UNU-MERIT

Working Paper Series

#2007-016

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FOREIGN DIRECT INVESTMENT AND FIRM LEVEL PRODUCTIVITY A PANEL DATA ANALYSIS*

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Abstract

This paper uses panel data to examine the effect of foreign presence on firm level productivity in the Kenyan manufacturing industry employing "traditional" and "recent" methodologies both based on production function framework. A detailed comparative behaviour between foreign and local indigenous firms showed that foreign firms dominated in virtually all the economic activities including productivity performance. Analysis of productivity determinants following traditional approach indicated a statistically significant role played by foreign presence on firm level total factor productivity thus, supporting spillover occurrence argument. However, results based on recent methodologies showed no effect of foreign presence on firm level total factor productivity hence failing to support spillover occurrence dictum. These results indicate that use of different methodologies even within the same theoretical framework can result in divergent findings. This notwithstanding, the paper further argues that use of productivity based methodologies largely masks the nature, actual processes and mechanisms through which spillovers occur. The paper therefore advocates for 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: Foreign presence, spillovers, total factor productivity, technological innovation and Kenya.

JEL Classification: C3, F2, L1, L6, O1, O3.

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UNU-MERIT Working Papers
ISSN 1871-9872

Maastricht Economic and social Research and training centre on Innovation and Technology, UNU-MERIT

UNU-MERIT Working Papers intend to disseminate preliminary results of research carried out at the Centre to stimulate discussion on the issues raised.

* This study was part of doctoral research project undertaken while at UNU-MERIT. I acknowledge with thanks financial support from United Nations University (UNU-MERIT) and African Economic Research Consortium (AERC). The paper benefited critical comments from Rajah Rasiah and Lynn Mytelka. Others whose comments and discussions helped refine this paper included Robin Cowan, Pierre Mohnen, Carlo Pietrobelli, Geert Duysters, Friso den Hertog and Sarianna Lundan. The usual disclaimer applies.

1. Introduction

Foreign Direct Investment (FDI) is perceived to play an important role in a host country economic growth and development process [Dunning, (1993: 1994); Lall, (1980:1987)]. As a result, countries are forced to liberalise their investment regimes in order to create 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. FDI 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; Gachino, 2006b).

The spillover literature further argues that due to FDI's superior productive capacity it is likely to introduce best practices in production – new production knowledge and skills – thus promoting leading edge production technology to host countries (Dunning, (1993); Rasiah, 2004). FDI can also disseminate skills and know how in organisational and managerial practices through demonstration or through establishment of business partners and strategic alliances. In the same vein, FDI could also facilitate supply and knowledge linkage formation, which could facilitate diffusion of skills and information to the greater economy (Lall, 1980; Rasiah, 1995; UNCTAD, 2001). Through demonstration effects, FDI might also catalyse the existing entrepreneurial effort in a host economy (Gachino, 2006b). Most importantly, FDI might help strengthen local systems of innovation by encouraging local R&D institutes to enhance commercialisation of their accumulated capability (UNCTAD, 2005). Due to the competitive pressure of the international market, Multinational Corporations (MNCs) are obliged more than the local firms to make continuous changes to their production process, product quality, managerial skills and the capacity for technological innovations (Wang and Blomstrong, 1992). Through FDI, international competition is likely to trickle down to local firms and enhance their competitiveness by forcing them to learn and introduce appropriate changes to achieve allocative and/or technical efficiency (Wang and Blomstrong, 1992; Gachino, 2006ab).

On the other hand, however, there is always the possibility that FDI out-compete local firms forcing them out of the market (Lall and Streen, 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. 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.

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 total factor productivity. 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. 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.

The paper is organised as follows. Section 2 presents the theoretical framework, data description and the estimation techniques used in this paper. Section 3 examines a 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. In section 4, the effect of foreign presence on total factor productivity using panel data estimation technique is undertaken. In the same section, productivity technique is used to examine whether firm size and technological gap influence spillover occurrence to the locally owned firms. Section 5 presents a summary discussion and emerging criticisms. Finally, section 6 presents conclusion and recommendations.

