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# Impact of foreign direct investment volatility on economic growth in Kenya: EGARCH Analysis

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**Abstract:** This study investigated the impact foreign direct investment volatility on growth in Kenya using time series data spanning 1970 to 2011. An endogenous growth model was estimated using the ordinary least squares to determine the relationship between the FDI volatility and economic growth. Bounds testing approach was employed to show that FDI volatility retards long-run economic growth in Kenya. Results suggest that FDI has a positive effect on growth whereas FDI volatility has a negative impact on growth. Notably, trade openness is not FDI inducing, thus affecting growth negatively. However, human capital endowment has a positive impact on growth. Although the overall effect of Foreign Direct Investment on economic growth is positive the volatility of capital flows may make it harder for the stable and predictable macroeconomic policies to be followed. Therefore, unstable inflows may dampen investment, hence affecting economic growth.

**Keywords:** Gross Domestic Product, Foreign Direct Investment Volatility, Arch, ARDL, EGARCH

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## 1. Introduction

Globalisation is the most salient feature of today's quest for encouraging cross border investment by multinational corporation (MNC's) and firms. Most countries especially the less developed countries strive to attract foreign direct investment due to its importance as a tool of economic growth and development (Asiedu, 2007). Most Africa countries Kenya included strive to seek Foreign Direct Investments as evidenced by being a signatory to New Partnership for Africa's development (NEPAD), which is seen as the vehicle for attracting foreign direct investment to Africa as a major component (Asiedu, 2007). Most African countries are faced with the problem of inadequate resources to finance long term investment. This poses a bigger challenge to economic growth and hinders the attainment of Millennium Development goals as set out by the United Nations (UNCTAD, 2005).

Foreign Direct Investment (FDI) is composed of flow of capital, expertise, and technology into the host country. It is an investment made to acquire lasting interest in enterprises operating outside the economy of the investor (IMF, 1993). FDI may also be defined as an investment undertaken by a foreign national for the purpose of production of goods and services, which are to be sold either in the domestic market or exported overseas (UNCTAD, 2005). Whereas volatility will be defined as the deviation around a trend, such that the

measure is interpreted as a percentage of mean, that is the year on year variability of the inflows (Lensink & Morrissey, 2002).

FDI has an important role to play in developing countries, which are characterized by lack of skilled manpower, infrastructure and capital among other problems (Bengoa, 2003; Blomstorm, 1996). The 'traditional' argument is that an inflow of FDI improves economic growth by increasing the capital stock, whereas recent literature points to the role of FDI as a channel of international technology transfer. In this approach, technological change plays a pivotal role in economic growth. FDI by multinational corporations is one of the major channels in providing less developed countries (LDCs) with access to advanced technologies. The knowledge spillovers may take place via imitation, competition, linkages and training (Grossman & Chauvet, 1991; Lensink & Morrissey, 2001).

Since independence, the Kenyan government has put great efforts to boost the levels of FDI to spur economic growth by offering various investment incentive packages. During the period 1970 to 1980 real GDP growth rate averaged 6.6 per cent per year and compared favourably with the East African countries, whereas the average FDI inflows was 30.5 million US Dollars . This remarkable performance was attributed to consistency of economic policy, promotion of small holder agriculture, high domestic demand, and expansion of market

of domestic output within East Africa region. The period 1981 to 1990 saw powerful external shocks with in appropriate fiscal and monetary policy, thus the decline in the growth of real Gross Domestic Product (GDP) to 5.2 percent over the period, while the FDI inflows averaged 30.4 million US Dollars. In the period 1991 to 2000, average GDP fell further to 2.21 percent due to increased budget deficit, declining export and political events resulted in the worst economic performance (UNCTAD, 2005).

In the last decade, that is 2001 to 2010 the GDP growth rate averaged 3.7 per cent, while FDI inflows increased to 128.5 million US Dollars. The increase in the GDP inflows may be attributed to the change in governance, for instance; in 2003 the government developed and implemented the Economic Recovery and Strategy Paper (ERSP) in order to accelerate the economic recovery. In 2008, Kenya launched its long term economic blue print the vision 2030 where it envisages to achieve global competitiveness and prosperity of the nation. This initiative is seen as a country's renewed commitment to attract Foreign Direct Investment to finance the industrialisation process (UNCTAD, 2005).

