sector-level***) | (0.003) | (0.012) | (0.003) | (0.012) | (0.003) | (0.015) | (0.003) | (0.015) |
| Constant | 1.614*** | 1.473*** | 1.600*** | 1.377*** | 0.873*** | 0.615*** | 0.782** | 0.666*** |
| | (0.240) | (0.339) | (0.264) | (1.115) | (0.319) | (0.436) | (0.343) | (0.453) |
| R squared | | | 0.59 | 0.60 | | | 0.62 | 0.63 |
| *Time & Industry Dummies* | NO | YES | NO | YES | NO | YES | NO | YES |
| Log Likelihood | -1417.80 | -1413.63 | | | -765.60 | -760.25 | | |
| Wald-Test for | 1249.20 | 1271.55 | 1230.07 | 1237.01 | 807.58 | 836.87 | 769.92 | 20030.96 |
| GroupWise Heter. | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| No. of observations | 849 | 849 | 849 | 849 | 476 | 476 | 476 | 476 |

Notes: Standard errors are presented in parentheses.
*, **, *** represent 10%, 5% and 1% levels of significance respectively.
Source: Computed from Kenya (various issues).

The results obtained for domestic firms were comparable to those obtained in the context of all the firms although coefficients estimated were relatively small in magnitude. Table 6 shows that results of GLS and RE estimated without inclusion of dummies produced a similar coefficient of 0.003 that was significant at 5%. This would mean that domestic firms with a low technology gap benefitted slightly less than when all the firms were considered. This is not surprising since in the category of all the firms, foreign firms, who are more endowed with resources necessary in the spillover process than their domestic counterparts, are included. Results obtained with dummies were not statistically significant. As in the above findings, these results perfectly supported the findings of the early contributors. Results estimated for domestic firms in the high technology gap category with dummies included were not significant. This supported the proponents of low technology gap for spillovers to occur. Further, the estimated results with all dummies included were insignificant, thereby supporting work following recent developments in spillover analysis.

## 5. Implications and Conclusions

Foreign participation at firm level was observed to have significant influence on firm level productivity, suggesting that productive benefits accrued from foreign owners. Foreign presence at the sector level produced two sets of results, depending on the methodological approach adopted. Estimated results following early contributions supported spillover occurrence, while results estimated following new developments did not support spillover occurrence discourse.

A similar trend was observed while spillovers were estimated by size and technology gap orientation. Consequently, following these findings the existing divergence in the spillover literature was witnessed in the Kenyan context, reflecting inconclusiveness of spillover analysis using the productivity approach.

These results, however, ought to be interpreted with caution as they could be misleading if interpreted to imply FDI has no effect on productivity. As pointed out, it is possible for manufacturing sectors to be different, and indeed they are on many fronts such as FDI presence, structure, conduct, and level of FDI activities. Hence, it is possible in such cases to have sectors with negative effect or low effect due to foreign presence, offsetting that of sectors with strong positive effect, making the resultant effect neutral and/or sometimes negative (Gachino, 2006b). The results of comparative behaviour indicated that FDI activities had a skewed distribution towards sectors with high foreign presence. This observation supports the fact that an ideal FDI analysis ought to be undertaken sector-wise and if possible by sub sectors, while maintaining the firm at the micro-level as the basic unit of analysis.

The aforementioned argument leads to an important fact that before a concrete conclusion that no spillovers exist in the Kenyan scenario can be made (or in any other context for that matter) an alternative framework must be considered. The productivity approach, though widely used in examining spillovers, was shown to be characterized by multiple caveats. It does not allow an exhaustive determination of how spillovers occur. Further, the approach is unable to demonstrate dynamic mechanisms through which spillovers impact on firm productivity. Productivity improvements may often depend on the learning effort and technological capabilities of domestic firms and not entirely on foreign presence *per se*. In such cases the productivity approach can underestimate the role of technological effort at the level of recipient firms or the wider system of innovation. This is particularly so given the tacit nature of technology and knowledge which makes them difficult to comprehend or capture exhaustively. Following Schumpeterian principles, high productivity performance alongside MNC presence in a given industry could also be due to the fact that small firms or the unproductive and un-competitive domestic firms have been forced to exit business, leaving only firms with high productivity.