2. Theoretical Framework, Data and Estimation Technique

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

2.1 Theoretical Framework: The Productivity Approach Revisited

Most studies examining spillovers from FDI have been largely based on productivity techniques 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 "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 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. He therefore attempted to test the effect of MNC competitors on the technical efficiency of host country firms as well as technology transfer to them. From his study, foreign presence was characterised by positive technological spillovers which enhanced technical efficiency of the domestic firms thus raising their productivity. This finding was supported by the observation that when the foreign share of sectoral labour rose, the disparity between foreign and domestic value-added disappeared. His conclusion was that the reduction in this disparity was as a result of positive spillovers from foreign presence.

Since Caves pionnering work, a plethora of empirical studies conceptualizing spillovers in terms of productivity gains – reporting similar findings – have emerged (Koizumi and Kopecky, 1977; Globerman, 1979; Blomstrom and Pearson, 1983; Kokko, 1996; Blomstrom and Sjoholm, 1999). A model by Koizumi and Kopecky (1977) found that when foreign investment is made in a host country, technical knowledge is transmitted in the form of externalities or 'spillovers'. Their model builds upon the standard model of long-term international capital movement, which investigates patterns of economic development in a country in the presence of free capital mobility. Their major critique of the standard model was that it failed to

distinguish the role played by FDI in a country's development. They argued that direct investment possessed superior know-how and managerial expertise, which enabled the MNCs to reap profits upon investment. Further, direct investment was likely to transfer intangible assets such as technical skills to the host country which would occur through discussions, observation and training with the possibility of diffusing throughout the host country's economy. They argued that transmission of foreign technical knowledge could be viewed as spillovers since MNCs could not fully appropriate returns from them.

Globerman (1979) investigated the spillover benefit to Canadian manufacturing industries employing the same methodology and specification as in Caves (1974). His results indicated a positive relationship between labour productivity of local firms and foreign presence. This was interpreted to mean that MNCs resulted in positive spillovers which were responsible for the increase in technical efficiency and productivity in the local firms. Following the same line of thought, Blomstrom and Pearson (1983) used industry level data to investigate whether technical efficiency of Mexican firms derived from spillover efficiency could be associated with FDI. Assuming MNCs represented advanced knowledge and technologies, they questioned whether the same gets transferred to domestic firms owing to the presence of MNCs. Labour productivity was considered as a measure of technical efficiency – if positive relationship existed between local firms and the share of foreign firms in a particular industry that would be interpreted to mean foreign investment raised the productivity of local firms through spillover efficiency. The proxy for capital intensity was taken as the ratio of total assets to the total number of employees in the local firms. Spillovers of technical efficiency were found to exist and were responsible for the increase in productivity of the local firms.

Using cross sectional analysis, Blomstrom and Sjoholm (1999) found similar results that foreign presence affected the productivity of local firms positively in Indonesia. They conducted an empirical analysis based on Indonesian establishment data to determine whether type of MNC ownership had any effect on productivity and degree of spillovers. More specifically, their study sought to examine whether establishments with minority joint ventures (JVs) and majority ownership (wholly owned subsidiaries) differred in terms of their productivity levels. They also investigated whether degree of spillovers varied with the extent of MNC ownership. Their underlying assumption was that MNCs prefer JVs with local firms when local

partners possess better knowledge of local conditions. In the event of that happening, local participation with MNC firms would reveal proprietary knowledge through various avenues such as training in foreign firms or gathering work experience all likely to influence technology diffusion – thus facilitating spillovers. 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. Labour productivity in local firms varied with the degree of foreign presence. However, the degree of ownership neither affected the labour productivity in foreign establishments nor the degree of spillovers.

The last empirical example which we provide is based on the endogenous principle by Kokko (1996) who determined the effect of competition in Mexican manufacturing industry by endogenising both the activities of foreign and locally owned firms. Given the argument for joint determination due to interactions, Kokko used simultaneous system of equations to capture contagion-type spillovers related to foreign presence as well as spillovers that are caused by competition. The dependent variable – labour productivity was measured by value added per employee for both local and foreign firms. Foreign presence was calculated for each industry as a ratio of foreign firms' employment to the total. This was included to capture the spillovers from contagion and demonstration related to the locally owned firms' exposure to foreign presence.