FDI flows to Kenya have not only been highly volatile, they generally declined in the 1980s and 1990s despite the economic reforms that took place and the progress made in improving the business environment. The investment wave of the 1980s dwindled in the 1990s as the institutions that had protected both the economy and the body politic from arbitrary interventions were eroded (Phillips, 2001; Mwega & Ngugi 2006). The main aim of Foreign Direct Investment is to finance investment. Planning is crucial for Investment decisions making and availability of funds, therefore predictability of FDI inflows is imperative. Low predictability is an indication of High volatility, and this may discourage investment. Similarly, political and economic instability in a country may discourage FDI inflows, and therefore associated with volatility. As a result, volatility is a useful indicator of; disincentives to investment and economic instability in the economy (Morrissey, 2003).

Most of the studies on FDI volatility and growth in sub Saharan Africa are cross-country evidences, while the effects of FDI volatility on economic growth can be country specific. The studies assert that relationship between FDI and growth depends on the macroeconomic conditions of the host country that is economic, social and environmental condition. Therefore the impact of FDI volatility on growth of any economy may be country and period specific, and as such therefore, there is the need for country specific studies. A number of studies in Kenya have analysed the relationship between FDI and economic growth (see for instance, Mwega & Ngugi, 2006; Musau, 2009; Nyamwenga, 2009; Macharia, 2010; kinuthia, 2010). However, the effect of FDI volatility has not been addressed. While volatility is expected to adversely affect GDP growth rate, it has not been empirically established in the Kenya case. This study will fill this gap by analysing the effect of FDI volatility on economic growth in Kenya.

The methodology adapted by most studies done in Kenya is

ordinary least squares (OLS) to model the relationship between FDI and economic growth, and determinant of FDI in Kenya. This study deviates from previous studies by taking into account the effects of FDI volatility on economic growth. The study will model FDI volatility using EGARCH model and ARDL bound test approach to test whether FDI volatility has positive or negative effects on economic growth.

The study is structured as follows: The introduction that provides relevant information about Kenya's FDI inflow and economic growth. The literature review both theoretical and empirical, the methodology which includes model specification, data source and chapter five has the conclusion part.

### ***1.1. Foreign Direct Investment Volatility; Why It Matters for Growth***

Capital flows do contribute to growth and as a result may help reduce poverty. However, volatility of inflows has a negative impact on growth, and especially private flows shows greater volatility than official flows. Therefore FDI volatility is expected to have adverse impact on economic growth for the following reasons. First possibility is that volatility itself has a negative effect on growth. The recent endogenous growth literature on FDI provides some arguments why this might be so. This literature shows that FDI positively affects growth by decreasing the costs of research and development (R&D) through stimulating innovation. If FDI inflows are uncertain, costs of research and development are uncertain, which negatively affects incentives to innovate. It may then be the case that volatility of FDI undermines investment by discouraging innovation and technology which is detrimental to economic growth. (Lensink & Morrissey, 2000)

Second, volatility of FDI inflows is a proxy for country specific economic risk uncertainty. Economic uncertainty is an important determinant of both growth and the productivity of investment. Economic uncertainty is the tendency of some developing countries to be particularly vulnerable to shocks that have the immediate effect of reducing income and, if recurrent, tend to reduce growth or constrain the ability of an economy to reach its steady state growth rate. Sudden Changes in the volume of FDI inflows can have a destabilizing impact on the economy. Foreign investors when confronted with risks may postpone or even withdraw the investments. Therefore, FDI volatility has a destabilizing effect on the economic performance, hence economic growth (Guillaumont & Chauvet, 1999; Lensink & Morrissey, 2000;).

