



African Economic Conference 2007

"Opportunities and Challenges of Development for Africa in the Global Arena"
15-17 November 2007, Addis Ababa, Ethiopia

Transport Infrastructure and FDI: Lessons from Sub Saharan African

Boopen Seetanah, Jamel Khadaroo
University of Technology, Mauritius



African Development Bank Group



Economic Commission for Africa

Transport Infrastructure and FDI: Lessons from Sub Saharan African Economies.

Jameel Khadaroo^a, Boopen Seetanah^{b,*}

^a*Bank of Mauritius, Port-Louis, Mauritius*

^b*University of Technology, Mauritius, Pointes aux Sables, Mauritius*

* Corresponding author. Tel.: +230 2346535; fax: +230 2346219

E-mail address: b.seetanah@utm.intnet.mu (Boopen Seetanah)

ABSTRACT

This paper analyses the role of infrastructure availability, particularly with respect to transportation in determining the attractiveness of foreign direct investment (FDI) inflows. The study is based a panel of 33 Sub-Saharan African countries for the period 1984–2002. Using both static and dynamic panel data approach, transport infrastructure availability is seen to have been contributing to the relative attractiveness of the countries in our sample. Foreign direct investors are also sensible to the other measure of infrastructure, though to a lesser extent as compared to transportation. FDI flows to African economies are confirmed to be resource seeking and also market seeking/openness seeking rather as well. Moreover the study also establishes the presence of dynamism and endogeneity in FDI modelling.

Key Words: *Transport infrastructure, FDI, Dynamic Panel Data, SSA.*

JEL classification: F23, O55

INTRODUCTION

Foreign Direct Investment (FDI) has often been claimed to be a major stimulus to economic growth in developing countries. Its perceived ability to deal with major obstacles such as shortages of financial resources, technology, and skills has attracted attention for policy makers in developing countries, particularly for African economies. In fact the Economic Report on Africa by the United Nations Economic Commission for Africa advocates that FDI is the key to solving Africa's economic problems. Bodies such as the IMF and the World Bank have suggested that attracting large inflows of FDI would result in economic development and Sub-Saharan African governments are very eager to attract FDI¹.

Research on the determinants of FDI has focused mainly on classical factors such as comparative labour costs, country size, economic openness nature of exchange rate regime return on investment and political factors. More importantly few scholars have actually acknowledged the important role of infrastructure² in stimulating FDI and among the few proponents feature Wheeler and Mody (1992), Loree & Guisinger (1995), Richaud et al (1999), Morisset (2000) Asiedu (2002), Sekkat et al. (2004). These authors have argued that good infrastructure is a necessary condition for foreign investors to operate successfully. Poor infrastructure or unavailable public inputs increase costs for firms. A freeway is faster than a washed out dirt road, email is faster than the post office, and time is money. Thus to the extent that the public input is non-excludable and non-

congestible, it will lower the costs of doing business for multinational and indigenous firms alike. Multinationals are in fact profit-seeking entities that seek to minimize the costs of doing business. If moving to a developing economy to take advantage of lower labor costs means losing patent protection to imitators, higher transport costs due to inadequate transportation or missed supply shipments due to communication problems, then they will not choose to do business there. Infrastructure and public inputs, or the lack thereof, contribute to firms cost structures and should be included in a model that explains the multinational's, as well as the host government's, decision for investment. Infrastructure is every bit as much of an input to production as labor, capital, and resources. Infrastructure should thus improve the investment climate for FDI by subsidizing the cost of total investment by foreign investors and thus raising the rate of return. Availability of crucial infrastructure, such as roads, highways, ports, communication networks, and electricity should increase productivity and thereby attract higher levels of FDI. As Wei and al. (2000) said 'a location with good infrastructure is more attractive than the others'.

Infrastructure is made up of many components including transportation. Studies focusing exclusively on recipient country's transport infrastructure where the latter enters as an independent and additional explanatory variable in the FDI equation has been to our knowledge limited. This work attempts to supplement the literature on the determinants of FDI with by laying special focus on the role of transportation infrastructure. Moreover while most studies have been overwhelmingly concentrated on developed countries cases, research based exclusively on samples of developing countries has been generally

neglected (For an extensive survey on the determinants of FDI, see Gastanaga et al., 1998 and Chakrabarti, 2001). With regards to research on the determinants of FDI to Africa, there is an even more dearth literature and among the very few features Schoeman et al (2000), Morisset (2000) and Asiedu (2002). Moreover it is also only lately that scholars have been implicitly dealing with the issue of causality and dynamics in the foreign direct investment modelling (Cheng K, 2000; Kinoshita and Campos, 2004). The aim of the paper is thus to investigate the empirical link between transport infrastructure and FDI for the case a panel of 30 Sub Saharan African countries, selected as per data availability, for the period 1984-2002 using panel data regression techniques. The study further allows for dynamics and endogeneity issues by using dynamic panel data estimates, namely the Generalised Methods of Moments (GMM) method. These empirical evidences from Africa are believed to supplement the growing literature in the debate.

The paper is organised as follows, section 2 deals with the theoretical and empirical literature review, section 3 describes the econometric modelling and discusses the empirical approach and the data used, it also presents the econometric results and analyses the findings and the last section concludes the study

THEORETICAL LITERATURE REVIEW

Determinants of FDI

Dunning's (1981, 1988) 'eclectic theory' provides a flexible and popular framework where it is argued that Foreign Direct Investment (FDI) is determined by three sets of

advantages, namely ownership specific advantage, the internationalisation advantage and the location-specific advantages, which direct investment should have over the other institutional mechanisms available for a firm in satisfying the needs of its customers at home and abroad.