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. The endogenous test showed positive results only when the industries characterised by enclaves were excluded. This finding compared to Kokko (1994) results where industries characterised 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 – believed to be isolated preserves of foreign firms operations only. This study had 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 was the support it gives to the need for local technological capability development in host developing countries.

Contrary to the studies analysed some less optimistic, empirical firm level studies exist based on 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 seemed to extend the original methodological tenets by considering spatial/regional dynamics, time and industry dynamics, firm-level specificities etc (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) utilised 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 large foreign presence. They examined the influence of foreign presence on dispersion of productivity levels, and then the influence of foreign presence on growth of productivity for local firms and finally the effect of foreign presence on the technology gap and the level of protection.

Joint ventures exhibited less deviation from best-practice productivity relative to domestic firms. The study showed that large firms were more likely to achieve higher levels of productivity than small firms. Results obtained on sector level foreign investment indicated that smaller deviation from maximum productivity levels existed in sectors with large foreign presence. This aspect of productivity dispersion being smaller in sectors with many foreign firms was explained to be due to competition induced by the MNC firms, causing firms that cannot approach the best-practice frontier to exit the industry. The results 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.

A similar study using plant level data to investigate the effects of foreign investment in Uruguayan manufacturing industry had a similar conclusion. Kokko, Tansini and Zejan (1996) noted in their statistical estimations that the effects of foreign presence was not significantly different from zero, which implied that foreign presence did not have any substantial impact on local productivity, there were no signs of spillovers.

Kokko, Tansini and Zejan (1996) examined the impact of the differences in technology gap between local firms and foreign affiliates on the relationship between local productivity and foreign presence. Their study used plant level data of the Uruguayan manufacturing industry. Locally owned firms that were less labour productivity than the foreign affiliates had the variable defined as the ratio of the average labour productivity of foreign plants in the relevant industry to the locally owned firms' labour productivity. Consequently, for the locally owned plants with higher labour productivity than their foreign owned competitors, the variable was taken as the inverse of this ratio. The results showed significant differences between the two samples. The coefficient of foreign presence was positive and was highly significant in the sub-sample with small technology gaps, but was not significant when the technology gap was large. This indicated 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. The study attempted to overcome the identification problem – where foreign investment was likely to be attracted to more productive sectors (industrial dynamics) of the economy. In such cases the productivity of domestic firms would overstate the positive impact of foreign investment. To avoid the identification problem, which affected past sectoral level studies the behaviour of each firm was observed over a period of time (time dynamics) to control for fixed differences in productivity levels across industries which might affect the level of foreign investment. They estimated log-linear production functions to investigate two basic propositions: whether foreign equity participation could be associated with an increase in the plant's productivity and whether foreign ownership in an industry affected the productivity of local firms in the same industry. The study found a positive relationship between foreign equity participation and firm performance implying productivity gains attributable to foreign equity participation. Surprisingly, the results however 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 suggested that such negative spillovers could be as 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, on the basis of discussion raised in this paper, we will argue that despite the considerable evolution demonstrated in estimation techniques of aggregate spillovers, relationships traced through underlying methodologies both tradition and recent, cannot be equated with actual spillovers due to their nature. Technological spillovers are complex and difficult to capture due to their uncertain, incomplete masterly and tacit nature of technology. This is more so when spillover occurrence mechanisms, firm and industry dynamics including institutional environment through which spillovers occur are hardly 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[1]. Contrary to the studies done in the past, we combine 'traditional estimations' and 'new developments' approaches for comparison purposes. The new developments will be conducted in line with recent studies such as Aitken and Harrison (1999). Accordingly, we will therefore undertake panel data analysis taking into consideration industry specificities (industry dummies) and time dynamics (time dummies). Panel data analysis is believed to capture the dynamics of change because of inclusion of both cross-sectional and time series dimensions. Due to the limitation and nature of data (observation required in the panel analysis) we will not be in a position to capture geographical location and other factors.

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1 The study is justified as little comprehensive studies on FDI exist based on the Kenya's manufacturing industry (Kaplinsky, 1978; Swainson, 1980).