We argue, therefore, that a different framework must be considered before a concrete conclusion can be drawn regarding spillover occurrence and their impact. So the findings obtained in this paper, which we regard as inconclusive, serve as a necessary overture and/or motivation provoking further work beyond the productivity approach. We recommend that this be done conceptualizing spillovers differently, for instance, in terms of technological learning, capability building and innovation. We extend this discussion by providing a vital hint on a theoretical literature which seems more appropriate for spillover analysis. This is the literature on technological innovations founded on evolutionary and endogenous economics that takes the National System of Innovation (NSI) as the point of departure. The NSI emphasizes the ways in which economic agents interact and relate with each other for the purpose of knowledge generation, learning and innovation (Nelson and Winter, 1982; Nelson, 1993). Flow of information and knowledge within NSI is regarded as the most important thing for fostering learning and innovation. According to Lundvall (1992: 2 and 12):

> A system of innovation is constituted by elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge and … a national system encompasses elements and relationships, either located within or rooted inside the borders of a nation state…. The broad definition includes all parts and aspects of the economic structure and the institutional set-

> up affecting learning as well as searching and exploring … the production system, the marketing system and system of finance.

According to Dahlman and Nelson (1995: 90), the NSI views FDI as:

> The network of agents and set of policies that affect the introduction of technology that is new to the economy. Since in the vast majority of developing countries technology is imported, the innovation system is defined very broadly to include policies towards FDI, arm's-length technology transfer, intellectual property rights, and importation of capital goods.

Interactions among agents are important for the purpose of production, diffusion and use of knowledge in bringing new products, processes and forms of organization into economic use. As noted from the definition, agents in support of this process would include institutions and organizations such as industry and business associations, R&D, innovation and productivity centres and technological and financing infrastructure support. Organizations comprise universities, public sector research bodies, science councils and firms that are the traditional focus of science and technology studies, while institutions can be viewed as "sets of common habits, routines, established practices, rules or laws that regulate the relations and interactions between individuals and groups" (Edquist, 1997: 7).

This paper takes the analysis on the effects of foreign presence on local firms further and argues that the results obtained, notwithstanding the productivity approach, is characterized by inherent weaknesses which prompts a rethinking in the framework of spillover analysis. As an example, the productivity approach is observed to be simplistic, blurring the mechanism of spillover occurrence while ignoring the role of domestic technological effort. The paper, therefore, recommends a broad approach in spillover analysis beyond the productivity approach to include technological innovations.

At the heart of technological innovations is the NSI which emphasizes the importance of learning, capability building and innovation. Only through use of this kind of framework can generation, diffusion and use of knowledge be determined and understood. The study also suggests a reconceptualization of spillovers in terms of learning and capability building contrary to past conceptualization in terms of productivity gains which were difficult to discern. To conclude, we reiterate that sound spillover based policy recommendations can only be made after studies have been done taking into consideration suggestions raised in this paper.

## Notes

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2. The study is justified as little comprehensive studies on FDI exist on Kenya's manufacturing industry (Kaplinsky, 1978; Swainson, 1980).
3. Computed from the World Bank (2001).
4. Computed from data supplied by the Ministry of Trade and Industry, Nairobi.
5. We are grateful to the Ministry of Trade and Industry, Kenya for allowing us access to the data.
6. Since the inception of this survey, it has been characterized by abysmally low levels of response rates. As a result the Ministry made it mandatory for all the firms to respond on an annual basis. This resulted in a tremendous improvement in the survey response rate beginning 1994, which justifies selection of 1994 as the base year for the panel data analysis.
7. The 8-year panel data for the period 1994-2001 compares well to the 5-year panel data for the period 1985-1989 used for the Moroccan study (Haddad and Harrison, 1993).
8. This comparison is based on figures obtained from the Kenya National Bureau of Statistics (KNBS), manufacturing section, Kenya.
9. This definition follows that of OECD and UNCTAD. Other benchmarks taken by other researchers studying other countries include Sjoholm (1999) who adopted a benchmark of 15% equity owned by foreigners, Haddad and Harrison (1993) considered foreign firms as those with at least 5% equity owned by foreigners while Djankov and Hoekman (1998) had a bench mark of 20%.
10. Even where such deflators existed they were normally based on outdated base years as was the case in the current study where the deflators used had 1982 as the base year.
11. ISIC is an acronym for International Standard of Industrial Classification.
12. The two sectors combined were ISCI 37 and ISIC 38 that deal with aspects such as metal, metal fabrication and machine works which are also referred to as engineering – in the Kenyan classification. We refer to it here as machine engineering industry.
13. Sectoral and industry dummies imply the same thing.
14. The data set used did not seem to have serious autocorrelation problem – this was not expected to pose a serious problem since the time span covered was not very long.
15. The shares were computed in percentages using the panel database created.
16. The growth rates were computed from data supplied by the Ministry of Trade and Industry, Nairobi, Kenya.
17. This follows Griliches (1992) standard approach to modelling externalities in industrial productivity growth whereby the level of productivity achieved by enterprise or industrial sector depends on level of knowledge accessible to it in addition to its own internal research effort. In related modelling cases, total factor productivity has been used as a procedure to measure productivity growth [Griliches and Lichtenberg, 1984; Coe and Helpman, 1995].

