Article

Effects of Infrastructure Development on Foreign Direct Investment in Kenya

Journal of Infrastructure Development
8(2) 1–18

SAGE Publications
sagepub.in/home.nav
DOI: 10.1177/0974930616667875
http://joi.sagepub.com

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Abstract

Kenya's foreign direct investment (FDI) inflows as a percentage of GDP have been increasing negligibly over the last 4 years, increasing from 0.4 per cent in 2010 to 0.9 per cent in 2013. And yet evidence shows that quality infrastructure lowers the cost of doing business and thus attracts FDI. Kenya has visible signs of infrastructure inadequacy and inefficiencies despite the fact that since the year 2000, there has been increased budgetary allocation to the infrastructure sector. This study, therefore, sought to determine the effects of transport, energy, communication and water and waste infrastructure development on FDI inflows in Kenya. The study used annual time series data sourced from Central Bank of Kenya, World Bank and the United Nations Conference on Trade and Development (UNCTAD). Using multiple regression analysis, it was established that improved transport infrastructure, communication infrastructure, water and waste infrastructure, exchange rate, economic growth and trade openness are important determinants of FDI inflows into Kenya. Hence, for Kenya to attract more FDI, continued infrastructural development is key since quality infrastructure affords investors a conducive investment climate in which to operate.

JEL Classification: H41, R42, F21, E22

Keywords: Infrastructure development, foreign direct investments, return on investment, exchange rate

1. Introduction

The importance of infrastructure for economic development cannot be gainsaid, as the superstructure of Kenya's overall wealth hinges on it. Infrastructure development represents a broad spectrum of activities and services without which no meaningful activity can be undertaken in the economy. As presented in

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the second Medium Term Plan, 2013–17 (Republic of Kenya 2013), infrastructure plays a key role in the economy and constitutes the wheels, if not the engine of development. Reliable, adequate and quality infrastructure will increase economic productivity, lower production costs, improve quality of life, raise the country's regional and global competitiveness, attract foreign direct investment (FDI) and help in modernising the economy.

Like in other developing countries, Kenya has visible signs of infrastructure inadequacy and inefficiencies. These include congested roads, erratic power supply, long waiting lists for installation of telephone/power lines, shortages of clean and safe drinking water, overloaded disposal system and pollution. This illustrates the widening gap between demand for and supply of infrastructure and raises questions concerning the sustainability of economic growth.

Attraction of companies/industries and entrepreneurs is a sure way of attracting FDI to a country. According to Nyaosi (2011), FDI brings financial resources to host countries, provides new technologies and enhances the efficiency of existing technologies. Foreign direct investment also facilitates access to export markets, thereby playing an important role in strengthening the export capabilities of domestic economies. In support, Mwega (2009) opines that FDI enhances skills and management techniques and may provide cleaner technologies and modern environment management systems. Importantly, FDI helps to develop a host country's infrastructure. A case in point is the auctioning of two mobile phone operators in Kenya in 1999 and 2000 which resulted in the rapid build-up of telecommunication infrastructure (UNCTAD 2005).

The Sessional Paper Number 10 of 1965 recognised attraction of FDI as a growing sector rather than a shrinking one and laid down strategies to attract more capital from abroad (Republic of Kenya 1965). Important to this, the paper recommended the need to finance more development-related activities and to improve infrastructure rapidly. However, the economic stagnation in the mid-1980s and the 1990s affected Kenya's industrialisation and hence development. To Rasiah and Gachino (2003), macroeconomic constraints arising from a collapse in the International Monetary Fund's (IMF) Structural Adjustment Programme (SAPs), massive destruction of infrastructure due to El-Nino rains and weak institutions had all contributed to the economic stagnation.

After the disappointing period of the 1990s, Kenya resumed the path to rapid economic growth in 2002 through the implementation of the Economic Recovery Strategy for Wealth and Employment Creation (Republic of Kenya 2003), which has been succeeded by the Kenya Vision 2030 (Republic of Kenya 2007a). During this period, the government implemented several strategies aimed at spurring growth, and included establishment of free-trade zones, improvement of terms of trade and business climate, rehabilitation and maintenance of infrastructure facilities and implementation of various incentives. Central to this was a commitment to attract FDI, which was hoped to assist in the industrialisation process. The government then prioritised the infrastructure sector, getting the second highest budgetary allocation through the Medium Term Expenditure Framework after the education sector (Republic of Kenya 2007b). However, the introduction of these strategies to attract and promote FDI and export-oriented industrialisation has not yielded much.

Attracting FDI has become a policy concern for the government. This is due to the contribution of FDI to capital formation, which is likely to help in reducing the financial gap experienced in the country. Foreign direct investment net inflows have been low and stable from 1970 to 2006 when it shot up. It later declined drastically between 2007 and 2008 due to global financial crisis that led to high fuel and commodity prices. Foreign direct investment net inflows steadily rose from 2009 to 2011 and slightly declined in 2012. Thereafter, it rose sharply from the year 2012 to 2013 (see Figure 1). The increased FDI net inflows could be attributed to infrastructure development. Empirical evidence has shown that quality infrastructure lowers the cost of doing business and improves the investment climate, thus attracting FDI. This study, therefore, sought to analyse empirically the effects of infrastructure development on FDI flows to Kenya, with a view to generating policy implications.

