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Technology Transfer and South African Investment in Tanzania

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Abstract

This paper examines whether transfer of modern technology from foreign drect investment among developing countries has a potential to raise the low technological bases and complement to the modern technology coming from developed countries. The paper takes the case of South Africa and examines how production plans by 29 South African companies, which entered in Tanzania between 1996 and 2002 in manufacturing, tourism and business service sectors, can address these technological issues.

The study uses foreign firms' annual turnovers, employments and investment costs recorded during their registrations to obtain the estimates of firm's total output growth. The study assumes Industrial Organization Approach, which predicts that all FDIs bring in new technology. The study also assumes that this new technology (foreign presence) and technology spillovers (firms' output share in a particular sector) are the sole determinants of total factor productivity (TFP). The paper then establishes the difference in terms of technology transfer from FDI and technology spillovers from output produced by the foreign companies between South African companies on one hand and 97 companies from Western countries and other developing countries on the other, through the regression analysis.

The results show that South African companies have a higher potential in terms of both technology transfer and technology spillovers compared to companies from Western countries and other developing countries. While these results should be treated with care, the study strongly believes that South African companies have a significant potential for technology transfer in the country and technology spillovers for the benefit of the domestic companies. The results also show that manufacturing and tourism sectors have a high potential for technology transfer and spillovers from FDI.

1. Background

Technology transfer is regarded as a key means of bridging the gap between the world's rich and poor countries. At the core of the developmental challenges in this era of globalization is the ability of the poor countries to participate in and benefit from the rapid advances in scientific research and technological innovations that now drive economic and social development. These powerful forces are largely controlled by industrialized countries in the North and are mostly directed to address the problems and needs of rich countries.

The South, as a whole, contributes little to modern science and technology. For instance, developing countries only account for only 4 per cent of world research and development expenditures and lag behind the developed countries in the generation and application of appropriate and modern technologies (Mohamed H.A, 2000). While North-South cooperation is vital to enable the developing nations gain technical and managerial capabilities, it should be complemented by South-South cooperation to enhance its indigenous capacity to generate, manage and utilize science and technology in ways that address its own basic needs such as poverty alleviation.

One way in which technology can be internationally transferred is through foreign direct investment (FDI). Tanzania's efforts[2] aimed at improving her low technological base before 1990 had been somehow impeded by the adoption of a planned economy, which was more or less closed (UNCTAD, 2002). The planned economy paid less attention to local and foreign private enterprises in favour of the State-run enterprises. However, the shift towards a market economy in the early 1990s triggered significant private investment both local and foreign in the country. These inflows opened up many opportunities including access to modern technology.

With the market economy, there has been a growing importance of South-South technology transfer in contrast to the traditional North-South flows. Since the early 1990s, Tanzania has attracted new investments from South Africa, Mauritius, Malaysia, China and India involving the transfer of technology, technical know-how, and managerial skills and new working style and culture from the home countries. FDI from these developing countries have been attracted to small- to medium-scale activities, which are generally labor-intensive and often rely more on local than expatriate personnel. The potential for backward and forward linkages and the diffusion of technologies and know-how that are more appropriate for the needs of Tanzanian enterprises is, therefore, higher.

One interesting case of this investment from developing countries is that from South Africa. South African investment has dramatically increased in the country and South African companies have substantially increased their stake in the country's economy for a very short 1994-2002 period. Increased South African investment in Tanzania during the second half of the

[2] Tanzania established the first policy document on technology "The National Science and Technology policy" in 1986, which was later revised in 1996.

Over the last four decades, Tanzania established a number of support institutions for technological development. These included the Tanzania National Scientific Research Council (TNSRC) in 1969; the Tanzania Commission for Science and Technology (COSTECH) in 1986 to determine R&D priority areas; the Centre for the Development and Transfer of Technology (CDTT) for monitoring and regulating technology flows; the Tanzania Industrial Research and Development Organization (TIRDO) in 1979 to monitor services related to Technology; Small Industries Development Organization SIDO to provide institutional support including marketing skill formation; and the Institute of Production Innovation (IPI) for production related innovations.

Other support institutions as far as technology development is concerned include Tanzania Bureau of Standards (TBS), Tanzania Industrial Studies and Consulting Organization (TISCO), National Construction Council (NCC), Building Research Units (BRU) and National Radiation Commission (NRC).

1990s has sparked debate around a number of topics. High on the list is whether or not the enlarged South African presence in the Tanzanian economy can improve the low Tanzanian technological base. Concerns have also been raised about potential impact of South African investment in complementing technology transfer from the North Industrialized countries.