## References


Abramovitz, M. (1986) "Catching Up, Forging Ahead, and Falling Behind", *Journal of Economic History*, 6(2): 385-406.

Aitken, B.J., Hanson, G. and Harrison, A. (1997) "Spillovers, Foreign Investment and Export Behaviour", *Journal of International Economics*, 43(1-2): 103-132.

Aitken, B.J. and Harrison, A. (1999) "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela", *The American Economic Review*, 89(3): 605-618.

Amin, S. (1977) *Imperialism and Unequal Development*, New York: Harvester and Monthly Review Press.

Asiedu, E. (2002) "On the Determinants of Foreign Direct Investment to Developing Countries: Is Africa Different", *World Development*, 30(1): 107-119.

Asiedu, E. (2004) "Policy Reform and Foreign Direct Investment in Africa: Absolute Progress but Relative Decline", *Development Policy Review*, 22(1): 41-48.

Blomstrom, M. and Persson, H. (1983) "Foreign Investment and Spillover Efficiency in an Underdeveloped Economy: Evidence from the Mexican Manufacturing Industry", *World Development*, 11(6): 493-501.

Blomstrom, M. and Sjoholm, F. (1999) "Technology Transfer and Spillovers: Does Local Participation with Multinationals Matter?", *European Economic Review*, 43(4-6): 915-23.

Cantwell, J. (1989) *Technological Innovation and Multinational Corporations*, London: Basil Blackwell.

Caves, R. (1974) "Multinational Firms, Competition and Productivity in Host-Country Markets", *Economica*, 41(162): 176-93.

Coe, D. and Helpman, E. (1995) "International R&D Spillovers", *European Economic Review*, 39(5): 859-87.

CSAE, Centre for the Study of Africa Economies, various papers.

Dahlman, C. and Nelson, R. (1995) "Social Absorptive Capability, National Innovation Systems and Economic Development", in Koo, B.H. and Perkins, D.H. (eds), *Social Capability and Long Term Economic Growth*, Basingstoke: Macmillan for Korea Development Institute.

Djankov, S. and Hoekman, B. (1998) "Foreign Investment and Productivity Growth in Czech Enterprises", *World Bank Economic Review*, World Bank.

Dunning, J. (1993) *Multinational Enterprises and the Global Economy*, London: Addison Wesley Publishing Company.

Dunning, J. (1994) "Multinational Enterprises and the Globalisation of Innovatory Capacity", *Research Management and Planning*, 23(1): 67-88.

Dupasquier, C. and Osakwe, P.N. (2006) "Foreign Direct Investment in Africa: Performance, Challenges and Responsibilities", *Journal of Asian Economies*, 17(2): 241-260.

Edquist, C. (ed.) (1997) *Systems of Innovation: Technologies, Institutions and Organizations*, London: Pinter Publishers/Cassell Academic.

Fedderke, J. and Aylit, T.R. (2006) "Growth Impact and Determinants of Foreign Direct Investment into South Africa, 1956-2003", *Economic Modelling*, 23(5): 738-760.