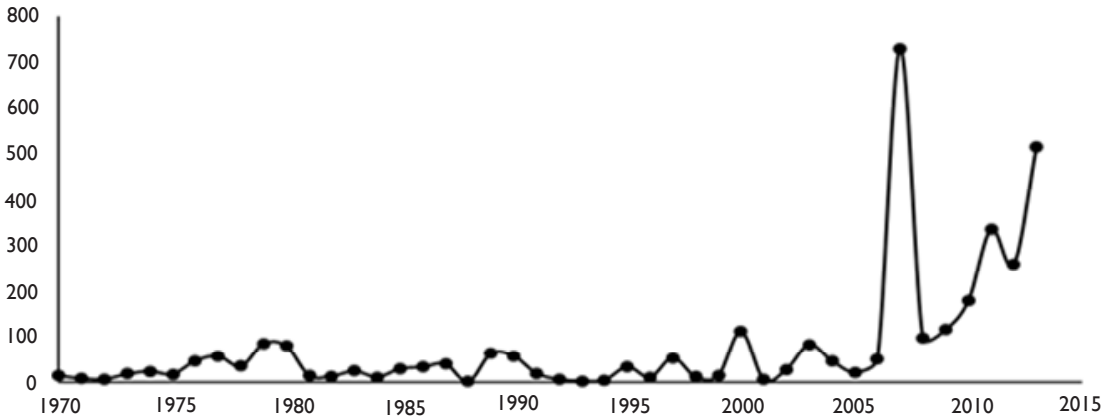

Figure 1. Foreign Direct Investment in Kenya (Current US$ in Millions)

Source: Constructed from study data by the authors.

The availability of high interconnectivity and access roads, telecommunications, railways, airports, for example, is a key asset for attracting most modern companies/industries and entrepreneurs. According to Rehman et al. (2011), infrastructure consists of communications, roadways, transportation, highways and ports. A study focusing on the impact of infrastructure on FDI concluded that there was a positive significant contribution of infrastructure in captivating FDI. Transportation costs, tariffs and access to a new market enhance the competitive position of a country (Rehman et al. 2011). Infrastructure availability reduces transportation costs, tariffs and improves access to new markets while reducing operational costs in a specific country.

Zheng (2009) categorised infrastructure development as part of public goods. Zheng argued that public goods have a vital impact on cost structure and productivity of private firms, and assumed that if such kind of infrastructure was not extended to local and multinational enterprises publicly, then they (local and multinational enterprises) would be operating with less efficiency as they would have to build their own infrastructure which would result in duplication and wastage of resources. As put by Rehman et al. (2011) and Zheng (2009), availability of public goods lowers the cost of private firms even if there is no direct role of infrastructure in the production performance and cost structure of private firms. Both opine that poor infrastructure limits access to both local and global markets which ultimately discourages FDI in developing countries. In summary, they argued that infrastructure development promotes FDI and greater return on investment to business owners.

Evidence from the Chinese economic revolution has shown that factors such as the average commute time—from main airports, ports and industrial parks—feature prominently in the country's capacity to attract and retain foreign companies, entrepreneurs and talent (UNCTAD 2005). Access to clean and adequate water, energy and necessary legal framework play a primary role in impacting expansion decisions by these foreign firms/entrepreneurs.

2. Statement of the Problem

Kenya's FDI inflows (as a percentage of GDP) have been increasing negligibly over the last 4 years. The country only attracted 178 million USD, 335 million USD, 259 million USD and 514 million USD between 2010 and 2013, which was way below the projections of 1.3 billion USD annually

(UNCTAD 2011). Further, FDI growth, as a percentage of GDP, and FDI per capita have been fluctuating over time.

On the other hand, since the year 2000, there has been increased budgetary allocation to the physical infrastructure sector. Resource allocation increased from KES 88.6 billion during the fiscal year 2008/09 to KES 161.9 billion during the fiscal year 2011/12 and then to KES 200.3 billion in 2014/15, as evidenced from Energy, Physical Infrastructure and ICT, Medium Term Expenditure Framework (MTEF) Sector Reports (Republic of Kenya 2007b, 2010, 2013). However, Kenya still has visible signs of infrastructure inadequacy and inefficiencies. These include congested roads, erratic power supply, long waiting lists for installation of telephone/power lines, shortages of clean and safe drinking water, overloaded disposal system and pollution, among others. This raises the question: What are the effects of infrastructure development on the meagre increase in FDI recorded in Kenya?

In addition, most of the studies conducted (Calderon 2009; Mwega 2009; Nyaosi 2011; UNCTAD 2005; World Bank 2009) used limited number of variables to represent the whole spectrum of infrastructure development. Key among the omitted variables include those on water and waste management which are key indicators of growth and their omission would give biased results and inappropriate policy decisions.

Further, most of the studies on the determinants of FDI inflows have relied on data from different regions and horizons to arrive at conclusions. Due to the different operating environments, the prescriptions are region based and hence the need for country-specific solutions. A study by Asiedu (2002), for example, established that high return on investment and infrastructure are significant determinants of FDI in non-sub-Saharan Africa countries but not significant for sub-Saharan Africa. Marginal impact of increased openness is a key factor in determining FDI for sub-Saharan Africa as opposed to non-sub-Saharan Africa. These results are too general to inform policy in the case of Kenya.

This study, therefore, sought to analyse the effects of infrastructure development on FDI inflows to Kenya, taking cognisance of the fact that infrastructure comprises many sub-indicators. Thus, the study takes into consideration most of the variables in previous studies, in addition to other selected sub-indicators, to construct infrastructure indices.

3. Objectives of the Study

The main objective of the study was to analyse the effects of infrastructure on FDI. The specific objectives were to

1. Determine the effects of transport infrastructure development on FDI inflows
2. Investigate the effects of energy infrastructure development on FDI inflows
3. Determine the effects of communication infrastructure development on FDI inflows
4. Find out the effects of water and waste management infrastructure development on FDI inflows

4. Literature Review

Wheeler and Mody (1992) found that infrastructure quality is an important variable for developing countries seeking to attract FDI from the United States. Further, using a self-reinforcing model of FDI, Cheng and Kwan (2000) found support for good infrastructure (density of roads) as a determinant of FDI in 29 Chinese regions from 1985 to 1995.

According to Houghwout (2001), 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. In Houghwout's argument, even if such infrastructure has no direct role in the cost structure, evidence suggests that the indirect spillovers from agglomeration and clustering created by public infrastructure lower the costs of firms.

In the African context, a study by Asiedu (2002) who analysed 34 African countries over the period 1980–2000 using the number of telephones per 1,000 population to measure infrastructure development concluded that countries that improved their infrastructure were rewarded with more investments. Asiedu estimated that a one-unit increase in infrastructure led to a 1.12 per cent increase in FDI/GDP in the 1980s.