The aim of the present study is therefore to find out whether South African investment can complement modern technology brought by companies from the Western countries and how local firms have a potential to benefit indirectly from technology brought about by the South African companies. The study analyses only indirect benefits because of the fact that markets for technology are imperfect (Buckley and Casson, 1976). The results to be obtained can have significant implications for devising FDI incentive policies. If South African investment can lead to higher productivity through technology transfer, it would strengthen the case for continuing the open investment policies in general and South-South investment cooperation in particular presently in place in Tanzania. But if South African FDI cannot bring a significant inward technology flow, then it would strengthen the case for designing incentives for South African companies to transfer technology in Tanzania.

After this background information, Section two of the paper will clarify some concepts on FDI and technology transfer; as well as the South African experiences in technology transfer. This will be followed in Section three by a review of the theoretical and empirical literature on the linkage between technology transfers from foreign direct investment and the productivity of both local and foreign companies. Methodology including a discussion of the model to be estimated, data and the construction of variables will be discussed in Section four, with the interpretation of statistical results in Section five. Lastly in Section six, the paper will give conclusions and policy implications.

2. FDI and Technology Transfer: Concepts and South African Experiences

Before proceeding further with the paper, it is necessary to have a clear understanding of what FDI is, sources of technology, and channels through which technology from FDI can spill over to the domestic companies.

In short, FDI involves the acquisition or creation of assets in a foreign country. Usually investors possess a controlling stake and have long-term interests in the investment (Vickers, B. 2002). FDI is one of the defining features of globalisation over the last two decades. Renewed interest in the development dimension of FDI is manifested by further trade and investment liberalization; new growth theory; and new data and measurement techniques.

There are three well known forms of FDI: first, Greenfield investment, which creates a new asset or facility, either as a wholly owned subsidiary or as a controlling equity stake in a joint venture with a local or foreign firm; second, cross-border merger and acquisition (M&A), which involves acquiring or merging with a local firm. In a cross-border M&A, two firms from different countries combine their assets and operations to form a new legal entity. A cross-border acquisition involves acquiring a controlling stake of more than 10 per cent of equity in an existing local firm or foreign affiliate. The third form is the Brownfield investment, a hybrid form of investment in which the foreign investor acquires a firm but almost completely replaces plant and equipment. Sometimes labour and product lines are also changed (CUTS, 2001).

Many South African companies found in Tanzania qualify as Greenfield investments. For instance, the Wonder Foods Tanzania Ltd, a subsidiary of Cow Bell International and headquartered in South Africa was established in 1998 as the first to pack, market and distribute milk powder in the country. The company qualifies as a Greenfield investment in that it introduced a new product to the Tanzania market with the production capacity located within the country (UNCTAD, 2000).

As regards the other forms of FDI, the Geita Mines is an example of Cross Border M& A between companies from two countries: Ashanti Company from Ghana and AngloGold Ltd from South Africa. The study has no information about South African companies engaged in Brownfield investment in which the company completely replaces the existing plant and machinery. But this is likely to happen in the privatization of the former state companies with very crude technologies.

The other concept is technology transfer. Technology can be transferred through imports of new capital and differentiated intermediate goods; learning by exporting; trade in technology (patents and licensing); and FDI (Damijan et al, 2001). This study focuses on technology, which comes with FDI.

FDI arguably comes with packages of modern technologies. Technology from FDI generally may take the following forms: (a) technology-embodying products such as machinery, equipment and tools; (b) technical skills such as management and organizational expertise, marketing, quality control and other production related skills; and (c) process-related technologies such as proprietary know-how, design and technical specifications and R&D capability. Note that, form (c) is very rare in Tanzania (UNCTAD, 2000).

As regards technology embodying products, there is no doubt that the recent surge in FDI inflows has increased the stock of technology-embodying products such as machinery and equipment, available in the country. In some cases the technology transferred is new to the

country. For instance, the Automated Teller Machines (ATM). This technology is adopted by several foreign banks including the South African NBC (1997).

Although Tanzania made commendable efforts in human resource development for three decades after attaining its independence in 1961, the country had not succeeded well in the area of technical training provision. This problem was aggravated during the mid-1980s by the reduction of public resources allocated in the education sector following the adoption of the Structural Adjustment Programmes. Special compliments should be paid to the positive impact of FDI in general and South African investment in particular in transferring these technical skills.

There are a number of South African companies, which are well known to provide training, both in-house and by sending technical staff for advanced training abroad. Some of these companies are South African NBC (1997) which is conducting staff training for its workers in order to cope with new technologies introduced in the bank; Tanga Cement, which has invested a lot in a human resource development programme aimed at improving the skill levels of her workforce of 325; and Tanzania Breweries which launched a major in-house training and development programme in 1994 to cater for local requirement ranging from formal technical training to first aid and life skills courses. Under the programme, selected employees are sent to South African Breweries's Training Institutions in South Africa for advanced management education and technical training.