Findlay, R. (1978) "Relative Backwardness, Direct Foreign Investment, and the Transfer of Technology: A Simple Dynamic Model", *Quarterly Journal of Economics*, 12(1): 42-56.

Frank, G. (1973) *Political Economy of Development and Underdevelopment*, New York: Random House.

Gachino, G. (2006a) "Foreign Direct Investment, Firm-Level Capabilities and Human Capital Development: Evidence from Kenyan Manufacturing", UNU-MERIT Working Paper Series, UNU-MERIT-2006-014.

Gachino, G. (2006b) "Foreign Direct Investment, Spillovers and Innovation: The Case of Kenyan Manufacturing Industry", UM-Ph.D, unpublished thesis.

Gershenberg, I. (1987) "The Training and Spread of Managerial Know-How, A Comparative Analysis of Multinational and Other Firms in Kenya", *World Development*, 15(7): 931-939.

Globerman, S. (1979) "Foreign Direct Investment and Spillover Efficiency Benefits in Canadian Manufacturing Industries", *Canadian Journal of Economics*, 12(1): 42-56.

Gorg, H. and Strobl, E. (2001) "Multinational Companies and Productivity Spillovers: A Meta-analysis", *Economic Journal*, 111(475): 723-39.

Green, W. (2002) *Econometric Analysis*, London: Prentice-Hall International.

Griliches, Z. (1992) "The Search for R&D Spillovers", *Scandinavian Journal of Economics*, 94(supplement): 29-47.

Griliches, Z. and Lichtenberg, F.R. (1984) "Inter-industry Technology Flows and Productivity Growth: A Re-examination", *Review of Economics and Statistics*, 66(2): 324-329.

Haddad, M. and Harrison, A. (1993) "Are there Spillovers from Direct Foreign Investment? Evidence from Panel Data for Morroco", *Journal of Development Economics*, 42(1): 51-74.

Jorgensen, J.J. (1975) "Multinational Corporations and the Indigenization of the Kenyan Economy", in Widstrand, C. (ed.), *Multinational Firm in Africa*, Uppsala: Scandinavian Institute of African Studies.

Kaplinsky, R. (1978) (ed.) *Readings on the Multinational Corporations in Kenya*, Nairobi: Heinemann.

Kenya Government Economic Survey (1997) *Industrial Transformation to the Year 2020*, Nairobi, Kenya: Government Publishers, Sessional Paper No. 2.

Kenya (various issues) *Annual Industrial Survey* undertaken by Ministry of Trade and Industry, Nairobi.

Koizumi, T. and Kopecky, K.J. (1977) "Economic Growth, Capital Movements and the International Transfer of Technical Knowledge", *Journal of International Economics*, 7(1): 45-65.

Kokko, A. (1994) "Technology, Market Characteristics, and Spillovers", *Journal of Development Economics*, 43(2): 279-293.

Kokko, A. (1996) "Productivity Spillovers from Competition between Local Firms and Foreign Affiliates", *Journal of International Development*, 8(4): 517-30.

Kokko, A., Tansini, R. and Zejan, M. (1996) "Local Technological Capability and Productivity Spillovers from FDI in the Uruguayan Manufacturing Sector", *Journal of Development Studies*, 32(4): 602-611.