Yasmin, Hussain and Chaudhary (2003) analysed the volume and determinants of FDI in developing countries. Basing the analysis on a sample of 15 developing countries, 5 each from upper-middle, lower-middle and lower-income countries, the study established that the flow of FDI to developing countries has followed an uneven path. The analysis further showed that urbanisation, GDP per capita, standard of living, inflation, current account and wages affect FDI inflows in low-income countries; urbanisation, labour force, domestic investment, trade openness, standard of living, current account, external debt and wages affect FDI inflows in lower-middle-income countries; and urbanisation, labour force, GDP per capita, domestic investment, trade openness and external debt affect FDI inflows in the sampled upper-middle-income countries. The study attributed variations in FDI to institutional and structural differences among the countries analysed. From the three segments, it is evident that urbanisation is a key determinant of FDI inflows; hence, well-planned urban areas with the necessary infrastructure facilities are likely to attract more FDI.

Using two proxies for road network (total roads length and paved roads) and electricity (installed power capacity and gross generation) in Argentina, Castro et al. (2007) established that paved and reliable roads matter in FDI attraction. From the results, a 10 per cent increase in per capita paved roads boosts FDI on the average by between 17 per cent and 33 per cent. Further, increasing energy supply in geographically close provinces would augment FDI inflows between 12 per cent and 14 per cent.

In a study to establish the impact of FDI in Malawi, Kazembe and Namizinga (2007) found out that investors attach more weight on the need to communicate with clients at ease and operate efficiently under reliable utilities. To Kazembe and Namizinga, such factors include functional transport, energy and communication infrastructure and utilities. Unreliable power and water supply and high cost of transport make it hard for international investors to manufacture and produce efficiently, while better road networks enable investors to transport and supply products at lower costs.

In a study on foreign investment and economic development in Costa Rica, Cordero and Paus (2008) established that the Costa Rican government's efforts to address concerns on improved road access, telecommunications, uninterrupted access to reliable electricity and water at reasonable prices had contributed towards attracting more FDI to the country. Cordero and Paus's findings were similar to Kazembe and Namizinga's (2007) findings.

Jordaan (2010), while studying FDI and neighbouring influences, established that good-quality and well-developed infrastructure increases the productivity potential of investments in a country and therefore stimulates FDI flows towards the country. Consistent with Asiedu (2002) and Ancharaz (2003), Jordaan argued that the number of telephones per 1,000 inhabitants is a good measure for infrastructure development. The study, however, noted that this measure falls short and only captures the availability and not the reliability of the infrastructure. The study only included fixed-line infrastructure and not cellular telephones, and omitted other important infrastructure facilities, such as roads and rail transport, water and energy supply and sources.

Using an econometric model based on cross-sectional analysis for 38 developing countries over the period 2000–10, Demirhan and Masca (2008) analysed the determinants of FDI in developing countries. The study used growth of per capita real GDP as a proxy for market size since absolute GDP reflects size

of population rather than income; telephone main lines per 1,000 people as a proxy for infrastructure and degree of openness computed as the sum of nominal export and import divided by the nominal GDP. According to the study, market size, infrastructure and the willingness of a country to accept foreign investment were found to positively affect FDI inflows, their effect being significant. This meant that better infrastructure is an important determinant in attracting FDI.

Voorpijl (2011) analysed FDI in Kenya, with an emphasis on the gains and losses associated with foreign involvement. Using a qualitative approach with a sample of investors who had made a long-term investment, the study unearthed the strengths of analysing the investment climate. This was necessary since the investment climate determines the economic stage of a country and is a reflection of the type of FDI. According to Voorpijl, the most important investment motives are the presence and access to a good infrastructural network and a highly educated and relatively cheap but qualified labour force.

To establish the main determinants and impacts of FDI on China's economy, Ang (2012) considered five key aspects including total inward and outward FDI flows; FDI inflows in comparison with other capital sources; main countries of origin and destination of investment; sectoral and geographical distribution of FDI; and forms of investment. On fitting a time series econometric model, the study found out the following to be the main determinants of FDI inflows: size and growth of the Chinese economy; natural and human resource endowments; physical, financial and technological infrastructure; openness to international trade and access to international markets; regulatory framework; and investment protection and promotion. In the study, physical, financial and technological infrastructure was found to be highly correlated with FDI inflows and this was attributed to the multiplier effect of infrastructure development, key to this being openness to international trade and access to international markets, which depends on sound infrastructural facilities.

Using cross-sectional data covering 18 Arab countries, Moosa (2012) argued that FDI can be explained in terms of the GDP growth rate, enrolment in tertiary education, spending on research and development, country risk and domestic investment. Countries that are more successful in attracting FDI are those that have growing economies that pay attention to education and research. Additionally, Moosa argued that openness of the economy represents the FDI and exports relationship, while telephone lines per 1,000 inhabitants is a measure of availability and cost of telecommunications. Moreover, energy availability and sustainability is of particular importance to efficiency-seeking investors.

According to Dumon (2014), every economy requires infrastructure resources in order to facilitate the sale of goods and services. Roads, highways, bridges and other forms of physical infrastructure should be present and well maintained to provide sufficient safety for the transportation of goods as well as for the commuting of employees. Lower transaction costs enable investors to earn returns on their investments as their enterprises are able to generate profits (Damon 2014).

Chakrabarti (2003) found that a rapidly growing economy provides relatively better opportunities for making profits than the ones growing slowly or not growing at all. The study therefore established a significantly positive effect of economic growth on FDI. Using data on US FDI, Loree and Guisinger (1995) found that political risk had a negative impact on FDI. On the other hand, Hausmann and Fernandez (2000) found no relationship between FDI flows and political risk. In a study on capital flows and FDI in developing countries, Edwards (2010) established that political instability had an effect on FDI, while political violence did not have an effect on FDI inflows.