According to the literature, there are four channels through which these packages of technology transferred by FDI can be diffused in the host country. These include:

- FDI establishing linkages with domestic enterprises – as suppliers (backward linkage) or users (forward linkage)[3].
- Skills transfer through training, learning-by-doing, learning-by-interacting, and job-mobility[4].
- Demonstration effects as local firms copy or adapt new technologies, market channels and management techniques introduced by foreign investors. This can take place in activities that involve processing or manufacturing and also services.[5]
- Strategic technology partnership between a foreign investor and a domestic partner in areas such as R&D.

This paper has no information about any strategic technology partnership between a South African investor and a domestic partner in areas such as R&D. However an attempt will be made to discuss South African experiences in transferring technology using other channels.

There are mixed opinions regarding South African experiences in locally transferring technology through backward linkages. For example, it is argued that most of the investors particularly those from neighboring countries have relied on raw materials from their home countries. It is even alleged that some South African retailers have failed to source locally and therefore been accused of being arrogant, self serving and aggressive. It is noteworthy that the local content of foreign firms is one of the main determinants of the strength of their linkages (Reuber et al. 1973). In Tanzania, establishing linkages with local enterprises has remained a free choice of foreign investors due to the fact that imposing domestic-content requirements – a typical protectionist

[3] Backward Linkages – Lall (1980), Behrman and Wallander (1979), Reuber et al. (1973) and Aitken and Harrison (1991) and Forward Linkages – Reuber et al (1973), McAleese and McDonald (1978) and Blomström (1991).
[4] Training of Local employees in foreign affiliates – Gerschenberg (1987), Chen (1983) and Fairchild and Sosin (1987)
[5] Demonstration effects – Riedel (1975), Swan (1973), Tilton (1971), and Langdon (1981).

approach – is not viable in the country given the Government's commitment to maintain a liberal investment policy climate.

As regards training, which contributes to skill formation, many South African firms have been conducting trainings within their firms and also made use of well-established affiliate firms in the country as training grounds. Tanzania has an advantage of having low cost labour and many foreign firms still regard foreign expatriates as expensive. It is estimated that hiring a manager from a developed country may cost between $200,000 and $250,000 per annum (UNCTAD, 2000). Therefore, training at the firm level is a necessary strategy for foreign firms in Tanzania, which require highly skilled technical and managerial staff.

Demonstration effects – another channel of technology transfer – occur when local firms copy or adapt new technologies, market channels and management techniques introduced by foreign investors. This often happens to services and manufacturing companies. Companies with high market shares, such as the Tanzania Breweries, may lead to other small companies which do not want to lose business to be forced to copy these big companies' management and marketing techniques. It is noteworthy that demonstration effects are often related to competition (Blomström, 1986).

Taking into consideration the above-mentioned packages of technology coming with FDI and channels through which this technology can diffuse locally, the study assumes that output from a foreign firm embodies some technology and this technology is transferred through local supplies (backward linkages).

3. Theoretical and Empirical Reviews

Theoretical Considerations

There are two approaches that economic theory uses in order to study the impact of Foreign Direct Investment on the host country's economy. The first one is based on the standard theory of international trade (MacDougall, 1960). This approach basically examines how marginal increments in investment from abroad are distributed. The model predicts that FDI will raise marginal product of labour and reduce marginal product of capital in the host country. Other benefits include higher tax revenue from foreign profits, economies of scale, and positive externalities where domestic firms are forced by foreign competition to adopt more efficient methods.

The second approach is referred to as an industrial organization approach. This revolves around the question why firms undertake investment abroad to produce the same goods as they produce at home. It assumes that for foreign investment to thrive there must be some imperfections in markets for goods or factors, including among the latter technology (Kindleberger, 1969). Thus to be able to invest in production in foreign markets, a firm must possess some assets that can be used profitably in the foreign markets. These assets include product and process technology or management and marketing skills.

Although the traditional trade theory approach and the industrial organization approach are not mutually exclusive, they have so far generally emphasized different aspects of capital movements. Trade theorists have mainly been interested in the direct effects of foreign investment on factor rewards, employment, and capital flows, while those following the industrial organization approach have put more emphasis on indirect effects or externalities. The present study will adopt an industrial organization approach because the technology market is imperfect and involves a lot of externalities (Buckley and Casson, 1976).