The panel data approach differs from the early contributions, which mainly uses cross sectional data that often results 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 long time period. This is contrary to survey data which would have to rely on a specific data point providing only a snap shot analytical scenarion. Second, panel data analysis allows an investigation of technological spillovers controlling for other factors such as industry 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 positive and statistically significant correlation between the MNCs and productivity of the locally owned firms. According to the early contributors, Caves 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.

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[2]. Foreign equity accounted for 69.1% of manufacturing fixed capital formation in 1994, 66.2% in 1999 and 63% in 2001[3]. 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 sub-Saharan Africa are characterised by low levels of FDI inflows.

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[4]. The survey data enabled us to create a panel database for the period 1994-2001[5].

[2] Computed from the World Bank (2001).
[3] Computed from data supplied by the Ministry of Trade and Industry, Nairobi.
[4] We are grateful to the Ministry of Trade and Industry, Kenya for allowing us access to the data.

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[6]. The data set is fairly representative as it represents an average of 40%[7] 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[8]. 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 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

[5] Since the inception of this survey, it has been characterised by abysmally low levels of response rates. As a result the Ministry made it mandatory for all the firms to respond on 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.

[6] 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).

[7] This comparison is based on figures obtained from Central Bureau of Statistics (CBS), manufacturing section – Kenya.

[8] This definition follows that of OECD and UNCTAD. Other benchmarks taken by other researchers studying other countries include Sjoholm (1997) 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%.

available[9]. Consequently, sales and capital investment values were deflated using 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 machinery and transport equipment.

Another limitation with this data set is that the analysis conducted at 2–digit level ISIC[10] 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[11]. 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 three or four digits as this reduces firms to only a few in each ISIC and would therefore not suffice for the intended panel analysis.

2.3 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 total factor 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:

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

Where i = 1, 2, ….., n denotes a cross sectional unit (a firm), and t = 1, 2, …., 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 jth non stochastic explanatory variable for firm i at period t. The random error term ε_{it} is assumed to have a mean of zero, $E(\varepsilon_{it}) = 0$, and

[9] 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.
[10] ISIC is an acronym for International Standard of Industrial Classification.
[11] The two sectors combined were ISCI 37 and ISIC 38 that deal with metal, metal fabrication, machine works etc-also referred in the Kenyan classification as engineering. We refer to it here as machine tool industry.

a constant variance, $E(\varepsilon_{it}) = 0$ and $\beta_{ij}s$ are unknown response coefficients to be modeled.

The above framework can be generalised 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 fixed effects model α_i is captured as the group specific constant term. The assumption in the fixed effects model is that differences across units can be captured in differences in the constant term and thus α_i is unknown parameter to be estimated. On the other hand, RE approach specifies α_i as group specific disturbance, similar to ε_{it}. The residual term for random effects can then be expressed as: $\mu_{it} = \vartheta_i + \varepsilon_{it}$. The component ϑ_i is the random disturbance characterising the ith 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 correlation more explicitly would be required. We do this by including dummies in our panel model specified in equation (1) above.

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

Where $DUMMY_i$ represents sectoral[12] 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)

[12] Sectoral and industry dummies imply the same thing.

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 (see Green, 2002: Stata, 2003). In the current scanarion, GLS will be estimated allowing for heteroscedasticity and assuming no autocorrelation[13]. Estimation of heteroscedasticity indicated no serious problem of 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 i.e. in which sectors of Kenyan Manufacturing industry are the MNC activities concentrated? This question can be answered by looking at shares of significant trends in the panel data. Are the MNCs located equally in all the sectors, sub-sectors or are they just present in a few selected sectors? If so, is it possible to identify them? Could it be the case that sectors with high foreign presence levels are also the most dynamic sectors – characterised by high levels of technological related characteristics such as physical and human capital investment, value added and

[13] 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.

productivity of labour or raw materials? To answer these questions, it is therefore pertinent to begin by conducting a general trend analysis on the basis of key economic indicators.

3.1 Comparing Foreign and Locally Owned Firms based on the Entire Manufacturing Industry

Participation of MNCs in the manufacturing industry was examined by comparing their relative shares with those of locally owned firms[14] on the basis of major manufacturing characteristics 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 utilisation (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, 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 utilisation of locally owned firms had increased over the same period.