From the literature reviewed, it is evident that the determinants of FDI inflows are many and varied. Most of these factors have been captured by Chakrabarti (2003). It is also evident that most of the studies are in agreement on the levels of variable measurement and description. It has been established that the different perspectives employed by the different studies, methodologies, sample selection, data horizons and the fitted models coupled with the analysis tools cause most of the variations. However, a sizable

number of the results are in consonance. For example, factors, such as labour costs, trade tariffs and barriers, trade openness and balance, exchange rate, quality infrastructure, economic growth and tax regimes, have been found to be significant determinants of FDI inflow. However, the level of significance has been found different for different regions and income cohorts. Hence, there are concerns on the reliability of the results of previous studies, in relation to their robustness.

One notable factor that has been narrowly captured in most of the studies has been infrastructure. Ancharaz (2003), Asiedu (2002), Jordaan (2010) and Moosa (2012) have all used telephone lines per 1,000 inhabitants to represent the whole infrastructure spectrum. To them, this is part of the infrastructure needed to conduct international business and is a measure of availability and cost of telecommunications, which is important for multinationals to coordinate cross-border activity. Nyaosi (2011) established that infrastructure affects FDI inflows significantly and these findings were similar to those of Calderon (2009), Mwega (2009), UNCTAD (2005) and World Bank (2009). All these studies used a few variables to represent the whole spectrum of infrastructure development. Key among the omitted variables include those on water and waste management, which are vital indicators of growth.

This study, therefore, takes cognisance of the fact that infrastructure comprises many sub-indicators and thus takes into consideration most of the variables considered in previous studies, in addition to other selected sub-indicators, to construct infrastructure indices using principal component analysis (PCA). Together with the infrastructure indices, other variables as presented in the conceptual framework (see Figure 2) were included in the study.

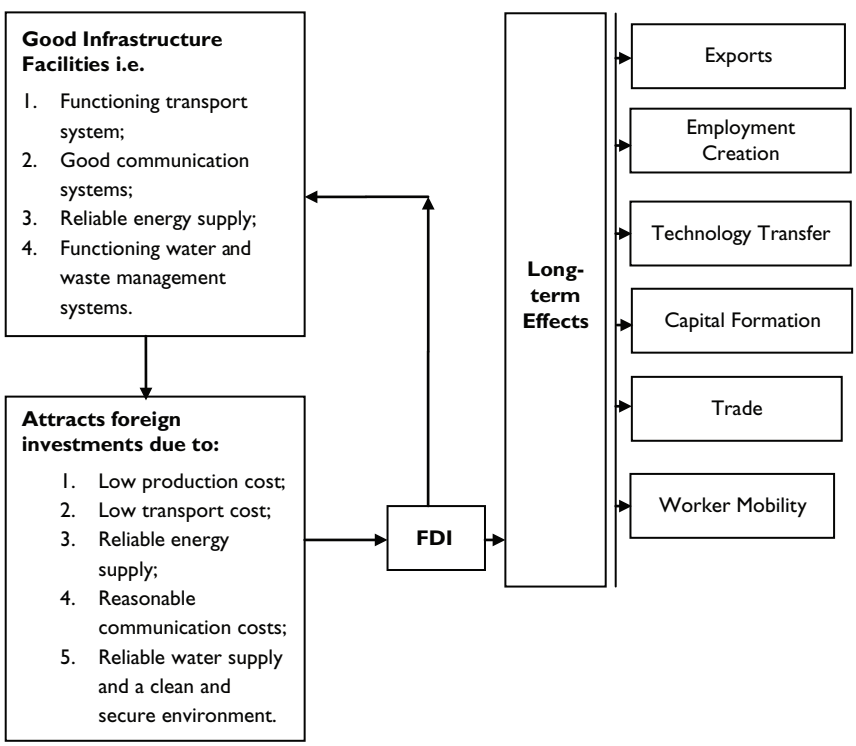

Figure 2. Conceptual Framework

Source: Constructed by the authors with some information from Nyaosi (2011).

It is expected that a functioning transport system as well as an efficient and reliable energy and water supply will cut down production costs. On the other hand, good communication systems will hasten communication, both locally and internationally. From literature, it has been established that investment decisions are hinged on quality infrastructure systems. Thus, improved infrastructural facilities lower the cost of doing business and hence improve the investment climate. Besides infrastructure, other factors, such as economic growth rate, exchange rates, openness to trade, wages and security, also influence the growth of FDI in a specific economy. Foreign direct investment on the other hand leads to improvement of a country's infrastructure, contributes to a country's capital formation, creates employment, results in technical transfers that encourage the establishment of local firms.

5. Empirical Model and Definition of Variables

As proposed by Kinda (2010), determinants of FDI and the decisions to invest in a certain country depend on the return on investment measured by profit. However, factors that determine profit also determine FDI. These factors include economic factors (transport infrastructure, energy infrastructure, communication infrastructure, economic growth and exchange rate), social factors (water and waste management infrastructure, wage) and political factors (security and openness to trade). Infrastructure comprises many sub-indicators and thus in this study, the selected sub-indicators were used to construct four infrastructure indices using PCA. The index was calculated using the formula:

$$\mathrm{II}_i = W_1 X_{j1} + W_2 X_{j2} + \ldots + W_n X_{jn} \tag{1}$$

where II_i is the infrastructure index for the ith category (TI, EI, CI and WWI) and W_i is the weight of the jth indicator. In general, the FDI inflows model takes the form:

$$\mathrm{FDI} = X'\beta + \varepsilon \tag{2}$$

where FDI inflows are a function of a $1 \times n$ vector of observations of n exogenous variables (X) with β coefficients and the regression error term (ε). All variables were introduced in logarithmic transformations except for security which was captured as a dummy variable. Therefore, the econometric model was specified in a multiplicative form:

$$\mathrm{FDI}_t = \beta_0 \mathrm{TI}_t^{\beta 1}\, \mathrm{EI}_t^{\beta 2}\, \mathrm{CI}_t^{\beta 3} \mathrm{WWI}_t^{\beta 4} \mathrm{EG}_t^{\beta 5} \mathrm{ER}_t^{\beta 6} \mathrm{SE}_t^{\beta 7}\, \mathrm{W}_t^{\beta 8} \mathrm{O}_t^{\beta 9} \mathrm{e}^{\varepsilon} \tag{3}$$

where TI is the transport infrastructure index, EI is the energy infrastructure index, CI is the communication infrastructure index, WWI is the water and waste infrastructure index, EG is the economic growth, ER is the exchange rate, SE is security, W is the nominal average earnings per person, O is the openness to trade, ε is the regression error term and t is the year. The estimated equation was:

$$\begin{aligned} \mathrm{InFDI}_t = \beta_0 + \beta_1 \mathrm{In}\ \mathrm{TI}_t, + \beta_2 \mathrm{In}\ \mathrm{EI}_t, + \beta_3\, \mathrm{InCIt} + \beta_4\, \mathrm{InWWI}_t, + \beta_5\, \mathrm{InEG}_t + \beta_6 \mathrm{In}\ \mathrm{ER}_t \\ + \beta_7\, \mathrm{SE}_t + \beta_8 \mathrm{In}\ \mathrm{W}_t + \beta_9 \mathrm{InO}_t + \varepsilon \end{aligned} \tag{5}$$