Lall, S. (1980) *The Multinational Corporation*, London and Basingstoke: Macmillan.
Lall, S. (1987) *Learning to Industrialise: The Acquisition of Technological Capability by India*, London: Macmillan.
Lall, S. and Pietrobelli, C. (2002) *Failing to Compete: Technology Development and Technology Systems in Africa*, Cheltenham, UK: Edward Elgar.
Lall, S. and Streeten, P. (1977) *Foreign Investment, Transnational and Developing Countries*, Basingstoke: Macmillan.
Langdon, S. (1981) *Multinational Corporations in the Political Economy of Kenya*, London: Macmillan.
Lucas, R. Jr. (1988) "On the Mechanics of Economic Development", *Journal of Monetary Economics*, 22(1): 3-42.
Lundvall, B.A. (1992) *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, London: Frances Pinter.
Marshall, A. (1920) *Industry and Trade*, London: Macmillan.
Nelson, R. (1993) *National Innovation Systems: A Comparative Analysis*, Oxford: Oxford University Press.
Nelson, R. and Winter, S.G. (1982) *An Evolutionary Theory of Economic Change*, Cambridge: Harvard University Press.
OECD, Organisation for Economic Co-operation and Development (Development Centre), various working papers focusing on Africa.
Pratten, C.F. (1971) *Economies of Scale in Manufacturing Industry*, Cambridge, UK: Cambridge University Press.
Rasiah, R. (1994) "Flexible Production Systems and Local Machine Tool Subcontracting: Electronics Transnationals in Malaysia", *Cambridge Journal of Economics*, 18(3): 279-298.
Rasiah, R. (1995) *Foreign Capital and Industrialisation in Malaysia*, Basingstoke: Macmillan.
Rasiah, R. (2002a) "Government-Business Coordination and Small Enterprise Performance in the Machine Tools Sector in Malaysia", *Small Business Economics*, 18(1-3): 177-195.
Rasiah, R. (2002b) "Systemic Coordination and the Knowledge Economy: Human Capital Development in Malaysia's MNC-driven Electronics Clusters", *Transnational Corporations*, 11(3): 89-129.
Rasiah, R. (2004a) *Foreign Firms, Technological Capabilities and Economic Performance: Evidence from Africa, Asia and Latin America*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar.
Rasiah, R. (2004b) "Technological Capabilities in East and Southeast Asian Electronics Firms: Does Network Strength Matter?", *Oxford Development Studies*, 32(3): 433-454.
Rasiah, R. and Gachino, G. (2005) "Are Foreign Firms more Productive and Export and Technology Intensive than Local Firms in Kenyan Manufacturing?", *Oxford Development Studies*, 33(2): 211-227.
Rasiah, R. (2006) "Technological Intensities and Economic Performance: A Study of Foreign and Local Manufacturing Firms in South Africa", *International Journal of Technology Management*, 36(1-3): 166-189.

Sabel, C. (1989) "Flexible Specialisation and the Re-emergence of Regional Economies", in Hirst, P. and Zeitlin, J. (eds), *Reversing Industrial Declines?: Industrial Structure and Policy in Britain and Her Competitors*, Oxford: Berg Publishers.

Scherer, F. (1973) "The Determinants of Industry Plant Sizes in Six Nations", *Review of Economics and Statistics*, 55(2): 135-175.

Scherer, F. (1980) *Industrial Market Structure and Economic Performance*, Chicago: Rand McNally.

Sekkat, K. (2007) "Openness, Investment Climate, and FDI in Developing Economies", *Review of Development Economies*, 11(4): 607-620.

Sjoholm, F. (1999) "Technology Gap, Competition and Spillovers from Direct Foreign Investment: Evidence from Established Data", *Journal of Development Studies*, 36(1): 53-73.

Smarzynska, B. (2002) *Spillovers from Foreign Direct Investment through Backward Linkages: Does Technology Gap Matter?*, Washington D.C.: The World Bank.

Smith, A. (1776) *The Wealth of Nations*, London: Pelican Books.

Stata, (2003) *Stata Version 8 Reference Manual*, Stata Press.

Swainson, N. (1980) *The Development of Corporate Capitalism in Kenya, 1918-1977*, London, Ibadan and Nairobi: Heinemann.

UNCTAD, (2005) *World Investment Report: Transnational Corporations and the Internationalisation of R&D*, New York, Geneva: United Nations Conference on Trade and Development.

UNIDO, United Nation Industrial Development Organisation, various papers.

Vaitsos, C. (1978) "The State and Foreign Business Interests", in Coughlin, P. and Ikiara, G. (eds), *Kenya's Industrialization Dilemma*, Nairobi, Kenya: Heinemann Kenya Limited.

White, H. (1980) "A Heteroskedasticity-consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity", *Econometrica*, 48(4): 817-830.

World Bank, various papers under the Regional Programme for Enterprise Development (RPED).