We concentrate on the location specific advantage which relate to the importance for the firm to operate and invest in the host country and are those advantages that make the chosen foreign country a more attractive site for FDI than the others. For instance firms may invest in production facilities in foreign markets because transportation costs are too high to serve these markets through exports. This could either be directly related to the actual nature of the good, either being a high bulk item or a service that needs to be provided on site, or due to policy factors such as tariff rates, import restrictions, or issues of market access that makes physical investment advantageous over serving the market through exports. Location advantage also embodies other characteristic (economic, institutional and political) such as large domestic markets, availability of natural resources, an educated labor force, low labor cost, good institutions (the clarity of country's law, efficiency of bureaucracy and the absence of corruption), political stability, corporate and other tax rates and good infrastructure (communications network, transport facilities or other form of infrastructure) among others. Given the objective of the study, we focus on the last type of factor, that is on the role of infrastructure, and in particular transport infrastructure in promoting FDI. The next section focuses on the theoretical underpinning between transport and foreign direct investment.

Transport Infrastructure and FDI.

The primary benefits of transport infrastructure development are increased accessibility and reduced transport cost and firms can benefit from these without actually contributing directly to the project. This is because of the 'free-riding' nature of these types of public capital. Transport infrastructure can be thought as being indeed a consequential intermediate input in private production process. Its ample supply at no or low costs to users is therefore conjectured to have a positive impact on cost and productivity of firms. In fact when a good or service is provided by the government, it affects a firm's cost. Clearly, start-up costs are less when public infrastructure is provided and if the costs of materials are less due to improved transportation systems for instance. Moreover the usefulness of privately owned and operated cars and trucks depends on a network of roads and bridges. For example, better road designs, materials and highway maintenance can reduce the wear and tear on privately owned and operated vehicles, thus reducing transportation costs. The same is true for aircraft, which require airports, and for private ships and barges, which require ports and navigable waterways. Improvement in the quantity and quality of transport infrastructure can reduce the amount or cost of private inputs needed for a given level of output. The reduction in supply costs is true at the firm level and in the aggregate as total output per unit of input increases when government-provided infrastructure results in a more efficient use of existing resources. Thus, in the above context, it can be argued that transport and the general public capital may enhance the productivity of private inward and foreign direct capital and thus their level².

Erenburg (1993) further argued that if these types of infrastructure were not publicly provided, the domestic private sector and Multinational Enterprises (MNEs) would operate less efficiently and attempts by them to provide their own networks would result in duplication and a waste of resources.

Indeed recent empirical research suggests that public inputs have a non-negligible impact on the productivity and cost structure of private firms (Aschauer, 1989; Nadiri et. al., 1994; Morrison et. al., 1996; Haughwout, 2001). Nadiri et. al. (1994), for instance, estimated a cost elasticity estimates with respect to infrastructure capital to range from -0.11 to -0.21 depending on the industry. Despite these evidences, universal agreement regarding the contribution of public investment on private sector cost and productivity does not exist. Conflicting studies have found that public investment does not have a statistically significant direct impact on productivity in the private sector (Holtz-Eakin, 1994; Holtz- Eakin et. al., 1995). Even if such infrastructure has no direct role in the cost structure and productivity of private firms, ample evidence suggests that the indirect spillovers from agglomeration and clustering created by public infrastructure lower the costs of firms (Houghwout, 2001). Limao and Venables (2001) in a recent paper using gravity regression analysis confirms the importance of transport infrastructure and gives an estimate of the elasticity of trade flows with respect to the trade cost factor of around -3.

Empirical literature review

Root and Ahmed (1979) were among the first scholars to establish the positive role of the general infrastructure level on FDI. Schneider and Frey (1985) reexamined the issue for less developing countries and confirmed the results. In their influential paper, Wheeler and Mody (1992) employed a translog specification and uses a panel of 42 countries for the period 1982-1988 to analyse the determinants of FDI. They interestingly reported that infrastructure quality (quality of transport, communications, energy infrastructure and degree of industrialization) exhibit a high degree of statistical significance and thus have large, positive impacts (1.57 to 2.54) on investment. Loree and Guisinger (1995) also constructed an indicator for infrastructure that encompassed measures such as highways, ports, communications and airports using principal components factor analysis and showed that the level of infrastructure did influence the flow of US direct investment. Kinoshita (1998), using survey data to study the locational determinants of foreign direct investment (FDI) by Japanese manufacturing firms in seven Asian countries, subsequently reported that infrastructure encourage firms to invest in a certain country with a reported regression coefficient of 0.26. Recently Cheng and Kwan (2000) confirmed the above for the case of 29 Chinese regions over the period 1985-1995. Kumar (2001), using a composite index of infrastructure availability for the case of 66 countries, concluded that 'MNEs decision making pertaining to location of product mandates for global or regional markets sourcing is significantly influenced from infrastructure availability (with an infrastructure coefficient varying between 0.6 and 1.5) considerations and that infrastructure development should become an integral part of the strategy to attract FDI inflows in general'.

Studies investigating the role of infrastructure in FDI in the African context have been very scarce and among the rare one features Asiedu (2002) who analysed 34 countries Africa over the period 1980-2000. Using the number of telephones per 1000 population to measure infrastructure development and controlling for classical FDI determinants she concluded that countries that improved their infrastructure were “rewarded” with more investments. In fact a one unit increase in infrastructure was estimated to lead to a 1.12 percent increase in FDI/GDP in the 1980s. However use of the proxy telephones per 1000 population as a general measure of infrastructure was admitted to have its own limitations.

Sekkat and Veganzones-Varoudakis (2004) estimated a correlation coefficient for infrastructure of 0.45 for the case of Middle East and North African (MENA) countries the 1990s with a lower correlation coefficient of 0.21 for the case of the manufacturing sector. They reported that in the 1990s, if the MENA countries had increased their infrastructures to the level of the East Asian economies, FDI flows could have reached 2.5% of GDP (compared to 1.2%).