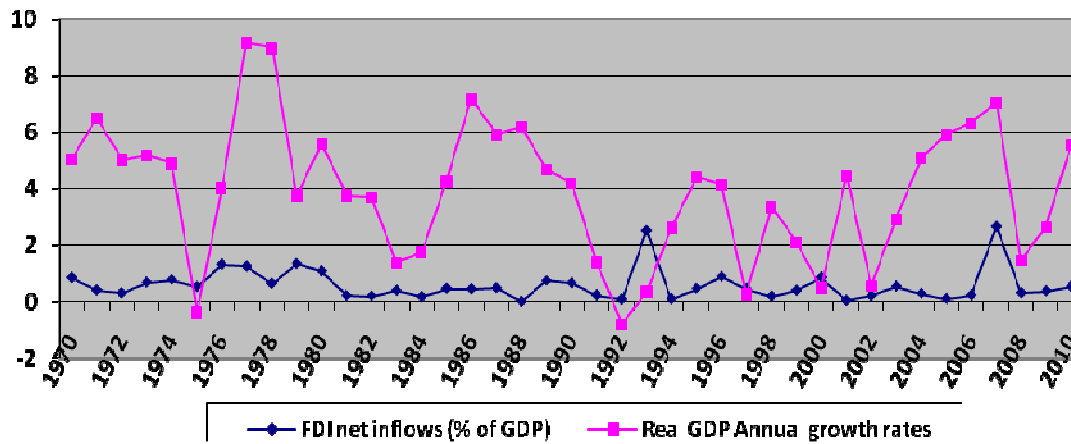
### ***1.2. Overview of Foreign Direct Investment and Economic Growth in Kenya***

Kenya has had mixed fortunes in terms of FDI inflows and economic trends in growth, which have shown great fluctuation. Figure 1.1 and 1.2 demonstrate the trend in Kenya's FDI and economic growth respectively for the period 1970 to 2011.

Kenya's FDI in the 1970's was about \$10 million a year

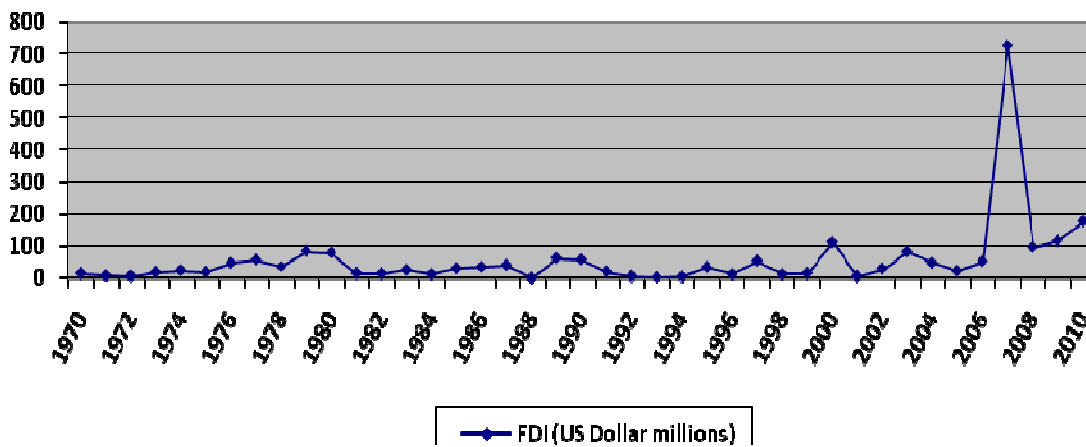
rising to approximately \$80 million in 1979-80. The most recent value for Foreign direct investment, net inflows (current US\$) in Kenya was \$178 as of 2010. Over the past 40 years, the value for this indicator has fluctuated between \$729 in 2007 and \$394,431 in 1988. The GDP growth rates for the same period were 5.55% in 2010, 7.05% in 2007 and 6.2% in 1988. Foreign direct investment, net inflows as a percentage of GDP in Kenya was 0.58 as of 2010. Its highest value in the last 40 years was 2.68 in 2007, while its lowest value was 0.00 in 1988. However, the early 1980's saw a decline in FDI as a

result of numerous factors such as the deterioration in economic performance, stop-go nature of economic reforms, political instability, rising costs of services and doing business, mediocre growth performance, corruption, poor governance, deterioration of public services and infrastructure. Theoretically increase in FDI to the host country should result into an increase in GDP growth rates, but from the graph it's evident that this is not so. That is why the study seek to investigate why this relationship exist.



Source: own composition data on UNCTADSTAT (2013).

Figure 1.1. FDI net inflows (% of GDP) and real GDP growth rates



Source: own composition, data from UNCTADSTAT (2013).

Figure 1.2. Trend of FDI inflow in Kenya (1970-2011).