[14] The shares were computed in percentages using the panel database created.

Table 1 Important Firm Trends in the Panel Data Sample: Percentage 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

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

Two reasons could account for this interesting phenomenon: The first one is that 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 disappearance (closures and relocations) of some of the MNC subsidiaries as a result of worsened conditions of doing business that characterised 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[15].

This interesting observation seemed to demonstrate a sort of catching up phenomenon by the locally owned firms. A plausible task is 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 characterised by external competition and entry of new domestic firms. During this period, the country was still grappling with SAPs – liberalisation and export orientation. The country was no longer favoured by donors including multinational financing organisations – hence reduced financial aid. The

[15] The growth rates were computed from data supplied by the Ministry of Trade and Industry, Nairobi, Kenya.

situation was further aggrevated by continued weakening of institutions, infrastructural decay and poor economic governance etc.

3.2 Comparing Foreign and Locally Owned Firms based on the Manufacturing 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 the highest FDI levels. The sectors were 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 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; i.e. 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 in all the manufacturing sectors, employment shares in food, beverages and tobacco seemed to increase for locally owned firms from 38% to 42% in 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 (Table 2). Similarly, domestic firms seemed to be raising their processing capability in chemicals, petroleum and plastics and in machine and engineering. Their shares seemed to increase from 37% to 39% and 35% to 47% in the period respectively (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% for the period respectively (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 similar conclusion to that obtained earlier in the context of the whole industry; 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. Interestingly, 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).

Table 2: Important 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	
1994	**Loc**	**For**	**Loc**	**For**	**Loc**	**For**	**Loc**	**For**	**Loc**	**For**	**Loc**	**For**	**Loc**	**For**
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
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
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

Source: Computed by the author from Kenya, Annual Industrial Survey undertaken by Ministry of Trade and Industry, Kenya. Key: Loc: Local firms and For: Foreign firms

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 (1993) in that more productivity indicators were used for consistency checks and instead of just computing ratios we undertake direct comparisons using a two tailed T-test statistical analysis. For firm productivity, we used the following indicators: value added, labour productivity, productivity of raw materials. More to our analysis, two intensities were computed to enrich comparisons; 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 various levels 1%, 5% or 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 – where foreign presence was the highest. *Third,* based on the same indicators, foreign firms dominated in the three sectors. T-tests performed 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 using total factor productivity. The empirical procedure is outlined below.

4.1 Total Factor 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:

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

Where i denotes the firm, j the industry and t the year; all the properties of production function are assumed to hold[16]. 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_{ijt} force can also be categorised 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, sectors and at the same time 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

[16] 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].

existing skill, usefulness of knowledge, firm-level capabilities and other characteristics. Such characteristics include managerial capabilities and organisational competence, inter-sector transfer of resources, R&D, increasing returns to scale, embodied technical progress, and diffusion of technology. Hence, taking the log level specification of equation 4 and incorporating an error term μ_{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 as follows:

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

Where $PART_{ijt}$ is foreign ownership at firm level, $FORPS_{ijt}$ is foreign presence at sector level, $DUMMY_{ijt}$ 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.

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

In this estimation, the dependent variable Y_{ijt}, is 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 also 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 were expected to be either positive or negative. A positive sign coefficient would suggest a positive correlation implying a positive impact of foreign presence on productivity in Kenya's manufacturing while a negative sign would mean a negative impact. A positive correlation would mean that foreign firms contributed positively to the total factor growth through technology transfer from foreign firms, knowledge, skills and other forms of spillovers.

In the contrary, negative correlation 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 characterised 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 such 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 to 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. With GLS a coefficient of 0.003 was obtained and 0.002 with RE which 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 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 but however emphasise 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 estimated 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.

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%, was likely to increase its firm 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 3 Impact of Foreign Presence on Total Factor Productivity: Panel Regression Estimates for All the Firms, Kenya, 1994-2001

Variable	GLS	GLS	GLS	Ran. eff.	Ran. eff.	Ran. 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

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

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 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 approximately between 0.20 and 0.24 percentage points. We emphasise that these results are in line with traditional models – standard productivity models estimated ignoring industry, time and locational effects etc.