**Appendix 1: Annual growth rates for all firms, selected manufacturing sectors, Kenya**

| | Locally Owned Firms | | | Foreign Owned Firms | | |
|---|---|---|---|---|---|---|
| | 1994-1997 | 1997-2001 | 1994-2001 | 1994-1998 | 1997-2002 | 1994-2001 |
| ***Annual Growth Rates Computed for All Firms in the Manufacturing Industry*** | | | | | | |
| *All Firms* | | | | | | |
| RMAT | -7.7 | -5.7 | -6.0 | -7.0 | -6.0 | -10.5 |
| KALF | -9.7 | -3.0 | -5.7 | -16.0 | -4.5 | -9.2 |
| EMPT | 0.1 | 1.7 | 1.0 | -8.4 | -1.9 | -4.6 |
| SKILL | 1.5 | 1.9 | 2.0 | -1.8 | -2.1 | -1.8 |
| VAD | 5.1 | -3.7 | 2.9 | -6.7 | -6.4 | -6.5 |
| VADL | 7.7 | -5.0 | 2.2 | -10.9 | -4.0 | -5.0 |
| TSALES | -1.7 | -4.6 | -2.1 | -6.8 | -6.3 | -6.2 |
| EXPTS | -4.5 | -14.4 | -5.6 | -5.5 | -16.1 | -8.9 |
| TECHN | 1.9 | -8.7 | 0.8 | -6.6 | -9.7 | -7.1 |
| ***Annual Growth Rates Computed for Some Selected Manufacturing Sectors*** | | | | | | |
| *Food, Beverages and Tobacco* | | | | | | |
| RMAT | -9.9 | -5.5 | -7.3 | -12.0 | -3.0 | -6.8 |
| KALF | -10.1 | 3.0 | -1.4 | 5.0 | -2.6 | 3.6 |
| EMPT | 0.5 | 1.9 | 1.4 | 0.7 | -2.2 | -1.1 |
| SKILL | 2.4 | 3.2 | 3.6 | -0.1 | -2.9 | -1.9 |
| VAD | 3.3 | -0.9 | 2.0 | 2.2 | -0.1 | 1.1 |
| VADL | -4.0 | -15.0 | -7.8 | -14.5 | -6.2 | -7.8 |
| TSALES | -9.0 | -6.3 | -7.2 | -9.3 | -6.1 | -7.6 |
| EXPTS | -5.9 | -10.1 | -3.3 | -11.3 | -16.7 | -11.5 |
| TECHN | 0.4 | 1.0 | 0.8 | 0.2 | 0.6 | -0.5 |
| *Chemicals, Petroleum and Plastics* | | | | | | |
| RMAT | -3.3 | -5.0 | -3.3 | -4.7 | -2.2 | -3.3 |
| KALF | -3.3 | -0.9 | -0.6 | -9.0 | -5.3 | -7.3 |
| EMPT | -3.0 | 6.2 | 3.1 | -1.2 | 1.3 | -0.4 |
| SKILL | -3.4 | 5.1 | 6.7 | -0.2 | -4.0 | -2.8 |
| VAD | 4.7 | 3.8 | 5.7 | 1.3 | 3.8 | 2.6 |
| VADL | -16.7 | -6.1 | -11.1 | -3.4 | 0.6 | 0.6 |
| TSALES | -4.7 | -4.2 | -3.6 | -7.6 | -2.8 | -5.1 |
| EXPTS | 2.2 | -16.3 | -2.3 | -1.3 | -10.1 | -3.0 |
| TECHN | 10.8 | 1.7 | 8.0 | 4.8 | 3.8 | 4.7 |
| *Machine and Engineering* | | | | | | |
| RMAT | -6.0 | -6.2 | 0.2 | -6.9 | -8.9 | 0.9 |
| KALF | -14.2 | -6.7 | 25.7 | -38.0 | -0.7 | -11.3 |
| EMPT | 2.7 | -3.2 | 0.9 | -24.0 | -8.6 | -1.0 |
| SKILL | 4.1 | -2.2 | 5.9 | 1.3 | -0.1 | 2.2 |
| VAD | 3.7 | 2.4 | 5.3 | 14.2 | -8.2 | 15.9 |
| VADL | 20.4 | -6.3 | 10.7 | -13.7 | -8.2 | 1.4 |
| TSALES | -6.6 | -5.4 | -0.9 | -3.4 | -11.1 | -2.0 |
| EXPTS | -9.0 | -14.6 | 18.9 | 10.2 | -26.2 | -0.4 |
| TECHN | 3.8 | 0.4 | 4.8 | 4.3 | 1.4 | 3.4 |

Source: Computed by the author from Kenya, *Annual Industrial Survey* undertaken by Ministry of Trade and Industry.