(For definitions and measurement of variables, see Table 1.)

Table 1. Variable Definition and Measurement

Variable	Definition and Measurement	Scale
Foreign Direct Investment (FDI)	This is a measure of net inflows in KES. It was the dependent variable.	Ratio
Transport Infrastructure Index (TI)	Transport infrastructure: Air transport (number of passengers and freight), kilometres of tarmacked roads as a percentage of total road network in Kenya, kilometres of railway line, port infrastructure (container port traffic in numbers), and number of passenger cars (per 1,000 people).	Ratio
Energy Infrastructure Index (EI)	Energy infrastructure: Electric power consumption per kWh; per capita consumption of kilogrammes of oil equivalent; energy generation in MW as a percentage of demand; renewable energy generation in MW as a percentage of total generation; and percentage connection to the national grid.	Ratio
Communication Infrastructure Index (CI)	Communication infrastructure: Fixed broadband Internet subscribers per 1,000 people; telephone lines per 1,000 people, ICT goods exports (as a percentage of total goods exports); ICT goods imports (as a percentage of total goods imports); and mobile cellular subscriptions (per 100 people).	Ratio
Water and Waste Management Infrastructure Index (WWI)	Water and waste management infrastructure: Kilometres of sewer lines as a percentage of urban population; water availability measured in M^3 as a percentage of demand in M^3; and improved water source in urban areas (% of urban population with access).	Ratio
Economic Growth (EG)	The level of economic growth expressed as a percentage.	Ratio
Exchange Rate (ER)	Kenya's official exchange rate against the US dollar.	Ratio
Wage (W)	Nominal average earnings per person in Kenya shillings.	Ratio
Security (SE)	This was a dummy variable. It proxies security situation in the country since 1980 as follows. The coup of 1982; tribal clashes in 1992, 1997, 2002 and 2007/08; and terrorist attacks in 1998, 2001, 2012 and 2013. The year of incidence occurrence took the value of 1 and year of no occurrence took the value of 0.	Nominal
Openness (O)	Trade openness expressed as the sum of export and import to GDP.	Ratio

Source: Authors' own construction.

6. Data

The study used annual secondary data from various sources, spanning from 1970 to 2013. This period was long enough for statistical inference, and data were available. Data were sourced from several websites that include websites of Central Bank of Kenya, World Bank and UNCTAD. Other sources include Kenya Statistical Abstracts (various issues) and Kenya Economic Surveys (various issues). The study took into consideration key infrastructure indicators, the period before and after the El-Nino rains, the Post-Election Violence (PEV) and the implementation of the first Medium Term Plan, 2008–12 (Republic of Kenya 2008). These are key moments in the history of the country. Both the

El-Nino rains and the PEV had a destabilising effect, with the rains causing havoc to infrastructure facilities. Further, during the implementation of the first Medium Term Plan, 2008–12, key infrastructure facilities were implemented, among them the Thika Super Highway, Mombasa Port Modernisation and dredging, rehabilitation of airports and airstrips and rehabilitation and maintenance of key national and international trunk roads.

To avoid errors in the analysis, the data were cleaned and refined. Several diagnostics (linearity test, test for influential elements, test for normality and homoscedasticity) were done prior to actual analysis to avoid reporting spurious results.

7. Empirical Results and Discussion

The model lag length was determined using Schwartz–Bayesian Information Criterion (SBIC), as the Johansen maximum likelihood method for testing for cointegration is sensitive to the number of lags. In this case, the lag length with the lowest SBIC was selected which was one. To avoid spurious results, the data were tested to ensure there was no trend or seasonality. The augmented Dickey–Fuller (ADF) test was done at levels and differences to determine the order of integration.

Most of the variables, log of transport infrastructure, log of communication infrastructure, log of energy infrastructure, log of water and waste infrastructure, log of nominal wage and log of exchange rate, were found to be integrated of first order, I (1), while log of FDI, log of economic growth and log of openness were found to be integrated of order zero, I (0). This meant that log of transport infrastructure, log of communication infrastructure, log of energy infrastructure, log of water and waste infrastructure, log of nominal wage and log of exchange rate were stationary at difference. The log of FDI, log of economic growth and log of openness were stationary at level, meaning that the null hypotheses for the presence of unit roots were rejected at 5 per cent for these variables.

Having established that some of the variables in the study were I (0) and others I (1), it was important to establish the existence of a long-run relationship between the dependent and independent variables. Using the Johansen test for cointegration, the trace statistic was found to be smaller than the critical value at 5 per cent level of significance, with a maximum rank of four. This implied that cointegration was present and that there existed at least four cointegrated equations, in ether bidirectional or unidirectional relationship. This meant that the dependent and independent variables move closely to achieve a long-run equilibrium.

Pair-wise correlation analysis results (see Table 2) show coefficients ranging from –1 to 1. If it is close to one, the relationship between the pair is strong, and vice versa. The results indicate that the log of energy infrastructure and the log of transport infrastructure, the log of water and waste infrastructure and the log of exchange rate had strong negative relationships. The log of transport infrastructure and the log of communication infrastructure had a strong positive relationship, while the log of communication infrastructure had a strong negative relationship with the log of exchange rate. However, a Durbin–Watson (DW) statistic of 2.46 lies in the indecision quadrant (is closer to 2 and far from the extreme values, 0 and 4); hence, the variables were considered as having no serial correlation problem.