Empirical Evidence on Spillovers

Empirically, there are many studies, which have analysed the impact of FDI to capture the external effects. Among the pioneering studies was the MacDougall (1960), which analysed the welfare impacts of FDI. Since then studies have taken many directions, some of them analysing the impacts of FDI on technology transfer. Among the recent studies included are those: on backward linkages (e.g, Aitken and Harrison, 1991), on forward linkages (e.g., Blomström, 1991), on training of local employees in the foreign affiliates (e.g., caves, 1996), on expenditure on R&D (e.g., Nadiri, 1991a), and on demonstration effects (e.g., Jenkins, 1990).

Many empirical studies have related technology with the foreign presence. For instance, Caves (1974) for Australia, Globerman (1979) for Canada and Blomström and Persson (1983) for Mexico. These studies included foreign presence as an explanatory variable in the multiple regressions. The three studies concluded that external effects are significant, although they could not say anything about how spillovers took place.

There are many recent studies, which have related technology transfers from the foreign company to changes in the productivity of local companies. For example, Nadiri (1991b) uses data from 1968 to 1988 from four countries – France, Germany, UK and Japan – to examine this relationship. The study found that increases in the capital stock owned by US Multinational companies (MNCs) seem to stimulate the domestic investment. The increase appears to have a positive impact on the growth of total factor productivity in host countries manufacturing sectors.

There is also a study by Aitken and Harrison (1991), which examined the behaviour of manufacturing companies in Venezuela using data from 1976 to 1989 to study the relationship between FDI and the productivity of a host firm. They found that FDI has a significantly positive effect on host firm productivity ("own- firm effect") and has a significantly negative effect on domestically owned firms ("business stealing effect")

One study done in Africa and belonged to Haddad and Harrison (1991,1993) investigated the behaviour of industrial sector in Morocco using 1985-1989 data. Haddad and Harrison found that spillovers do not take place in all industrial sectors; foreign presence lowers the average dispersion of a sector's productivity; and external effects are more significant in sectors with simple technology.

Another study was by Borenzstein, De Gregorio and Lee (1998), which used the 1970-1989 data for 69 developing countries and found that FDI significantly affects growth in developing countries, but only when the host country has a minimum threshold of human capital (sufficient absorptive capability).

In the same year – 1998, Djankov and Hoekman (1998) studied the behaviour of the industrial sector in the Czech Republic using data from 1992 to 1996. They found that FDI has a significant impact on host firms' productivity and has significant negative spillover effects on other firms in the industry. Imports of capital goods serve as a mechanism of technology transfer to domestic firms.

Very recent in 1999, Konings (1999) used the 1993-1997 data for three East European countries – Belgium, Romania and Poland. The study found a significant positive impact of FDI on host firms. However, the study found no significant spillovers to domestic firms in Belgium and Romania, and significant negative spillovers in Poland.

In brief, a number of empirical studies generally show that increase in FDI can lead to an increase in the productivity of both local and foreign firms through indirect technology channels. But this depends on country's characteristics and the policy environment.

4. Methodology

Model Specification

The model draws on Schmidt and Sickles (1984) who have suggested a way to estimate firm-specific productivity using panel data. However, this study attempts to modify this model into cross-section analysis[6]. The Schmidt and Sickles (1984) assumes the production function for firm *i* in sector *j* to have a Cobb-Douglas form as follows:

(1a) $Y_{ij}=A_{ij}K^{a}_{ij}L^{b}_{ij}N^{c}_{ij}, \qquad r=a+b+c=1$

where Y_{ij} is gross output, K_{ij}, L_{ij} and N_{ij} represent capital stock, labor input and materials; and Aij is total factor productivity (TFP).

However, due to the lack of data on intermediate materials, the present study uses the following version of the model:

(1b) $Y_{ij}=A_{ij}K^{a}_{ij}L^{b}_{ij}, \quad r=a+b=1$

The firm's TFP changes are therefore obtained after taking the logarithm of (1b):

(2) $y_{ij}=a_{ij}+a\,k_{ij}+bl_{ij}$

where lower case characters indicate percentage changes.

But the above technology parameter a_{ij} is simply the regression residual and it tells us nothing about factors that influence TFP percentage changes. Thus, TFP can be replaced in the equation by factors that are known to determine its percentage changes and hence growth:

(3a) $A_{ij}=f(Rd_{ij}, H_{ij}, F_{ij}, Spill_{ij}, X_{ij}, M_{ij}, d_j)$

where Rd_{ijt} and H_{ijt} account for technology determinants internal to the firm, factors F_i through M_{it} account for factors external to the firm, i.e., international technology spillovers. Rd_{ijt} respresents stock of R&D, H_{ijt} indicates accumulated human capital, Fs_i is dummy for foreign ownership in the firm, $Spill_{it}$ measures the extent of foreign technology spillovers of a firm in the sector which the present study defines as the share of company's output in the particular sector, X_{ijt} and M_{ijt} refer to export and import propensity of the firm respectively, while d_j are the sector dummies which the present study defines as tourism, manufacturing and business services sectors.