Kandiero and Chitiga (2003) analysed primarily the impact on FDI of openness in manufactured goods, primary commodities and services using cross-country data comprising 52 African countries observed over the period 1980-2001. They found that FDI to GDP ratio responds well to increased openness in the whole economy and in the services sector in particular. The authors also interestingly established positive link between infrastructure and FDI.

While most studies found the importance of infrastructure for FDI, there are also other studies which failed to validate the hypothesis. For instance Quazi (2005), on the other hand, could not establish positive and significant relationship between infrastructure (measured as the number of telephones per 1,000 people) and FDI using panel data from 1995-2000 for a sample of seven East Asian countries. The authors however admitted that 'it is plausible that their proxy variables - the natural log of the number of telephones available per 1,000 people and the adult literacy rates, respectively, perhaps inadequately capture their true effects on FDI'.

A review of literature suggests that while the role of infrastructure in attracting FDI has received increasing interest from academic scholars lately, yet these studies focused on the general level of infrastructure and moreover have largely ignored developing country cases, particularly African economies. Thus the current study attempts to fill in this gap and thus supplements the growing literature on FDI.

Methodology

We follow recent empirical work, particularly Adeisu (2002), to investigate the role of infrastructure on FDI. Given that the aim of this paper, in addition to the widely used measure of infrastructure namely the number of telephones per 1000 population, we include in addition another proxy for the general level of transportation infrastructure namely the length of paved roads per square kilometer of area. The latter is been the only

available consistent measured to proxy the general level of transportation infrastructure. Inclusion of both types of infrastructure is also believed to better model the role of infrastructure. Our sample consists of 30 Sub Saharan African countries (SSA)⁴, selected as per data availability and cover the time period. We also improve on Aseidu (2002) by accounting for the possibility of endogeneity and dynamics in FDI modeling.

The hypothesis that well-developed regions with better infrastructures such as superior transportation facilities are more attractive to foreign firms is examined by extending a reduced form specification for demand for inward direct investment with the above transportation infrastructure proxy in a reduced form specification for demand for inward direct investment. Such an economic model has been extensively used in the literature (See Wheeler and Mody, 1992; Chen and Kwan, 2000; Adeisu, 2002 and Quazi, 2005) and has generally included various explanatory variables as determinants of FDI such domestic market size, economic openness, human capital, tax incentives, labor costs, and quality of infrastructure among others.

The following economic model⁴ is specified and has been guided by the empirical literature. It should be pointed out that the selection of explanatory variables was constrained by data availability for countries in SSA.

$$FDI_{it} = f(RES_{it}, SIZE_{it}, WAGE_{it}, XM GDP_{it}, SER_{it}, POL_{it}, TRAN_{it}, COM_{it}) \quad (1)$$

We use i to index the countries and t to index time and the rationale for including these variables is explained next. Extrapolation was kept to a minimum.

(i) *Natural Resource Intensity (RES)*: As posited by the eclectic theory, all else equal, countries that are endowed with natural resources would receive more FDI. Very few studies on the determinants of FDI control for natural resource availability (except Gastanaga et al., 1998; Morisset, 2000 and Noorbakhsh et al., 2001). The omission of a measure of natural resources from the estimation, especially for African counties case, may cause the estimates to be biased (Asiedu, 2002). We therefore include the share of minerals and oil in total exports to capture the availability of natural resource endowments. This measure of natural resources has been employed in several studies, including Warner and Sachs (1995), Asiedu and Esfahani (2001) and Aseidu (2002) among others and was available from World Development Indicators 2003.

Market Size: For foreign investors the size of the host market, which also represents the host country's economic conditions and the potential demand for their output as well, is an important element in their FDI decision-makings. Moreover, Scaperlanda and Mauer (1969) argued that FDI responds positively to the market size 'once it reaches a threshold level that is large enough to allow economies of scale and efficient utilization of resources'. The importance of the market size has been confirmed in many previous empirical studies (see Kravis and Lipsey, 1982; Schneider and Frey, 1985; Wheeler and Mody, 1992; Tsai, 1994; Loree and Guisinger, 1995; Lipsey, 1999; Wei, 2000). To proxy for market size (*SIZE*), we follow the literature and use real GDP per capita. The figures

are drawn from *Penn World Table 6*. Since this variable is used as an indicator of the market potential for the products of foreign investors, the expected sign is positive. Per capita GDP may also proxy for capital abundance (Edwards, 1990) and investment climate (Wei, 2000 and Aseidu, 2002).

Labour cost: Labor cost is a major component of total production cost and of the productivity of firms. Wage variables have thus been often included in the empirical literature and this is particularly true for labor-intensive production activities where a higher wage would deter FDI. However, wages may also be high because of high local inflows of FDI. We use the nominal wage rate (*WAGE*) as used Wheeler and Mody (1992) and Tsai (1994) to proxy for labor cost. We would generally expect a negative sign on the coefficient (e.g., countries with lower labor costs would attract more FDI). Our source of data is the International Labor Organization (ILO) and their yearly compilation of labor statistics⁵ and the World Development indicators.

Human Capital (SER): Foreign direct investors should be concerned not only with the cost of labor, but also with its quality. In fact the cost advantages accrued by lower wages in developing nations can well be mitigated by lowly skilled workers. A more educated labor force can learn and adopt new technology faster and is generally more productive. Higher level of human capital is a good indicator of the availability of skilled workers, which can significantly boost the locational advantage of a country. Root and Ahmed (1979), Schneider and Frey (1985), Borensztein et al, (1998), Noorbakhsh et al. (2001) and Aseidu (2002) found that the level of human capital is a significant determinant of

the locational advantage of a host country and plays a key role in attracting FDI. We control and test for the impact of labor quality, using the general secondary education enrollment rate (*SER*) (as used by Hanson, 1996 and Noorbakhsh et al., 2001). The source of the data on *SER* was from World development Indicators and individual countries CSO web sites.