The diagnostic tests that were conducted include normality tests, test for omitted variables, model specification, serial correlation, model fit and test for homoscedasticity (see Table 3). As the study model was a multiple regression equation, the error term was expected to be normally distributed, with a zero mean and constant variance. This test was done by predicting residuals and running density and normal

Table 2. Correlation Analysis results

	lnFDI	lnTI	lnEI	lnCI	lnwwI	lnER	lnEG	lnO	lnw	lnS
Log FDI (lnFDI)	1									
log transport infrastructure (lnTI)	–0.54	1								
log energy infrastructure (lnEI)	0.41	–0.95	1							
log communication infrastructure (lnCI)	–0.45	0.85	–0.83	1						
log water and waste infrastructure (lnwwI)	0.65	–0.88	0.71	–0.76	1					
log exchange rate (lnER)	0.29	–0.89	0.95	–0.89	0.65	1				
log economic growth (lnEG)	–0.11	–0.14	0.23	–0.09	–0.09	0.29	1			
log openness (lnO)	–0.16	0.37	–0.38	–0.24	–0.28	–0.32	–0.01	1		
log wage (lnw)	–0.46	–0.97	0.97	–0.91	0.08	0.96	0.20	–0.37	1	
Security (lnS)	0.18	–0.37	0.39	–0.40	0.31	0.39	0.36	–0.32	0.41	1

Source: Constructed from study data by the authors.

Table 3. Summary of Diagnostic Tests Results

Test	Description	*t*-statistic	*p*-value
Jarque–Bera	For checking normality	0.89	0.641
Ramsey RESET Test	Test for omitted variables	0.58	0.632
Durbin–Watson Test	Test for serial correlation (if lies close to 0 and 4, then presence of collinearity)	2.46	–
Link Test	Test for model fit	0.067	0.454
White's Test	Test for homoscedasticity	44	0.429

Source: Constructed from diagnostic tests results data by the authors.

plots (see Figures 3 and 4). The plot showed that the error terms were not normally distributed before transformation, but were after the data were transformed. A Shapiro–Wilk test for normal data and Jarque–Bera normality test support the result (see Table 3). Hence, the assumption that the residuals followed a normal distribution could not be rejected at 5 per cent level of significance.

Further, using White's test, the error term was found to be homoscedastic with a calculated chi-square value of 44 with probability 0.429, implying that the null hypothesis of constant variance could not be rejected at 5 per cent level of significance, as the probability was greater than 0.05 (see Table 3). Again, a DW statistic of 2.46 lies in the indecision quadrant (is closer to 2 and far from the extreme values, 0 and 4); hence, the variables were considered as having no serial correlation problem.

Model specification tests were done using the Ramsey's regression equation specification error test (RESET) and the null hypothesis was that the model had no omitted variables. The test results showed

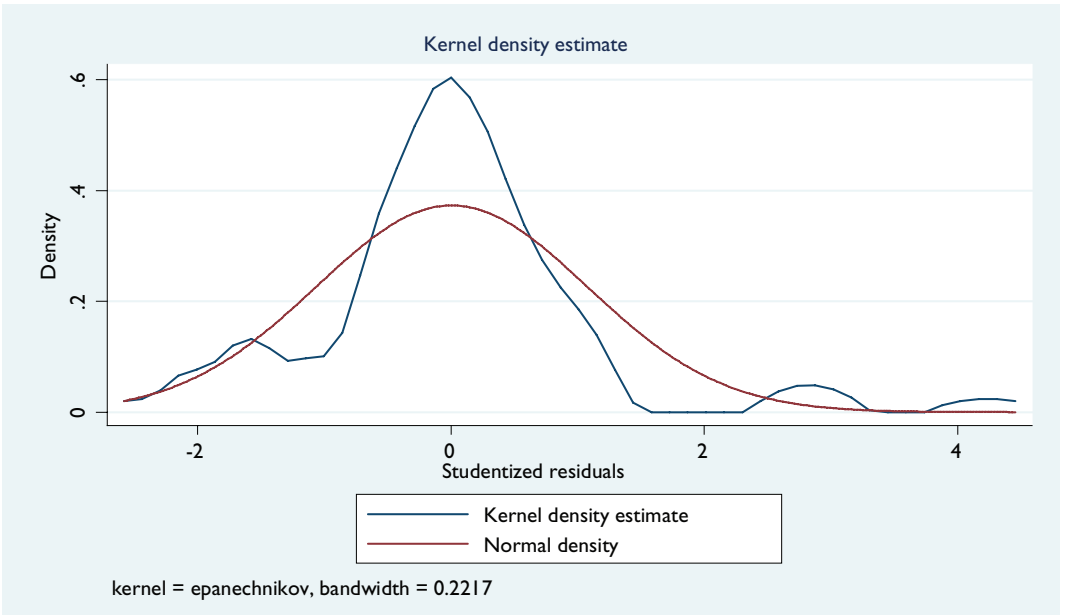

Figure 3. Residual Density Plot (before transformation)

Source: Constructed from distributional test results by the authors.