Due to lack of data on R&D expenditures, accumulated human capital, export and import propensity of the firm, these variables are left out of the model. The model of TFP remains with the foreign ownership *F* which is divided into three categories: Western country ownership *wfdi*, South African ownership *sfdi*, and other developing countries' ownership *ofdi*. Therefore the TFP function modifies into:

(3b) $A_{ij}=f(wfdi_{ij}, sfdi_{ij}, ofdi_{ij}, spill_{ij}, d_j)$

Equation (1b) is therefore extended and specified as follows:

[6] The possibility of panel data analysis can still be explored given the availability of data and can help to have a richer analysis.

(4) $$Y_{ij} = b_0 + b_1 L_{ij} + b_2 K_{ij} + b_3 wfdi_{ij} + b_4 sfdi_{ij} + b_5 wfdi*Spill_{ij} + b_6 sfdi*Spill_{ij} + b_7 ofdi*Spill_{ij} + b_8 tour*Spill_{ij} + b_9 manf*Spill_{ij} + e_{ij}$$

where Y_{ij} is the estimated annual output of firm i in sector j; $tour_{ij}$ is the dummy for tourism sector, $manf_{ij}$ is the dummy for manufacturing sector and e_{ijt} is the error term of the regression. Note that the dummies for FDI from other developing countries *ofdi* and for the business services sector *serv* are left out of the model to avoid the dummy variable trap. Note also that in Equation 4, *Yij*, *Lij*, *Kij* and *spill* are in logarithmic form.

The model tries to answer three research questions:

1. Does South African FDI represent a significant potential for transfer of technology to Tanzania?
2. Can South African FDI generate significant externalities to domestic firms?
3. What difference can we draw between FDI from South Africa on one hand, and FDI from Western countries and other developing countries on the other in terms of the potential for technology transfer and spillovers?

This study hypothesizes the following:

- that, percentage increases in labour, capital, and FDI leads to percentage increases in annual output;
- that, percentage increases in technological spillovers from foreign firms in the sectors (manufacturing, tourism and business services) will either increase or decrease the productivity of other firms in the sector;
- and that, the effects of Western FDI on technology transfer and spillovers is both greater than that from South African FDI.