We also added political instability (*POL*) following works from Schneider and Frey (1985), Edwards (1990), Loree and Guisinger (1995), Hanson (1996), Jaspersen et al. (2000) and Aseidu (2002). In fact political stability, especially for the case of African states, is a significant factor in the location decision of Multinational Corporations (MNCs). Political instability and the frequent occurrences of disorder 'create an unfavorable business climate which seriously erodes the risk-averse foreign investors' confidence in the local investment climate and thereby repels FDI away' (Schneider and Frey 1985). We use a political risk rating⁶ as provided by the International Country Risk Guide (1999) as a proxy. The rating awards the highest value to the lowest risk and the lowest value to the highest risk and provides a mean of assessing the political and institutional framework of the countries (see ICRG, 1999).

Openness: It is a standard hypothesis that openness promotes FDI (Hufbauer et al. 1994). In the literature, the ratio of trade to GDP is often used as a measure of openness of a country and is also often interpreted as a measure of trade restrictions. In fact, Rodrik (1998) finds an inverse and robust relationship between several measures of trade policy (particularly trade restrictions) and trade/GDP. This proxy is also important for foreign

direct investors who are motivated by the export market. Empirical evidences (Jun and Singh, 1996; Aseidu, 2002 among others) exist to back up the hypothesis that higher levels of exports lead to higher FDI inflows. We therefore include Trade/GDP in the regression to examine the impact of openness on FDI.

Transport Infrastructure: The variable central to our study is that of transport infrastructure. To assess the level and quality of transport infrastructure, the only consistent and reliable measure available for our sample is the length of paved roads per square kilometer of area (*TRANS*). This measure has been used by a number of authors, especially in the assessment of the economic importance of the general level of transport infrastructure (see Canning, 1999; Canning D, and E Bennathan, 2000 among others). The data was available and constructed from Canning (1999) database, the International Road Federation (IRF), and also from various countries' Central Statistical Office.

To control for other types of infrastructure in the recipient countries and to better model the role of infrastructure in FDI, a proxy for communication infrastructure, namely the number of telephones available per 1,000 people (*COM*) was added. Availability of main telephone lines is necessary to facilitate communication between the home and host countries. This measure has been extensively employed in the determinants of foreign direct investment literature, for instance by Loree and Guisinger, 1995; Asiedu, 2002; Alam and Quazi, 2003). Availability of main telephone lines is necessary to facilitate communication between the home and host countries. Canning (1999) data base and World Development Indicators (various issues) provided the source for this data.

The dependent variable, *FDI*, is measured as the net foreign direct investment inflow as a percentage of GDP and is a widely used measure (see Adeisu, 2002; Quazi, 2005; Goodspeed et al, 2006). The main sources of data series are from the International Monetary Fund's International Financial Statistics (IFS) (various issues), World Development Indicators (various issues) and from African Development Bank, Selected Statistics on African Countries (2000).

The Econometric Model and preliminary tests

Applying logs on both sides of the equation 1 (for ease of interpretation) and denoting the lowercase variables as the natural log of the respective uppercase variable and *t* for time result in the following:

$$fdi_{it} = \alpha + \beta_1 res_{it} + \beta_2 size_{it} + \beta_3 wage_{it} + \beta_4 xmgdp_{it} + \beta_5 ser_{it} + \beta_6 pol_{it} + \beta_7 tran_{it} + \beta_8 com_{it} + \varepsilon_{it} \quad (2)$$

Panel Unit Root Test

A central issue before making the appropriate specification, often ignored by past researchers, is to test if the variables are stationary or not. We thus carry out panel unit root tests on the dependent and independent variables. We follow the approach of Im, Pesaran, and Shin (IPS) (1995) who developed a panel unit root test for the joint null hypothesis that every time series in the panel is non stationary. This approach is based on

the average of individual series ADF test and has a standard normal distribution once adjusted in a particular manner. Assuming that the cross-sections are independent, IPS propose to use the following standardized t -bar statistic .The IPS panel unit root test

$$\Psi_i = \frac{\sqrt{N} \left\{ \bar{t}_{NT} - \frac{1}{N} \sum_{i=1}^N E[t_{iT}(p_i, 0)] \right\}}{\sqrt{\frac{1}{N} \sum_{i=1}^N Var[t_{iT}(p_i, 0)]}}$$

N is the number of panels, \bar{t}_{NT} is the average of the ADF test for each series across the panel. The values for $E[t_{iT}(p_i, 0)]$ and $Var[t_{iT}(p_i, 0)]$ are obtained from the Monte Carlo simulations. The standardized t -bar statistic Ψ_i converge weakly to a standard normal distribution as N and $T \rightarrow \infty$. The panel unit root inference is conducted by comparing the obtained Ψ statistic to critical values from the lower tail of the $N(0,1)$ distribution.

Results of this test applied on our time series in levels are reported in table 1 below. In every case we reject a unit root in favor of stationarity (the results were also confirmed by the Fisher-ADF and Fisher-PP panel unit root tests) at the 5 percent significance level and it was deemed safe to continue with the panel data estimates of the above econometric specification (equation 2).

Table 1 : Panel unit root tests on levels of variables.

Variables	IPS Statistics
<i>fdigdp</i>	-4.53
<i>res</i>	-5.64
<i>size</i>	-4.57
<i>wage</i>	-4.38
<i>xmgdp</i>	-4.74
<i>ser</i>	-5.76
<i>pol</i>	-4.54
<i>tran</i>	-5.76
<i>com</i>	-4.24

Variables are in natural logarithmic forms. The test statistic, calculated as the difference between the average *t*-value and the expected value, and adjusted for the variance, has a $N(0,1)$ distribution under the null of non-stationarity, with large negative values indicating stationarity (Canning, 1999).