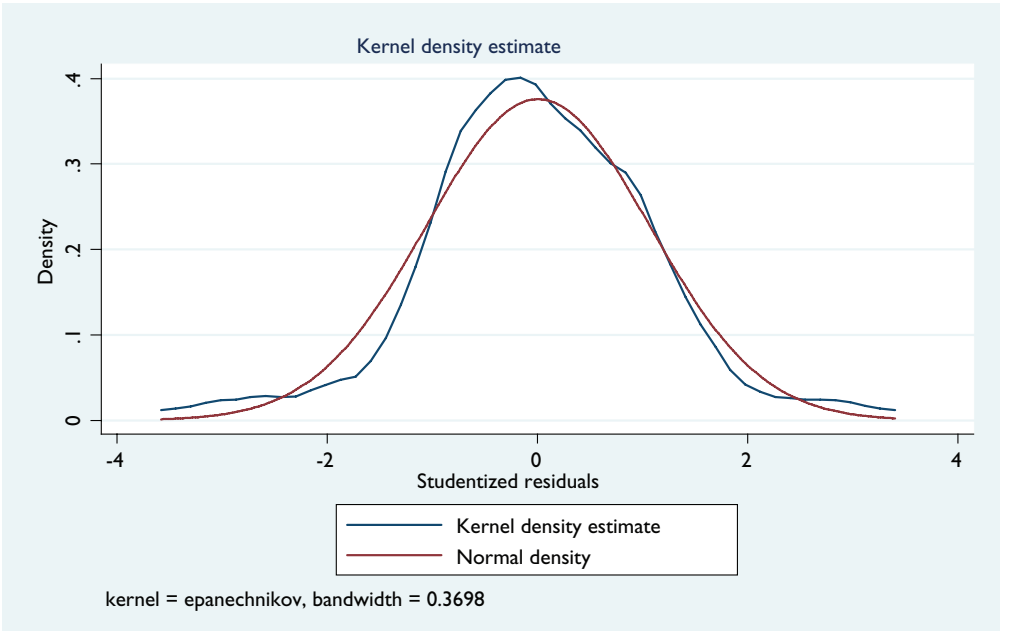

Figure 4. Residual Density Plot (After Transformation)

Source: Constructed from distributional test results by the authors.

that the model had no omitted variables [F (3, 32) = 0.70, $p > 0.05$)], while a test of model specification showed that the model fitted well ($p = 0.449$) (see Table 3). Hence, the null hypothesis that the model had no omitted variables and fitted well could not be rejected at 5 per cent level of significance. A cumulative sum (CUSUM) test (see Figures 5 and 6) shows that parameter constancy in the model is maintained for the entire study period.

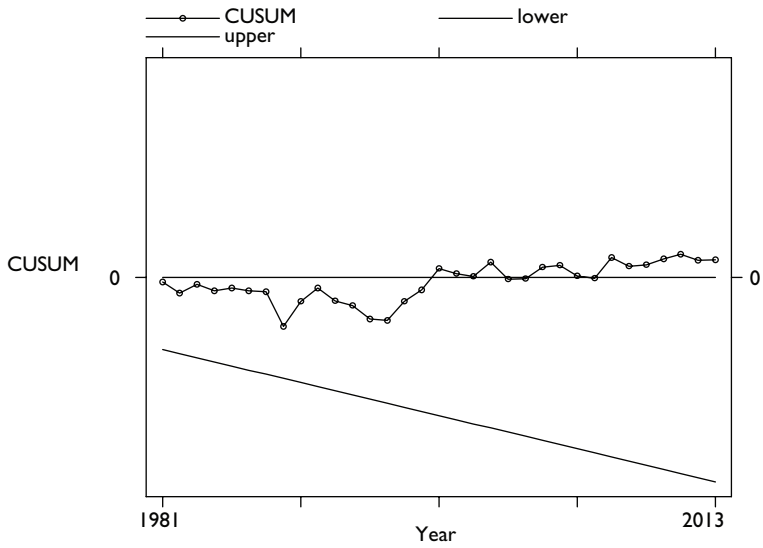

Figure 5. CUSUM Test

Source: Constructed from CUSUM test results by the authors.

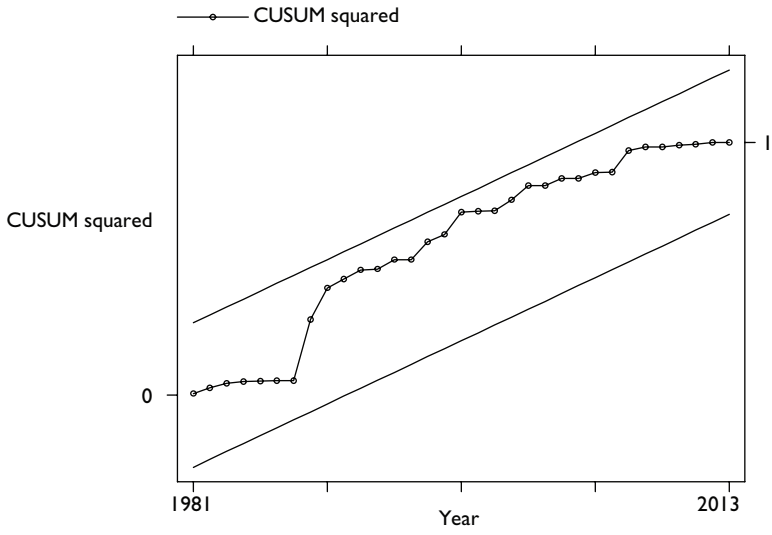

Figure 6. CUSUM Squared Test

Source: Constructed CUSUM test results by the authors.

Table 4. Regression Results

Variable	Coefficient	*t*-statistic	*p*-value
Constant	2416.455	0.41	0.686
Log transport infrastructure	4.881**	4.26	0.000
Log energy infrastructure	1.524	1.25	0.213
Log communication infrastructure	1.127**	9.77	0.000
Log water and waste infrastructure	0.605**	6.21	0.000
Log exchange rate	0.602**	6.75	0.000
Log economic growth	0.460**	2.80	0.005
Log openness	0.624**	4.72	0.000
Log wage	–0.131	–1.50	0.132
Security	0.352	–0.93	0.353

Source: Constructed from regression results by the authors.
Notes: (1) *R*-squared = 0.5604, adjusted *R*-squared = 0.4440, root mean squared error = 1.0713.
(2) $^{*}p < 0.05$, $^{**}p < 0.01$; F (9, 34) = 4.81, $p = 0.004$.

The regression results (see Table 4) show that the *F*-statistic (4.81) is statistically significant at 1 per cent level, meaning that all the independent variables as a group explain 44 per cent of the total variations in FDI inflows. The model has a trend at 2,416.455, meaning that in the absence of all the model variables, FDI inflows increase with a constant factor, equivalent to the trend (see Table 4).