Notable recent trends in sectoral composition of FDI are in horticulture, floriculture, garments, and tourism. While interest in horticulture and floriculture has been in response to favourable local conditions linked to climate and transport infrastructure, Garment investment has been in response to the U.S. granting preferential access to its market under African Growth and Opportunities Act (AGOA). Manufacturing FDI has concentrated on consumer goods sectors, such as the food and beverage industry. Most foreign investment in manufacturing since 2001 has been in the Export Processing Zone (EPZs), with the majority in AGOA-related textiles.

EPZs have expanded from their initial textiles focus to also produce a number of other goods. FDI in services has been directed to a wide array of sub-sectors such as tourism, financial and business services and telecommunications. Kenya has attracted foreign investors in banking and professional services (UNCTAD, 2005; Kinuthia, 2010).

### 1.3. Policies by the Government to Enhance and Attract Foreign Direct Investments

The move by the Government towards making the private sector a new engine of growth and promoting FDI has been a

consequence of this and has brought rewards in terms of GDP growth. In this light, KenInvest was created in 2004 and given autonomy in 2007 to market the country's opportunities, facilitate investors and ensure aftercare. Several reform bills have been lined up, which include; public private partnerships (PPPs) bill, Privatization Commission has been set up to manage the Government's privatization programme in a transparent and competitive way. Furthermore, the Government has published its Vision 2030, which includes clear benchmarks on how it wishes to develop and bring investment into a number of key sectors.

With regards to governance, a new Constitution was approved with much optimism by referendum in August 2010 with far-reaching changes. At the heart of Vision 2030, is the Government's desire to significantly improve the country's infrastructure, including road and rail. This has already begun with some major road upgrading. However, private sector investment is sought to develop a new transport corridor to South Sudan including port, road and rail, upgrade roads and railways between Mombasa and the Ugandan border, enlarge Mombasa port and expand Jomo Kenyatta International Airport, a key hub in the region (UNCTAD, 2012)

## 2. Literature Review

### 2.1. Theoretical Literature

Neoclassical growth theory and endogenous growth theory provide the basis for most of the empirical work on the FDI and Economic growth.

#### *Neoclassical growth theory as per Solow (1956)*

Solow (1956) developed neoclassical growth model. The theory outlines how a steady economic growth rate will be accomplished with the proper amounts of the three driving forces: labour, capital and technology. It states that by varying the amounts of labour and capital in the Cobb Douglas production function, an equilibrium state can be accomplished. This theory emphasizes that technological change has a major influence on economic growth. It further argues that economic growth will not continue unless there are continuous advances in technology. The neoclassical theory postulates that long-run economic growth arises from two exogenous factors namely: technological progress and labour force growth.

In the neoclassical theory, FDI inflows are a solution to fill the saving-investment gap, the foreign exchange gap, and the fiscal gap in host developing countries. FDI may act as an engine of the economic growth of the host economies through increasing capital formation, augmenting employment, promoting manufacturing growth, bringing management expertise and establishing brand name, and providing the skilled labour with an access to the international production network. Neoclassical theory considered the role of uncertainty in investment decisions. It stipulates that if investors are uncertain of the future returns they may reduce the investments or completely fail to invest. The theory states that there is a negative link between uncertainty and investment thus FDI volatility has impacts on economic

growth.

#### *Endogenous growth theory*

These are equilibrium models of endogenous technological change in which Long run growth is driven primarily by the accumulation of knowledge by forward looking, profit maximizing agents (Romer, 1986). The endogenous growth theory points out that FDI have a long-run effect on the growth of output. In order to explain the role of FDI in the long term growth of host countries, Barro and Sala-i-Martin,(1995) Lucas,(1990); Mankiw,(1992); and Romer,(1987); amended the neoclassical growth model by Solow by including the growth-driving factors of human capital as well as physical capital to explain the importance of FDI in developing countries.

The authors made it possible to model FDI as promoting economic growth in the long run through the permanent knowledge transfer that accompanies FDI. As an externality, this knowledge transfer will account for the non-diminishing returns that result in long run growth. Hence, if growth determinants, including FDI, are made endogenous in the model, long run effects of FDI will follow. Therefore, a particular channel whereby technology spills over from advanced to lagging countries is the flow of FDI. FDI not only contributes to economic growth through capital formation and technology transfers but also does so through the augmentation of the level of knowledge through labor training and skill acquisition.