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, it is tempting to support these findings. However, we choose not to and emphasise that extra work is required employing alternative analytical techniques including a reconceptualisation of spillovers.

Table 4: Impact of Foreign Presence on Total Factor Productivity Panel Regression Estimates for Domestic Firms, Kenya, 1994-2005

Variable	GLS	GLS	GLS	Ran. eff.	Ran. eff.	Ran. 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

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

All the other independent variables had the expected results, positive and were significant at 1% when time and sectoral dummies were included. 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: Analysis by 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 total factor productivity by scale orientation. The influence of scale on spillover occurrence can either be positive or negative. For industries involved with economies of scale then minimum efficiency scale is involved and in such a case scale would influence productivity [see 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). Rational 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 the firm can acquire advanced expensive machinery and equipment. They also enjoy managerial economies in that a firm gets better placed to organise its administration by undertaking proper division of labour based on specialisation. Chain of command is established leading to improved techniques for production and distribution. This is in line with Adam Smith emphasis of labour and specialisation (Smith, 1776). Financial economies of scale whereby large firms can borrow at lower rates than small firms. Marketing economies of scale in that; a large firm is in a better position to spread cost of its advertisement in national television, radio and local dailies across a large level of output. R&D economies when a firm is able to develop new and better products. Similarly, as articulated by Alfred Marshall, large firms are better placed to enjoy from existing external economies of scale such as: existing local skilled labour force. Existing specialised support system e.g. suppliers of parts or services (Marshall, 1920).

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 above 138 were classified as "large firms".

The estimated results of foreign impact on total factor 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 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 above – with dummies included – the results were not significant. Two interesting conclusion emerge. 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 more 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 in future. 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.

Table 5: Impact of Foreign Presence on Total Factor Productivity by Scale
Panel Regression Estimates for All the Firms by Scale

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 GroupWise Heter.	2320.62 (0.000)	2380.22 (0.000)	2120.27 (0.000)	2216.64 (0.000)	1545.17 (0.000)	1617.52 (0.000)	1428.28 (0.000)	1495.99 (0.000)
No. of observations	2258	2258	2258	2258	1389	1389	1389	1389
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 (0.000)	730.29 (0.000)	461.05 (0.000)	470.01 (0.000)	166.39 (0.000)	475.71 (0.000)	158.83 (0.000)	200.22 (0.000)
No. of observations	624	624	624	624	282	282	282	282

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

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 in above, results obtained with dummies included supported results observed with recent developments in the productivity analysis.

4.3 Effect of Foreign Presence on Firm Productivity: Analysis by 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. 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 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 with those obtained with recent developments to the empirical spillover literature.

Contrarily, results obtained with 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 requirement for spillovers suggesting that a relatively low technology gap was inevitable for spillovers to occur in the Kenyan context. This observation differs with 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.

Table 6: Impact of Foreign Presence on Total Factor Productivity by Technology Gap: Panel Regression Estimates by Technology Gap

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 (0.000)	3103.00 (0.000)	2903.65 (0.000)	2960.07 (0.000)	1652.17 (0.000)	1723.93 (0.000)	1557.24 (0.000)	1633.65 (0.000)
No. of observations	2033	2033	2033	2033	1195	1195	1195	1195

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 GroupWise Heter.	1249.20 (0.000)	1271.55 (0.000)	1230.07 (0.000)	1237.01 (0.000)	807.58 (0.000)	836.87 (0.000)	769.92 (0.000)	20030.96 (0.000)
No. of observations	849	849	849	849	476	476	476	476

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

The observation is in support of low technology gap advocates [Cantwell, 1989; Kokko, 1994; Kokko, Tansini and Zejan, 1996; Sjoholm, 1997]. When technology gaps are too large they usually require inputs of far more sophisticated machinery embedded in wider systems of control, quality etc 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 (e.g. in terms of knowledge, technology assistance, finance etc).

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 benefited slightly less than when all the firms were considered. This is not surprising since in the category of all the firms, foreign firms are included who are more endowed with resources necessary in the spillover process than their domestic counterparts. Results obtained with dummies were not statistically significant. As in above, 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 supporting work following recent developments in spillover analysis.