**Appendix 2: Two-tail t-test results comparing productivity performance behaviour of foreign and local firms, Kenya sample, 2004**

| Industrial Sector<br>Two-Digit (ISIC Rev. 2) | Firms | Value Added (VAD) | Productivity of Labour (VAD/Lab.) | Productivity of Raw Materials VAD/Raw Mat | Capital Intensity Capital/Empt | Skill Intensity Skill Lab./Empt |
|---|---|---|---|---|---|---|
| Food, Beverages and | Local Firms | 22,733 (1,953) | 220 (18) | 2.428 (0.458) | 758 (187) | 0.515 (0.015) |
| Tobacco | Foreign Firms | 189,050 (31,563) | 767 (90) | 6.202 (1.004) | 1230 (173) | 0.677 (0.018) |
| | T-Values | -7.337*** | -7.941*** | -3.925*** | -1.630 * | -6.625*** |
| Textile, Wearing Apparel | Local Firms | 6013 (703) | 1061 (302) | 1.180 (0.134) | 1164 (369) | 0.621 (0.017) |
| and Leather | Foreign Firms | 15684 (2650) | 114 (12) | 3.447 (0.943) | 2938 (861) | 0.636 (0.022) |
| | T-Values | -4.414*** | 2.34** | -3.117*** | -2.187** | -0.535 |
| Wood and | Local Firms | 4747 (710) | 144 (16) | 1.652 (0.221) | 780 (213) | 0.605 (0.279) |
| Wood Products | Foreign Firms | 1049 (115) | 34 (5) | 1.114 (0.137) | 41 (9) | 0.542 (0.031) |
| | T-Values | 3.13*** | 4.031*** | 1.427 | 2.087** | 1.602 |
| Paper, Printing and | Local Firms | 53468 (17002) | 447 (121) | 2.788 (0.496) | 122 (14) | 0.691 (0.016) |
| Publishing | Foreign Firms | 51074 (11543) | 287 (74) | 2.462 (1.067) | 535 (93) | 0.711 (0.026) |
| | T-Values | 0.092 | 0.871 | 0.317 | -6.234*** | -0.697 |
| Chemicals, Petroleum | Local Firms | 11403 (1019) | 162 (9) | 1.157 (0.072) | 126 (10) | 0.529 (0.015) |
| and Plastics | Foreign Firms | 27494 (3001) | 313 (28) | 2.735 (0.872) | 696 (115) | 0.572 (0.014) |
| | T-Values | -4.875*** | -4.873*** | -1.715 * | -4.702*** | -2.172** |
| Non-metallic | Local Firms | 19762 (5602) | 151 (21) | 3.827 (0.696) | 324 (78) | 0.398 (0.032) |
| Mineral Products | Foreign Firms | 59068 (18078) | 200 (55) | 3.306 (717) | 193 (42) | 0.446 (0.041) |
| | T-Values | -2.001** | -0.801 | 0.520 | 1.512 | -0.918 |
| Machine Engineering Industry; | Local Firms | 7309 (738) | 200 (39) | 1.30 (0.111) | 2809 (921) | 0.672 (0.014) |
| Basic Metal Industries, | Foreign Firms | 36072 (7310) | 409 (91) | 1.730 (0.162) | 3129 (904) | 0.578 (0.016) |
| Machinery and Equipment | T-Values | -4.063*** | -2.160** | -2.226** | -0.247 | 4.522*** |

Notes: Numbers in parentheses represent standard errors.
*, ** and *** represent 10%, 5% and 1% levels of significance respectively.
Note that the spillover indexes computed for various channels may differ slightly from those computed in other tables due to multiple averaging and aggregations done.

Source: Compiled by the author using firm level data obtained from the Ministry of Trade and Industry, Kenya.