According to endogenous growth theory, three main channels can be detected through which FDI affects growth. First, FDI increases capital accumulation in the receiving country by introducing new inputs and technologies. Second, it raises the level of knowledge and skills in the host country through labor and manager training. Third, FDI increases competition in the host country industry by overcoming entry barriers and reducing the market power of existing firms.

Endogenous growth theory argues that FDI has a positive effect on economic growth, whereas the volatility in FDI inflows has a negative effect on economic growth. The theory states FDI positively affects growth by decreasing the costs of research and development through stimulating innovation. If FDI inflows are uncertain, costs of research are uncertain, which negatively affects incentives to innovate. Thus, FDI volatility depresses investment and negatively affects real GDP growth.

### 2.2. Empirical Literature

Alpaslan (2011) study explores the impact of FDI volatility and economic growth for the Czech Republic and Hungary for the period 1990-2007, by implementing time series analysis. The study used exponential generalized autoregressive conditional heteroskedasticity (EGARCH) model to estimate the volatility of FDI and autoregressive distributed lag (ARDL) co integration procedure to test for the existence of short run or long run relationship between economic growth and volatility of FDI. The study found out that FDI volatility has a negative and statistically significant impact on economic growth. Whereas the empirical results

based on ARDL approach indicate that there exists a cointegration or long-run equilibrium relationship between FDI volatility and real GDP growth in the cases of the Czech Republic and Hungary.

Chee-keong and Liew (2011) examined the empirical relationship between the FDI volatility and economic growth in ASEAN-Five countries for the period 1974-2005. The objective of the study was to determine whether FDI volatility is harmful or beneficial for long-run growth. The variable to be estimated were real GDP growth rate (*RGDPGR*) and gross FDI as a percentage of GDP (*FDIGDP*). The study measured FDI volatility in two different ways, that is; FDI standard deviations is calculated by taking the standard deviation of error from the autoregressive equation for FDI with one-year lagged value and a time trend, and *FDIEGARCH* the alternative measure generated EGARCH model. The study examine the long-run relationship between FDI volatility and economic growth using ARDL cointegration testing procedure proposed by Pesaran, Renelt, and Smith (2001). The study found out that countries with higher FDI volatility have lower growth and it is significantly harmful for long-run growth in Association of south East Asian Nations (ASEAN) developing countries. The estimated bound test results indicate existence of long-run relationship between FDI volatility and economic growth. The policy implication is that policy-makers should mitigate the effect of an adverse shock to FDI flows, which may produce an uncertainty to reduce the effectiveness of FDI and economic growth.

Duasa (2007) study on FDI volatility and economic growth in Malaysia for the period of 1990-2002 uses ARCH model to test the effect of FDI volatility on economic growth. The findings of the study were FDI volatility have negative impacts on economic growth. The policy implication is the improvement of FDI should be emphasized to ensure stability of FDI inflow hence improved economic growth. Growth should come with the quality of human capital, infrastructure, good governance, information and communication technology and legal framework. All these are the compulsory elements needed to enable the country to be competitive in attracting FDI and to maintain the stability of FDI particularly for future development. The study recommended that a dynamic package internally will definitely attract FDI into the country and will ensure its stability hence ensuring efficiency of FDI. Policy on attracting FDI is important for improved economic growth.

Morrissey (2003) examines the trend, capital inflows and volatility of such inflows, for a sample of 26 countries of sub-Saharan African (SSA) over the period 1970 - 1997. The data consisted of FDI and other private flows, foreign aid and debt flows. For each of the capital inflows, measures of volatility for each country are calculated and discussed. The three alternative measures include; standard deviation around a simple trend; standard deviation around a forecast value; and coefficient of variation. The study found out that private inflows to SSA are very low, and accounted for less than two per cent of GDP on average over the whole period. Foreign aid remains the most significant inflow, averaging 12 per cent of

GDP over the entire period. The study provides evidence that volatility has increased in the 1990s that official flows are less volatile than private flows, and the volatility of FDI is much less than of other private flows. While private inflows, especially of short-term capital, pose problems in macroeconomic management, such flows have been too small to pose such problems in SSA prior to the late 1990's.