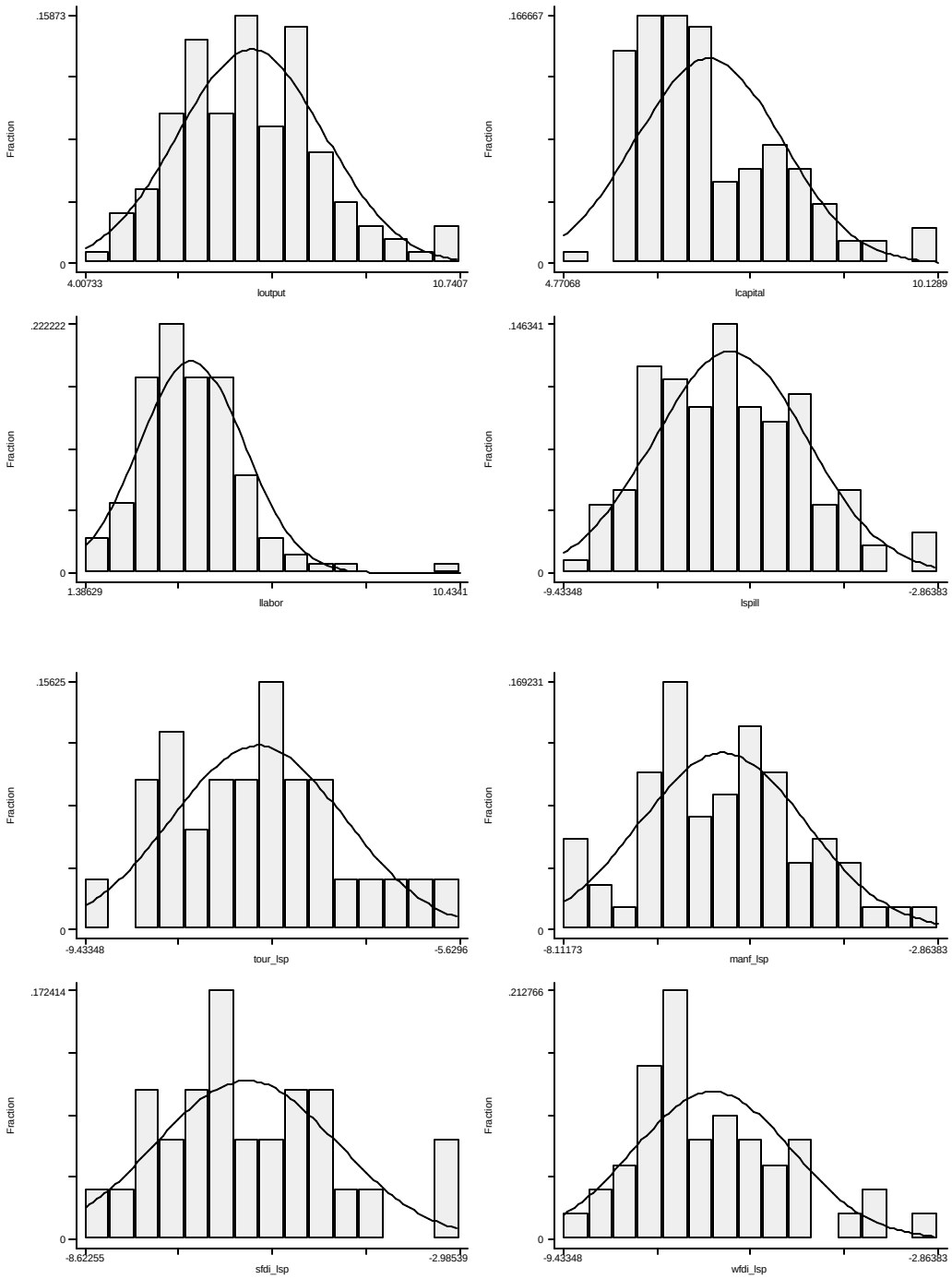
The model was estimated by the STATA econometric package using cross sectional data analysis.

Data Description

The data set consists of the recent records of foreign companies, which have been registered with the Tanzania Investment Centre (TIC) between 1996 and 2002 in the selected regions and sectors. The total number of companies was 126 and the companies were divided into 3 categories according to their nationalities: those coming from South Africa were 29 (23 percent), those coming from developed countries (mostly Europe, USA, and Japan) were 49 (39 percent) and those coming from other developing countries (mostly Asia and Africa) were 48 (38 percent).

The 29 South African companies represent more than 90 percent of South African companies available in the TIC dataset between 1996 and 2002. The selection for other 97 foreign companies was based on the criteria that a company possesses full information required for the study. This might have led to selection bias. However, the normality of the variables, as shown by the histograms (see Figure 1 below), presents reliable evidence that the selection has covered all characteristics available in the firms.

Figure 1. Histograms for the Main Variables



In addition to the nationalities of the companies, the data set was classified in terms of location and sector. The companies were from two regions Arusha (17) and Dar es Salaam (109) and from three sectors: manufacturing (68), business and financial services (26) and tourist services (32). The reason for choosing the two regions and the three sectors was simply that a lot of FDI registered by TIC flew into the two regions and the three sectors. If all the regions and sectors were selected and included, the resulting estimated coefficients could be inefficient due to fact

that some regions and sectors would contain a very few South African companies for analysis. Table 1 below shows details resulting from this classification.

Table 1: FDI Sample by Region and Location, 1996-2002

	Total FDI			South African FDI			Western Country FDI			Other Countries FDI		
	Arusha	Dar	Total	Arusha	Dar	Total	Arusha	Dar	Total	Arusha	Dar	Total
Manufacturing	5	63	68	1	10	11	3	18	21	1	35	36
B&F Services	1	25	26	1	11	12	0	9	9	0	5	5
Tourism	11	21	32	2	4	6	6	13	19	3	4	7
Total	17	109	126	4	25	29	9	40	49	4	44	48

Source: TIC

According to Table 1, the Arusha region lacks sufficient information in the manufacturing and financial business services sectors. In this case, the paper would not draw any conclusion regarding the regional potential differences in terms of technology transfer and spillover effects.

The main variables in the TIC dataset consisted of planned employment, investment costs and estimated annual output. The main limitation was that in most companies in the sample, information regarding the estimated annual output was not given in monetary terms. An attempt was therefore made to convert some of the output figures into monetary terms using the price information in the recent Economic Survey (2001).