5. Summary Discussion and Emerging Critiques

The theoretical issues in this paper drew insights from FDI, spillovers and productivity literature. While studies done following early contributions usually found spillovers, those based on recent developments failed to find spillovers. The aim of this paper was to undertake an empirical determination of the effect of FDI on total factor productivity following the two different methodologies in order to provide a wide set of results for comparison in the Kenyan – sub Saharan context.

Foreign participation at firm level was observed to have significant influence on total factor productivity suggesting 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 on the contrary, 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 productivity techniques.

These results; however ought to be interpreted with great caution as it can be misleading on one side to interprete them to imply FDI has no effect on productivity. As pointed out, it is possible for manufacturing sectors to be different, and indeed they do on many fronts such as FDI presence, structure, conduct, level of FDI activities etc. 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 butterless the fact that an ideal FDI analysis ought to be undertaken sector-wise and if possible by sub sectors while maintaining firm, micro level, as the basic unit of analysis.

The aforegoing argument leads to an important fact that before a concrete conclusion that no spillovers exist in the Kenyan context can be made, or in any other context for that matter, an alternative framework must be considered. Productivity techniques – including total factor productivity – though widely used in examining spillovers was shown to be characterised 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 learning effort and technological capabilities of domestic firms and not entirely on foreign presence per se. In such cases productivity technique 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 doctrines, a correlation between productivity and 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 therefore argue that a different framework must therefore 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 productivity

techniques. We recommend that this be done conceptualising 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 and taking NSI as the point of departure. The NSI emphasises the ways in which economic agents interact, 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 forstering learning and innovation. According to Lundvall (1992):

> "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"(Lundvall, 1992: p. 2 & 12).

According to Dahlman and Nelson (1995) NSI is viewed to include 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" (Dahlman and Nelson, 1995: p. 90).

Interactions among agents are important for the purpose of production, diffusion and use of knowledge in bringing new products, processes and forms of organisation into economic use. As noted from the definition, agents in support of this process would include institutions and organisations such as industry and business associations, R&D, innovation and productivity centres and technological and financing infrastructure support. Organisations 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).

6. Conclusion and Recommendations

The objective of this paper was to examine whether spillovers occurred in the Kenyan manufacturing industry using both traditional and recent developments in productivity technique. From the literature, results obtained using both techniques were inconclusive. A comparative behaviour undertaken between foreign and locally owned firms confirmed MNCs dominated in virtually all the economic activities. The paper showed that the results obtained for the Kenyan manufacturuing were inconclusive thus in line with those observed in the literature – even when considering technology gap and size orientations.

This paper took the analysis further and argued that the results obtained not withstanding productivity approach was characterised by inherent weaknesses which prompted a rethinking in the framework of spillover analysis. As an example the productivity technique was observed to be simplistic, blurring the mechanism of spillover occurrence while ignoring the role of domestic technological effort. The paper therefore recommended a broad approach in spillover analysis, beyond productivity techniques to include technological innovations.

At the heart of technological innovations is the NSI which emphasises the importance of learning, capability building and innovation. Only through use of this kind of framework can generation, diffusion and use of knowledge can be determined and understood. The study also suggested a reconceptualisation of spillovers in terms of learning and capability building contrary to past conceptualisation 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 considerations suggestions raised in this paper.

Appendix 1: Annual Growth Rates for All Firms and Some Selected Manufacturing Sectors, Kenya