Osei, Morrissey and Lensink (2002) examine the trends, levels of capital inflows, and the volatility of such inflows, to a sample of 60 developing countries over the period from 1970-1997. The data consisted of foreign aid (official development finance) as the main forms of official flows, FDI and other private flows, and debt as a relative aggregate inflow measure. The data consisted of FDI and other private flows, foreign aid and debt flows. For each of the capital inflows, measures of volatility for each country are calculated and discussed. The three alternative measures include; standard deviation around a simple trend; standard deviation around a forecast value; and coefficient of variation. For analysis and summary of the results, the countries were grouped into low income, lower middle and upper middle income. The findings of the study were that; volatility has increased in the 1990s comparative to the 1980s, but not to the 1970's; official flows are less volatile than private flows; volatility in FDI is lower than in other private flows; the poorest countries have become increasingly dependent on aid and debt finance, attracting almost no private capital and little FDI; total private capital inflows declined by more than 80% between the peak of the late 1970s and trough of the early 1990's; and that only the richer developing countries attract significant volumes of FDI and private capital but both are quite volatile.

Lensink and Morrissey (2001, 2002) study on FDI flows volatility and growth deviates from previous studies by introducing measures of the volatility of FDI inflows. As introduced into the model, these are predicted to have a negative effect on growth. They estimated the standard model using cross-section, panel data and instrumental variable techniques. Whilst all results are not entirely robust, there is a finding that FDI has a positive effect on growth whereas volatility of FDI has a negative impact. The evidence for a positive effect of FDI is not sensitive to which other explanatory variables are included. In particular, it is not conditional on the level of human capital (as found in some previous studies). There is a suggestion that it is not the volatility of FDI per se that retards growth but that such volatility captures the growth-retarding effects of unobserved variables. This is consistent with Lensink and Morrissey (2000) who find that the volatility of aid receipts is negatively associated with growth, although the level of aid has a positive impact.

In their earlier study Lensink and Morrissey (2000) conducted a study on FDI inflow, volatility and growth in less developed countries (LDC) for the period 1975-1997. They estimated the relationship between FDI volatility and economic growth in LDC using a simple OLS growth regression. The study estimated a standard growth model including FDI and volatility using cross-section, panel data

and instrumental variable techniques. The study found that FDI had a positive effect on growth whereas volatility of FDI has a negative impact. They argued that FDI inflow instability, measured as a residual of an autoregressive trend estimate of FDI receipts, can proxy for two forms of uncertainty that may be growth reducing. First is recipient uncertainty regarding future FDI receipts, which may have adverse effects on investment; second, is economic uncertainty, as the incidence of shocks will tend to attract unanticipated FDI, hence increase measured instability of FDI flows. They found out that the coefficient on the FDI instability measure is negative and significant and infer that economic uncertainty is growth-retarding. This result was robust for the sample of African countries and the full sample of developing countries.

Serven (1998) conducted a study on the impact of uncertainty in FDI inflow on investment in less developed countries for the period 1970-1995. He used a large cross country data set, comprising of 94 developing countries and used generalized autoregressive conditional heteroskedasticity (GARCH) to model FDI uncertainty. The study found out that FDI uncertainty negatively impacted on levels of investment for Developing countries. This was due to the fact that FDI uncertainty tends to increase the cost of research and development and lower expected returns thus reducing the level of investment.

Borensztein, Gregorio and Lee (1998) examined empirically the effects of FDI on economic growth and the channels through which FDI can be beneficial to growth. In the growth model they developed the variety of capital goods available is represented through technical progress. Therefore FDI determines technical progress since multinational companies encourages the adoption of new technology, thus increasing the production of capital goods, therefore increasing variety. The authors found that FDI has positive impact on growth although the magnitude of this effect depended on stock of human capital available in the host country. They found that for a country with very low level of human capital, FDI effects on growth was actually negative. In addition they found that FDI has positive impact on domestic investment.

**2.3. Overview of Literature Review**

The relationship between FDI and economic growth has motivated voluminous empirical and theoretical literature focusing on both developed and developing countries. From the literature reviewed, it is clear that the use of GARCH based measures of volatility have increasingly been preferred. This is because they are likely to produce consistent estimates of parameters of interest and also they are less likely to breach the non-negative constraint. The study drew much relevance in the use of ARDL and GARCH as a measure of volatility. These methods were therefore adapted in the study.