Cross - Section and Pooled OLS Analysis

We performed cross section (averaged over the sample period 1984-2003) and pooled OLS analysis of our hypothesis for some preliminary results. Standard errors of the OLS regression were corrected by the White procedure. White (1980) proposed the heteroskedasticity-robust variance matrix estimator to adjust the standard errors of a regression in the presence of heteroskedasticity. The results are reported in table 1 (column 2 and 3). The positive and significant coefficient of *tran* from the cross section analysis a priori suggests that transport infrastructure has been an ingredient in explaining FDI flows to African economies over the period of study, although, as judged by its coefficient, it is not as an important factor as other classical factors. Other infrastructure as proxied by *com* are also reported to have positive influence of foreign direct investors. The results are more or less consolidated when using Pooled OLS estimates. The limitations of using a single-equation OLS cross sectional regression model and pooled

OLS are known (see Kennedy 2003). To overcome these shortcomings, panel data techniques are advised. The paper still reports, for comparative purposes and to get a broad overview the above estimates.

Panel Data Estimates

Thus in this section we employ both static and dynamic (Generalised Methods of Moments) techniques to identify and compare the determinants of FDI, particularly with respect to transport infrastructure in the recipient countries. In fact use of panel data allows not only to control for unobserved cross country heterogeneity but also to investigate dynamic relations. We use the Hausman test to test the use of a random or fixed effect estimation. In fact the Hausman test tests the null hypothesis that the coefficients estimated by the efficient random effects estimator are the same as the ones estimated by the consistent fixed effects estimator. The specification test recommended the use of fixed effects model and table 2 (fourth column) reports the relevant estimates.

Table 2: Panel data estimates : Fixed effects (33 countries x 19 years (1984-2002))

Dependent variable $\ln \text{fdigdp} = (\log \text{ of fdigdp})$

<i>Variable</i>	<i>Cross country estimates</i>	<i>Pooled OLS estimates</i>	<i>Fixed effect estimates</i>
<i>Constant</i>	-68.4 (-1.95)*	-6.07 (-11.02)***	-6.18 (-11.87)***
<i>Res</i>	0.03 (1.87)*	0.05 (1.94)*	0.015 (2.32)**
<i>size</i>	1.04 (1.15)	0.39 (2.55)**	0.15 (3.55)***
<i>wage</i>	-0.09 (-0.21)	-0.05 (-2.41)**	-0.066 (-3.13)**
<i>xmgdp</i>	0.78 (1.99)*	0.12 (9.96)***	0.45 (10.18)***
<i>pol</i>	-0.16 (-2.24)**	-0.23 (-2.34)**	-0.14 (-2.55)**
<i>trans</i>	0.07 (1.76)*	0.04 (1.98)*	0.17 (2.37)**
<i>com</i>	0.44 (0.46)	0.31 (4.82)***	0.11 (2.24)**
<i>Ser</i>	2.64 (2.17)**	0.19 (5.53)***	0.15 (5.45)***
<i>R²</i>	0.94	0.44	0.46
<i>Number of obs</i>	33	627	627

Hausman Test

Prob>chi2=0.034

*significant at 10%, ** significant at 5%, ***significant at 1%

The small letters denotes variables in natural logarithmic and t values are in parentheses

From column 4 of table 2, it is observed that the robust coefficient of transport capital is positive and significant, implying that foreign direct investors are sensitive to transport

capital. This is in line with the theoretical underpinnings discussed earlier. The other type of infrastructure is also judged to be important by these investors, though to a slightly lesser extent than transport. The above are particularly true for the case of SSA where much FDI have originally flown to the extractive industries which usually locate in remote areas and thus requires access to basic amenities such as roads, communication, electricity and water among others. Aseidu (2002) argued that that ‘physical infrastructure is more relevant for non-natural resource (non extractive industries) based investments. As a consequence, host countries need to provide infrastructure of much better quality than the infrastructure available in previous years, in order to attract the “new” types of FDI’. Provision of infrastructure could thus explain to some extent the change in sectoral composition of FDI (towards investments in non-extractive industries) to SSA. Our results are consistent with the findings (although they were based mainly on the general infrastructure) of Kinoshita (1998), Kumar (2001) and particularly Aseidu (2002) and Sekkat and Veganzones-Varoudis (2004) for the case of sample of African economies (although our coefficients are reported to be comparatively lower). Thus the result indicates that countries that improve their transport and other types of infrastructures have attracted significant amounts of investment from foreigners.

As far as the other explanatory variables are concerned, they are seen to behave according to theoretical predictions and are in line with recent empirical evidences. For instance the abundance of natural resources as measured by *RES* is seen to be positive and significant confirming the results of Aseidu (2002) for African case and Kinoshita

and Campos (2004). This means the presence of resource-seeking FDI, though the elasticity cannot be readily interpreted since it is a qualitative variable.

Openness had a positive impact on FDI as well suggesting that an efficient environment that comes with more openness to trade is likely to attract foreign firms (this conclusion is also supported by Asiedu, 2002; Edwards, 1990), and that countries in SSA that embarked on trade liberalization were rewarded with more FDI. In fact, the significance of *xmgdp* even after controlling for natural resource availability suggests that FDI is not only resource seeking and that government can play a major role as well in the FDI equation. FDI is believed to thus flow to non extractive industries (Non-natural resource based FDI) as well. This is particularly important to SSA because such investments, for instance investments in manufacturing and technologically intensive industries, enhance technological spillovers and fosters employment.

The size of the domestic market, stock of human capital, though to a large extent as witnessed by the size of their respective coefficients, played a positive role while political instability and labour cost a negative role in attracting FDI in the markets and the results are consistent with empirical works in the field.

Dynamic Panel Data Regression.