The coefficient of the log of transport infrastructure index (see Table 4) was statistically significant at 1 per cent level of significance ($p < 0.01$), meaning that transport infrastructure was important in attracting FDI. Consistent with the theory, a percentage increase in transport infrastructure development index increases FDI inflows by 4.88 per cent, making transport infrastructure very important in attracting FDI. This means that an increase in air transport (passengers and freight), more kilometres of tarmacked roads as a percentage of total road network, more kilometres of rail line, improvement in port infrastructure (container port traffic) and increase in passenger cars are key determinants in attracting FDI to the country.

These findings are similar to those by Dumon (2014), Rehman et al. (2011), Cheng and Kwan (2000), Castrol et al. (2007), Kazembe and Namizinga (2007), Demirhan and Masca (2008) and Jordaan (2010). In Argentina, Castro et al. (2007) found that a percentage increase in paved roads causes a 1.7 per cent growth in FDI which is way below 4.88 per cent growth in FDI inflows in Kenya in this study.

The coefficient for the log of energy infrastructure index (see Table 4) was not statistically significant ($p > 0.05$) at 5 per cent level of significance, meaning that energy infrastructure was not important in attracting FDI. A percentage increase in energy infrastructure development index has no effect on FDI inflows in Kenya. This may be due to the fact that the cost of energy, a key determinant, was not considered in the determination of the energy infrastructure index. This result differs significantly from the results of Castrol et al. (2007) and Kazembe and Namizinga (2007). Both establish a positive and significant causal relationship between the two variables, with Castro et al. establishing that a percentage increase in reliability of energy supply increases FDI inflows by 1.2 per cent.

The coefficient of the log of communication infrastructure index (see Table 4) was statistically significant at 1 per cent level of significance ($p < 0.01$), meaning that communication infrastructure was important in attracting FDI. Consistent with the theory, a percentage increase in communication

infrastructure development index increases FDI inflows by 1.13 per cent. This means that increased broadband Internet connectivity, increased export of ICT goods and services and increased mobile cellular subscriptions are key determinants in attracting FDI to the country. This result resonates with Kazembe and Namizinga (2007) study which found that investors attach more weight on the need to communicate with clients at ease and operate efficiently under reliable utilities, such as functional transport, energy and communication infrastructure.

The coefficient of the log of water and waste infrastructure index (see Table 4) was statistically significant at 1 per cent level of significance ($p < 0.01$), meaning that water and waste infrastructure was important in attracting FDI. A percentage increase in water and waste infrastructure development index increases FDI inflows by 0.605 per cent. This means that improved water availability and access and proper waste disposal in urban areas are key determinants in attracting FDI to the country. According to Kazembe and Namizinga (2007), unreliable power and water supply and high cost of transport make it hard for international investors to manufacture and produce efficiently. This result is consistent with that of Jordaan (2010), Asiedu (2002) and Ancharaz (2003).

The coefficients for the log of exchange rate, log of economic growth and log of trade openness (see Table 4) were statistically significant at 1 per cent ($p < 0.01$). A percentage increase in the log of exchange rate, log of economic growth and log of trade openness causes an increase of 0.602, 0.460 and 0.624 percentage points in FDI inflows, respectively. A strong exchange rate means that exports are cheaper compared to imports, hence a positive balance of payment. The volumes of trade as a percentage of GDP determine how open an economy is. In this case, and as presented by Yasmin et al. (2003), Ang (2012) and Moosa (2012), trade openness is one of the key determinants of FDI inflows in most economies. Additionally, when the economy grows, the market for goods and services grows, stimulating savings, and hence investments.

As was expected, the coefficient of log nominal average earnings per person and security were negative (see Table 4), meaning that nominal average earnings and insecurity had a negative relationship with FDI inflows. A percentage increase in nominal wage has no effect on FDI inflows in Kenya because the coefficient was not statistically significant at 5 per cent ($p > 0.05$). However, according to the theory, high costs of labour discourage investors. This is because the decisions to invest in a certain country depend on the return on investment. But the return on investment captured by profit is the total revenue less total cost. The total cost includes cost of inputs that contains wages. In this case, the results show that high labour costs reduce the rate of return. However, the effect is insignificant.

The coefficient of security was negative and statistically insignificant at 5 per cent level ($p > 0.05$) (see Table 4). This implies that the presence of insecurity has no effect on FDI inflows into Kenya. In this case, the coup of 1982; tribal clashes in 1992, 1997, 2002 and 2007/08; and terrorist attacks in 1998, 2001, 2012 and 2013 did not have a significant effect on FDI inflows. This finding is contrary to that of Nyaosi (2011) who established that insecure situations constrain the investment climate, thus scaring away investors.

8. Conclusion and Policy Implications

Transport infrastructure, communication infrastructure, water and waste infrastructure, exchange rate, economic growth and trade openness have a positive effect on FDI inflows. Energy infrastructure has a positive but insignificant effect on FDI inflows. Labour costs and insecurity have a negative effect on FDI inflows although the effect is insignificant.

The results imply that the government should endeavour to increase air transport (passengers and freight), more kilometres of tarmacked roads as a percentage of total road network, more kilometres of rail line, improve port infrastructure (container port traffic), increase broadband Internet connectivity, increase export of ICT goods and services, increase mobile cellular subscriptions, improve water availability and access and implement proper waste disposal in urban areas. These are key determinants of FDI inflows as established from this study.

The government should modernise ports and airstrips, tarmac more kilometres of roads, construct more kilometres of rail line and improve port infrastructure to increase container port traffic in order to attract FDI inflows.

The government should increase broadband Internet connectivity, expand technical training institutes and harness innovative ideas for increased export of ICT goods and services. This will improve communication structure thereby attracting FDI inflows.

The government should construct and rehabilitate water and waste management systems in order to attract FDI inflows.

The government should work towards improving the investment climate as openness coupled with ease of doing business was found to be a key requisite to investments. In this regard, the government should strengthen institutional infrastructures and governance, as they play a critical role in attracting foreign investments.

Economic growth and a strong currency are key determinants of FDI inflows; hence, macroeconomic stability should be a priority for the government. The Central Bank of Kenya should strive to retain inflation and interest rates as low as possible, and to maintain a strong currency.

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