	Locally Owned Firms			*Foreign Owned Firms*		
Annual Growth Rates Computed for All Firms in the Manufacturing Industry						
	1994-1997	**1997-2001**	**1994-2001**	**1994-1998**	**1997-2002**	**1994-2001**
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 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 Tobacco	Local Firms	22,733 (1,953)	220 (18)	2.428 (0.458)	758 (187)	0.515 (0.015)
	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 and Leather	Local Firms	6013 (703)	1061 (302)	1.180 (0.134)	1164 (369)	0.621 (0.017)
	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 Wood Products	Local Firms	4747 (710)	144 (16)	1.652 (0.221)	780 (213)	0.605 (0.279)
	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 Publishing	Local Firms	53468 (17002)	447 (121)	2.788 (0.496)	122 (14)	0.691 (0.016)
	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 and Plastics	Local Firms	11403 (1019)	162 (9)	1.157 (0.072)	126 (10)	0.529 (0.015)
	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 Mineral products	Local Firms	19762 (5602)	151 (21)	3.827 (0.696)	324 (78)	0.398 (0.032)
	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; Basic Metal Industries, Machinery and Equipment	Local Firms	7309 (738)	200 (39)	1.30 (0.111)	2809 (921)	0.672 (0.014)
	Foreign Firms	36072 (7310)	409 (91)	1.730 (0.162)	3129 (904)	0.578 (0.016)
	T-Values	-4.063***	-2.160**	-2.226**	-0.247	4.522***

Note: *, ** and *** - Significant at 10%, 5% and 1% levels 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. The numbers in parebthesis represent standard errors.

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

References

Abramovitz, M. A. (1986). "Catching Up, Forging Ahead, and Falling Behind", *Journal of Economic History* **66**: 385-406.

Aitken, B. and A. E. Harrison (1992). "Does Proximity to Foreign Firms Induce Technology Spillovers?" Mimeo, World Bank and International Monetary Fund.

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

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

Blomstrom, M. and H. Persson (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 F. Sjoholm (1999). "Technology Transfer and Spillovers: Does Local Participation with Multinationals Matter?", *European Economic Review* **43**: 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. T. and E. Helpman (1995). "International R&D Spillovers", *European Economic Review* 39(5): 859-87.

Dahlman, C. and R. Nelson (1995). Social Absorptive Capability, National Innovation Systems and Economic Development, in *Social Capability and Long Term Economic Growth.* B. Koo and D. Perkins: 82-122.

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

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

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

Edquist, C. (1997). *Systems of Innovation: Technologies, Institutions and Organizations.* London, Science, Technology and the International Political Economy.

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.

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.

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

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

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

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

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

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

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

Koizumi, T. and K. J. Kopecky (1977). "Economic Growth, Capital Movements and the International Transfer of Technical Knowledge", *Journal of International Economics* **7**: 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**: 517-30.

Kokko, A., R. Tansini and M. Zejan (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,* The Macmillan Press Ltd.

Lall, S. (1987). *Learning to Industrialise: The Acquisition of Technological Capability by India*. London, Macmillan Press.

Lall, S. and P. Streeten (1977). *Foreign Investment, Transnational and Developing Countries,* Basingstoke: Macmillan

Lucas, R. E. J. (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: Francis Pinter.

Marshall, A. (1920). *Industry and Trade,* London: macmillan.

Nelson, R. R. (1993). *National Innovation Systems: A Comparative Analysis,* Oxford: Oxford University Press.

Nelson, R. R. and S. G. Winter (1982). *An Evolutionary Theory of Economic Change,* Cambridge: Harvard University Press.

Pratten, C. F. (1971). *Economies of Scale in Manufacturing Industry,* Cambridge, UK: Cambridge University Press.

Rasiah, R. (1995). *Foreign Capital and Industrialisation in Malaysia,* Basingstoke: Macmillan.

Rasiah, R. (2004). *Foreign Firms, Technological Capabilities and Economic Performance: Evidence from Africa, Asia and Latin America.* Cheltenham, UK and Northampton, MA, USA, Edward Elgar.

Rasiah, R. and G. Gachino (2005). Are Foreign Firms more Productive and Export and Technology Intensive than Local Firms in Kenyan Manufacturing? *Oxford Development Studies 33(2)*

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

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

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

Sjoholm, F. (1997). "Technology Gap, Competition and Spillovers from Direct Foreign Investment: Evidence from Established Data", *Journal of Development Studies* **36**: 1.

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, Nairobi: Heinemann.

UNCTAD (2001). *World Investment Report: Promoting Linkages.* New York, Geneva, United Nations Conference on Trade and Development.

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

Wang, J. and M. Blomstrom (1992). "Foreing Investment and Technology Transfer: A Simple Model", *European Economic Review* **36**: 137-155.

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

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