In fact there still exists the possibility of endogeneity of the explanatory variables and the loss of dynamic information even in a panel data framework. For instance, Quazi (2005) argued that foreign investors are typically risk averse and tend to favor familiar territories thus implying endogeneity and dynamism in FDI modeling. The author said that it is very important for countries to ‘establish a track record of FDI inflow, which can help dispel

the foreign investors' fear of investing in an unknown location'. Cheng and Kwan (2000) further argued that FDI is one of the least volatile forms of foreign capital flows. In fact it has a relatively higher sunk cost of physical investment and becomes more irreversible once it is undertaken. It is thus likely to be persistent over time. Noorbakhsh et al. (2001) also brought evidence that many Multinational Corporations test their new markets by staggering their investments, which gradually reach the desired levels after some time adjustments. It is expected that incremental lagged changes in FDI should therefore contribute positively toward the current level of FDI. In the words of Kinoshita (1998) 'it takes time for the stock of FDI to reach the optimal level'.

The incorporation of dynamics into our model necessitates equation above to be rewritten as an AR (1) model in the following.

$$fdi_{it} - fdi_{it-1} = \alpha_i + \nu fdi_{it-1} + \beta x_{it} + \mu_{it} \quad (3)$$

where the LHS is the log difference in tourist arrivals over a period; fdi_{it} = the log of fdi at the start of that period; x_{it} = the vector of explanatory variables, that is $x = [res, size, wage, xmgdp, pol, trans, com, ser]$ and α_i = the period specific intercept terms to capture changes common to all sectors; μ_{it} = the time variant idiosyncratic error term.

Equivalently, above equation can be written as

$$fdi_{it} = \alpha_i + (\nu + 1) fdi_{it-1} + \beta x_{it} + \mu_{it} \quad (4)$$

We can also write the above in first differences

$$\Delta fdi_{it} = \alpha_i + (\nu + 1)\Delta fdi_{it-1} + \beta\Delta x_{it} + \Delta\mu_{it} \quad (5)$$

A problem of endogeneity might exist if fdi_{it-1} is endogenous to the error terms through u_{it-1} , and it will therefore be inappropriate to estimate the above specification by OLS. To overcome this problem of endogeneity, an instrumental variable need to be used for Δfdi_{it-1} . Two approaches, namely Instrumental Variable (IV, Anderson and Hsiao 1982) and two GMM estimators (Arellano and Bond's 1991), first and second step respectively, can be used in this regard. We used the latter technique, as the IV approach leads to consistent but not necessary efficient estimates of the parameters (see Baltagi 1995). Moreover, the first step GMM estimator will be used since it has been shown to result in more reliable inferences. The asymptotic standards errors from the two step GMM estimator have been found to have a downward bias (Blundell and Bond 1998). The results from estimating equation (5), extended with some lagged terms, using the Arellano-Bond (1991) first step GMM estimator are contained in table 3 (in Appendix). The various estimated equations passes all diagnosis test related to Sargan Test of Over-identifying restrictions and the Arellano-Bond test of 1st order and 2nd autocorrelation.

Table 3: Dynamic Panel Data Estimation (First Step GMM estimator)

<i>Variable</i>	<i>GMM estimates</i>
<i>Constant</i>	0.001 (0.29)
<i>fdi(Lagged)</i>	0.55 (4.64)***
<i>dres</i>	0.023 (2.22)**
<i>dsize</i>	0.11 (5.69)***
<i>dwage</i>	- 0.08 (-3.44)***
<i>dxmgdp</i>	0.15 (8.04)***
<i>dpol</i>	-0.1 (-0.33)
<i>dtrans</i>	0.08 (1.80)*
<i>dcom</i>	0.05 (3.17)***
<i>dser</i>	0.18 (4.55)***
<i>Diagnosis tests</i>	
<i>Sargan Test of Overidentifying restrictions</i>	<i>prob>chi2=0.92</i>
<i>Arellano-Bond test of 1st order autocorrelation</i>	<i>prob>chi2=0.14</i>
<i>Arellano-Bond test of 2nd order autocorrelation</i>	<i>prob>chi2=0.81</i>

*significant at 10%, ** significant at 5%, ***significant at 1%

The small letters denotes variables in natural logarithmic, d denotes variables in first difference and the heteroskedastic-robust z-values are in parentheses

The results from the dynamic panel analysis validate more or less the preceding ones. Transport infrastructure is observed to have been an ingredient in the attractiveness of the country as a FDI destination. Such is also the case for other infrastructure capital as well. Interestingly the positive and significant coefficient of fdi_{t-1} from the table shows that lagged FDI has been contributed positively towards the current level of FDI, that is there is a self-reinforcing effect of FDI on itself and suggest that foreign investors' incremental knowledge about investment opportunities in host countries are important as well. In fact the value of the coefficient of the lagged FDI is 0.55 for the aggregate sector sample case, implying a coefficient of partial adjustment α of 0.45. (Kinoshita and Campos (2004) found similar adjustment pace for Central and Eastern European and former Soviet Union countries). This means that net investment in one year is 45 percent of the difference between the optimal and the current level of fdi . Since a lower α means a slower speed of adjustment, this implies a larger role for persistence in the pattern of FDI in these economies. This confirms the existence of dynamism and endogeneity in FDI modeling and is consistent with Cheng and Kwan, (2000), Kinoshita and Campos (2004) and Quazi (2005). The openness of the country, labour cost and home country's educational level are also reported to be important ingredients in explaining the inflow of FDI in SSA countries while political instability turned out to be insignificant.

Conclusions

This paper investigated the role of transport infrastructure in enhancing the attractiveness of FDI recipient country and is based on a sample of SSA countries over the period 1984-2002. Results from the analysis shows that transportation capital has been an important

ingredient in making the countries attractive to foreign direct investors both in the short and long run and same is observed for the case of non transport infrastructure. The results are consistent with those obtained recently by scholars, particularly for developing country cases. The positive and significant lagged value of the dependent variable also confirms the existence of dynamism and endogeneity in FDI modeling suggesting that there is a self-reinforcing effect of FDI on itself and that foreign investors' incremental knowledge about investment opportunities in host countries are important as well. The other classical variables included in the model yielded the expected signs and results on the overall.