The other main data computation involved the calculation of spillovers. The study assumes spillovers mainly come from output produced and supplied into the domestic market[7]. Due to lack of data on export propensity of a firm, the study used subjective approximation of the export propensity: that is, 0.5 for manufacturing sector (assuming that all foreign manufacturing companies tend to export), and 0 for the business services and tourism sectors (assuming that services are only supplied within the country's geographical boundaries). The spillovers were then calculated as the ratio of a firm's annual output produced for the domestic market to the 1996-2002 average sector's GDP at market prices. However, this method can overstate the estimated spillover effects because annual output produced by the companies is not measured using value-added method like in the case of GDP.

[7] As noted in Section 2 above, other channels through which technology can be transferred both internationally and nationally include skills transfer, strategic technology partnerships and demonstration effects.

5. Discussion of the Regression Results

Table 2 presents the descriptive statistics of the model and Table 3 presents the regression results of the model in Equation 4, which was estimated using Ordinary Least Squares (OLS) technique.

Table 2: Descriptive Statistics of the Sample Data For Regression

Variable	Obs	Mean	Median	Std. Dev.	Min	Max
sfdi_lsp	123	-1.4583	0.0000	2.7161	-8.6226	0.0000
wfdi_lsp	123	-2.6051	0.0000	3.4328	-9.4335	0.0000
ofdi_lsp	123	-2.4372	0.0000	3.2043	-8.8739	0.0000
tour_lsp	123	-1.9963	0.0000	3.4088	-9.4335	0.0000
manf_lsp	123	-3.1053	-3.9889	3.0629	-8.1117	0.0000
llabor	126	3.9691	3.9120	1.2717	1.3863	10.4341
lcapital	126	6.8490	6.5958	1.0374	4.7707	10.1289
loutput	126	7.0031	6.9078	1.3116	4.0073	10.7407
lspill	123	-6.5006	-6.6766	1.3412	-9.4335	-2.8638

Table 3: Regression Results For Foreign Firms' Production Function

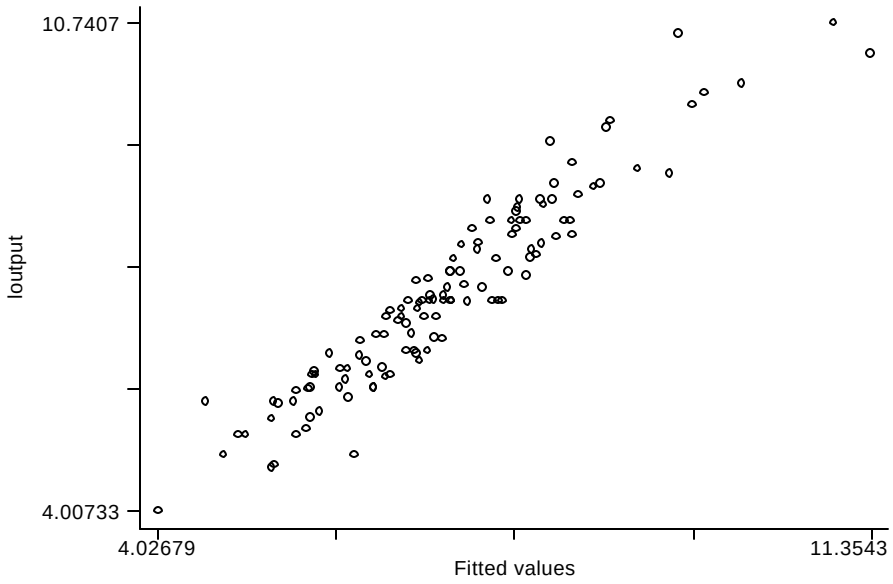
	Model I		Model II	
Explanatory Variables	**Coef.**	**Standard Errors**	**Coef.**	**Standard Errors**
Llabor	0.0465	0.0408		
Lcapital	0.1828**	0.0578	0.2099**	0.0528
Tour	3.3346**	0.7783	3.3633**	0.7789
Manuf	4.1274**	0.3709	4.1673**	0.3697
fdi_s	3.1460**	0.4725	3.2452**	0.4651
fdi_w	1.7564**	0.4269	1.8052**	0.4254
tour_lsp	0.5487**	0.1010	0.5498**	0.1012
manf_lsp	0.6240**	0.0579	0.6259**	0.0580
sfdi_lsp	0.4549**	0.0732	0.4713**	0.0718
wfdi_lsp	0.2786**	0.0625	0.2859**	0.0622
_cons	5.5079**	0.3750	5.4877**	0.3750
Number of Obs		123		123
F Statistic	F(10, 112)	104.8300	F(9, 113)	116.0300
Prob>F		0.0000**		0.0000**
Chi2 Statistic	chi2(1)	3.2400	chi2(1)	5.2800
Prob > chi2		0.0717		0.0216*
R-squared		0.9035		0.9024
Adj R_squared		0.8949		0.8946

Note: ** means significant at one percent whereas * means significant at five percent.