These findings imply that transportation and other infrastructure development is also an important element of the strategy to attract FDI inflows and this is particularly true for SSA counties where there is much to be done in that respect. It is recommended thus that the government refrains from undergoing drastic cuts in public capital expenditure and this is even more important in the case of transport capital projects. It is believed that the government would be better off in taking advantage of World Bank's and other international institutions infrastructural and developmental loans instead of capital expenditure cuts from the budget. Given the government's budget constraint and in the light of our empirical analysis, the case of private financing and joint public/private financing arrangements should be less ambiguous so long there is addition to the country's stock of transport capital, no matter who is financing it. Countries should abstain from controversial debate from the general public and from politicians themselves concerning the suitability and functioning of such projects as these have often led to the rejection of valid proposals. The government should rather ensure that the private sector

has sufficient incentives to invest in transport capital and in its services as well. To this end, the government needs to develop an efficient institutional framework and further improvements are also required in a number of areas to create a conducive environment. These include improving the legislative and regulatory environment, including the formulation of a Bill Operated Transfer (BOT) law, removing unnecessary bureaucratic procedures and practices.

References

Anderson, T.W. and C. Hsiao (1982), Formulation and Estimation of Dynamic Models Using Panel Data, *Journal of Econometrics* 18, 67-82.

Arrelano, M and Bond, S (1991), Some Tests of Specification for panel data: Monte Carlo Evidence and an application to employment equations, *Review of Economic Studies*, 58:277-297.

Asiedu, E, and H S Esfahani (2001). "Ownership Structure in Foreign Direct Investment Projects," *Review of Economics and Statistics* 83 (4), 647-62.

Asiedu, E. (2002). On the Determinants of Foreign Direct Investment to Developing Countries: Is Africa Different? *World Development*, 30(1), 107-118.

Aschauer, D., 1989. Is public expenditure productive?, *Journal of Monetary Economics*, 23, 167-200.

Billington, Nicholas, (1999), The location of foreign direct investment: an empirical analysis, *Applied Economics*, 31, 65-76.

Blundell and Bond, (1998), Initial conditions and Moments restrictions in dynamic panel data models, *Journal of Econometrics*, 87:115-144.

Borensztein, J., J. De Gregorio and J-W. Lee (1998), How does foreign direct investment affect economic growth?, *Journal of International Economics*, 45, 115-135.

Canning, D (1998). 'A Database of World Stocks of Infrastructure, 1950-95', *The World Bank Economic Review* 12(3): 529-47

Canning, D. and Bennathan, E., 2000. The social rate of return on infrastructure investments. *World Bank Research Project* , RPO 680-89, Washington, D.C.

Chakrabarti, A. (2001). "The Determinants of Foreign Direct Investment: Sensitivity Analyses of Cross-Country Regressions," *KYKLOS*, 54, 89-114.

Cheng, L. and Y. Kwan. 2000, What are the determinants of the location of foreign direct investment? The Chinese experience. *Journal of International Economics*.51: 379-400.

Dunning, J. D. (1981), Explaining the international direct investment position of countries toward a dynamic or development approach, *Weltwirtschaftliches Archiv*, 117, 30-64.

Dunning, J. D. (1988), The eclectic paradigm of international production: a restatement and some possible extensions, *Journal of International Business studies*, 19(1), 1-31.

Edwards, S. (1990). Capital Flows, Foreign Direct Investment, and Debt-Equity Swaps in Developing Countries, *NBER working paper*, No 3497.

Erenberg, S.J., 1993. The real effects of public investment on private investment. *Applied Economics*, 23, 831-837.

Gastanaga, Victor, Jeffrey B. Nugent and Bistra Pashamova (1998). "Host Country Reforms and FDI Inflows: How Much Difference Do They Make?" *World Development*, 26 (7), 1299- 1314.

Goodspeed T, Martinez-Vazquez J and Zhang L (2006)., Are Government Policies More Important Than Taxation in Attracting FDI, *ISP Working Paper Number 06-14*, *International Studies Program working paper series*.

Hanson, J.R., Jr. 1996, "Human Capital and Direct Investment in Poor Countries", *Explorations in Economic History* 33, pp. 86-106.

Haughwout, AF., (2001), Infrastructure and Social Welfare in Metropolitan America.

Economic Policy Review, Vol. 7, No.3.

Holtz-Eakin, D., 1994. Public sector capital and the productivity puzzle. *The Review Of*

Economics and Statistics, LXXVI, 12-21

Holtz-Eakin, D. and Schwartz, A. E., 1995. Spatial productivity spillovers from public infrastructure: Evidence from state highways. *NBER Working Paper Series*, No 5004, NBER.

Hufbauer et al., (1994), Cost of protection in the United States, Washington: Institute for international economics.

Im, K., Pesaran, H., and Y. Shin, (1995), Testing for Unit Roots in Heterogeneous Panels, *DAE Working Papers Amalgamated Series* No. 9526, University of Cambridge.

International Labor Organization. International Labor Organization. Retrieved October 28, 2002, From: <http://www.ilo.org/public/english/>

International Country Risk Guide (1999), Brief Guide to the Ratings System.

Jaspersen, F.Z., A.H. Aylward, and A.D. Knox. 2000. "The Effects of Risk on Private Investment: Africa Compared with Other Developing Areas." In *Investment in Risk in Africa*, edited by P. Collier and C. Pattillo. New York: St. Martins Press

Kandiero T and M Chitiga (2003) 'Trade Openness and Foreign direct investment in Africa', Paper prepared for the Economic Society of Southern Africa 2003 Annual Conference, Cape Town, South Africa.