In brief, the adjusted R-squared is reported at about 89 percent in both Model I and Model II showing that the variations in the changes of total factor productivity and factor inputs explain about 89 percent of variations in the changes of total annual output. The F-statistic for testing the null hypothesis that all slope coefficients are zero is rejected at 1 percent level of significance.

However, the Chi-squared statistic from the Breusch-Pagan test for heteroscedasticity (non-constant variance) shows that heteroscedasticity significantly exists in Model II at 5 percent significant level. However, the plot of the fitted values of the dependent variable against the regression residuals (See Figure 2 below) apparently shows that there is no significant evidence of non-constant variance. This conclusion can also be justified if the one-percent-significance level is used.

Figure 2: Plotting Regression Residuals Against Fitted Values



Turning into the factor inputs (labor and capital) the regression results in Model I show that labor input – an important variable in the production function – has a very low positive coefficient, which is not statistically significant. Probably a more classification of labor in terms of skills is required. The productivity of capital in both Model I and Model II is positive as expected showing that for every one percent increase in capital, total annual output increases by about 0.2 percent. Other variables in the model determining Total Factor Productivity (TFP) have positive productivities as expected, which implies that new technology has a positive relationship with the Total Factor Productivity (TFP) of the foreign firms which leads to a positive relationship with total annual output.

As regards comparisons in terms of technology, the regression results show that South African FDI as the main channel of technology transfer into Tanzania surpassing FDI coming from Western countries and other developing countries. The coefficient *fdi_s* in Model II shows that being a South African company increases annual output by about 324 percent (or about 4 times) compared to being a company from other developing countries. Whereas being a company from Western country *fdi_w* increases annual output only about 180 percent (or about 3 times) compared to companies from other developing countries.

In terms of potential for technology spillovers, South African companies seem to do better than companies from Western countries or companies from other developing countries. The results from Model II, which is more parsimonious, show that technology spillovers from South African companies are about 20 percent higher than that from Western companies. The coefficients of

sfdi_sp and *wfdi_sp* in Model II mean that South African companies' share of output in the sectors is about 47 percent higher than that from other developing countries whereas the share of output by the companies from Western countries is only about 29 percent more than that of companies from other developing countries. This implies that South African companies have a greater potential for technology spillovers to the local industries through their products than other foreign companies.

As regards sectors, the manufacturing sector seems to be the main channel of technology transfer in the country. According to the sample used in the study, the sector performs better than the other two sectors (tourism services and other services) in terms of channelling technology in the country. According to Model II, being a manufacturing company increases the annual output by about 417 percent (about 5 times) more than being a company from services sector other than tourism. Whereas being a tourism investment only increases annual output by about 336 percent (about 4 times) more than being an investment for other business services. In addition, the manufacturing sector has a more potential for technology spillovers through products produced than tourism and business service sectors. This is manifested in model II by the coefficient of *manf_sp* being positive and greater than the coefficient of *tour_sp*. Note that, these sectors' differences might give a distorted picture as a result of employing subjective values of the export propensities of the firms. However, the paper can conclude that manufacturing and tourism sectors have a high potential for technology transfer and spillovers.

6. Conclusions and Policy Implications

The study found that South African companies have a significant potential to improve the country's low technological base and complement to modern technology brought by companies from Western countries through technology transfer and spillovers.

As regards comparisons between the potential for South African companies in channelling technology in the countries and other foreign companies, the study's results should be translated carefully. This is due to the selection procedure and a small sample size used for the foreign companies other than from South Africa. However, the study is confident enough to conclude that there is a significant potential in terms of technology transfer and spillover effects from the South African companies. In addition, the study can only conclude that South African companies have a potential to complement the technology from other foreign companies but cannot tell by how much.

One policy implication this paper can draw is that attracting a large volume of South African investment is not bad for the country's economy in terms of efforts to improve the low technological base. Therefore, the paper calls for increased open investment policies with a bias towards attracting investment from developing countries particularly those with more modern technology capacity than that of Tanzania. In terms of sectors, the paper calls for continual efforts to attract FDI in manufacturing and tourism sectors, as these sectors have a high potential for technology transfer and spillovers.

The paper also recommends for an improvement of the absorptive capacity of domestic companies in order to take advantage of the potential for technology spillovers from foreign firms in general and South African companies in particular. This capacity can be increased by encouraging skill formation and R&D activities in the local firms.

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