Kennedy, Peter. 2003. *A Guide to Econometrics*, 5. th. edition. Cambridge, MA: The MIT Press. (3).

Kinoshita Y, (1998), Micro-determinants of Japanese Foreign Direct Investment in Asia, *Eastern Economic Association and Japan Economic Seminar* at Columbia University.

Kinoshita Y, Campos N,(2004) Estimating the Determinants of Foreign Direct Investment Inflows: How Important are Sampling and Omitted Variable Biases? CEPR-WDI Transition Conference

Kravis, I, B and R.E. Lipsey (1982), Location of overseas production and production for exports by US multinational firms, *Journal of International Economics*, 12, 201-223.

Kumar, N (2001), Infrastructure Availability, Foreign Direct Investment Inflows and Their Export-orientation: A Cross-Country Exploration. *Research and Information System for Developing Countries*, New Delhi, November 2001

Limao N, and A, J, Venables (2001), Infrastructure, geographical disadvantage, transport costs and trade, *World Development Economic Review*, 15, 451-479

Loree D. W. and S. E. Guisinger (1995), Policy and non-policy determinants of U.S. equity foreign direct investment, *Journal of International Business Studies*, 26 (2), 281-299.

Martin, C and F J Velázquez. (1997), The Determining Factors of Foreign Direct Investment in Spain and the Rest of the OECD: Lessons from the CEECS. *Centre for Economic Policy Research. Discussion Paper 1637*

Morrisset Piere (2000). FDI to Africa, Policy Matters. *Mimeo*

Morrison, C J. and A E Schwartz. State Infrastructure and Productive Performance'. *American Economic Review*, 86, Issue 5, 1996.

Mwilima, N. (2003), Foreign Direct Investment in Africa, Social Observatory Pilot Project – Final Report – FDI, Africa Labour Research Network

Nadiri, M. and T. Mamuneas., 1994. The effects of public infrastructure and R & D capital on the cost structure and performance of U.S manufacturing industries. *The Review of Economics and Statistics*, LXXVI, 22-37

Noorbakhsh, F., A. Paloni and Youssef A., (2001). Human Capital and FDI Inflows to Developing Countries: New Empirical Evidence, *World Development*, 26 (7), 1593-1610.

Quazi, R (2005), Economic Freedom and Foreign Direct Investment in East Asia. College of Business Prairie View A&M University Prairie View, Texas 77446, USA
International Academy of Business and Public Administration Disciplines (IABPAD) meetings

Richaud, C., K. Sekkat and A. Varoudakis (1999), Infrastructure and Growth Spillovers: A Case for a Regional Infrastructure Policy in Africa, *Mimeo*, University of Brussels.

Rodrik, D (1998). "Trade Policy and Economic Performance in Sub-Saharan Africa," NBER Working Paper No 6562.

Root, F.R. and A.A. Ahmed (1979), Empirical Determinants of Manufacturing Direct Foreign Investment in Developing Countries, *Economic Development and Structural Change*, 27, 751-767.

Sachs and Warner (1995). "Natural Resource Abundance and Economic Growth," NBER Working Paper No. 5398.

Scaperlanda, A.E. & Mauer, L.J. 1969, 'The determinants of US direct investment in the

EEC', *The American Economic Review*, vol. 59, no. 4, September, pp. 558–568.

Schneider, F. and Frey, B. (1985), Economic and Political Determinants of Foreign Direct Investment, *World Development*, 13(2), 161-175.

Schoeman, N.J., Robinson, Z.Clausen; DeWet, T,J (2000). Foreign Direct Investment Flows and Fiscal Discipline in South Africa, *South African Journal of Economic and Management Sciences*, 3(2), 235-44.

Sekkat K and Veganzones-Varoudakis, M.,(2004), Trade and foreign exchange liberalisation, investment climate and FDI in the MENA countries., Working Papers DULBEA, Université libre de Bruxelles, Department of Applied Economics (DULBEA).

Tsai, P. (1994), Determinants of Foreign Direct Investment and Its Impact on Economic Growth, *Journal of Economic Development*, 19, 137-163.

Wei, S. (2000). How Taxing is Corruption on International Investors? *Review of Economics and Statistics*. 82 (1): 1-11.

Wheeler, D. and A. Mody (1992), International investment location decisions: The case of U.S. firms, *Journal of International Economics*, 33, 57-76.

UNCTAD (1998), World Investment Reports

WDI (2002), World Development Indicators, World Bank, Washington, D.C.

World Bank (2001). World Development Indicators on CD-Rom.

Endnotes

1. Interested readers can refer to Mwilima (2003) for an overview of FDI in Africa.
2. Although a considerable volume of literature has highlighted the importance of physical infrastructure as a determinant of economic growth (e.g. Aschauer 1989 and Gramlich, 1994 for reviews)
3. The countries included in the study are Angola, Benin, Botswana, Burkina Faso, Cameroon, Congo Dem Rep., Congo Rep, Cote D'Ivoire, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Nigeria, Senegal, Sierra-Leone, Somalia, South Africa, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe.
4. The model has been extensively used in the literature and have generally included various subsets of explanatory variables of determinants of FDI such domestic market size, economic openness, human capital, tax incentives, labor costs, and quality of infrastructure among others (see Wheeler and Mody, 1992; Chen and Kwan, 2000; Adeisu, 2002 and Quazi, 2005).

5. ILO collects data on over 200 countries in the areas of employment, unemployment, labor costs, wages, hours of work, consumer price indices, and several other factors.

6. The political risk index is composed of 12 indicators: government stability, socioeconomic conditions, investment profile, internal and external conflicts, corruption, military in politics, religion in politics, law and order, ethnic tensions, democratic accountability, bureaucratic quality.