The shortcomings of the literature reviewed are that most of the studies are not country specific and instead, they are cross-country meaning they might fail to bring on board unique characteristics in these countries. Lack of such a study may imply that local policy may be being formulated based on

foreign ideas. This poses the risk of not addressing the Kenyan economic situation adequately. It was therefore imperative to conduct further study to try and close these gaps especially doing a country specific study which was to bring out the actual issues in the specified countries especially on the impact of FDI volatility on growth.

**3. Research Methodology**

**3.1. Model Specification**

This study adopted EGARCH methodology to model FDI volatility. EGARCH model is an improvement of autoregressive conditional heteroskedasticity (ARCH) model proposed by Engle (1982) and generalized autoregressive conditional heteroskedasticity (GARCH) by Bollersley (1986) and Taylor (1986).

The economic growth rate variable was represented by real GDP growth rates (RGDPGR). The measures of FDI volatility was constructed in two ways as an indication of macroeconomic uncertainty. First volatility measure (FDISD) was obtained by regressing FDIGDP on its one year lagged values, with an intercept and linear time (Trend) terms.

$$FDIGDP_t = \beta_0 + \beta_1 FDIGDP_{t-1} + \beta_2 Trend + \mu_t \quad (1)$$

Where  $\mu_t$  is the error term and from which standard deviation will be calculated.

Secondly volatility measure was generated using exponential generalized autoregressive conditional heteroskedasticity (EGARCH) that is FDIEGARCH. Therefore the model was specified as;

$$FDIGDP_t = \mu + \delta FDIGDP_{t-1} + \epsilon_t + \varphi \epsilon_{t-1} \quad (2)$$

Where  $\epsilon_t$  has a mean and a conditional variance of zero and  $\delta^2_t$  respectively,  $\mu$  is the intercept term,  $\delta$  and  $\varphi$  represent the magnitude of the autoregressive term and moving average terms respectively and;

$$Log \sigma_t^2 = \omega + \alpha \left| \frac{\epsilon_t}{\sigma_{t-1}} \right| + \gamma \left| \frac{\epsilon_{t-1}}{\sigma_{t-1}} \right| + \beta_0 \log \delta_{t-1}^2 \quad (3)$$

Where  $\delta_{t-1}^2$  represents conditional variance of  $\epsilon_t$ ,  $\alpha$ ,  $\beta$  and  $\gamma$  are the parameters of ARCH, GARCH and leverage parameters respectively. Thus the log transformation of the variance rules out the negative variances. Therefore no restriction is required on the variance equation to ensure a positive volatility process as in the GARCH model.

Once the study identifies the magnitude of volatility, the study was to establish the effects of FDI volatility on economic growth using ARDL approach to cointegration also known as bounds testing approach. The ARDL has the following advantage; once the order of ARDL has been identified, the estimation can be done by OLS; it does not require a specific identification of the order of the data and it is suitable for small sample size. The ARDL was developed by Pesaran et al. (2001) as an alternative procedure to the

standard cointegration analysis. The equation to be estimated was specified as:

$$\Delta GDP_t = \beta_0 + \alpha_1 GDP_{t-1} + \alpha_2 FDI_{t-1} + \lambda_3 POP_{t-1} + \gamma_4 OPENNESS_{t-1} + \chi_5 FDIV_{t-1} + \sum_{t=i}^P \beta_i \Delta GDP_{t-i} + \sum_{t=i}^P \beta_i \Delta FDI_{t-i} + \sum_{t=i}^P \beta_i \Delta POP_{t-i} + \sum_{t=i}^P \beta_i \Delta OPENNESS_{t-i} + \sum_{t=i}^P \beta_i \Delta FDIV_{t-i} + \varepsilon_t \quad (4)$$

Where GDP is the gross domestic output, FDI- Foreign direct investment inflow, t -time trend,  $\Delta$  is difference operator, FDIVOL- FDI volatility,  $\varepsilon_t$  is the error term. p is lag structure to be included to eliminate autocorrelation in  $\varepsilon_t$ .

### 3.2. Data Type and Source

To achieve the objectives of these study secondary annual time series data was used. Data on GDP growth, FDI, Labour force, openness for the year 1970-2011 will be obtained from United Nations Centre for Trade and Development (UNCTAD), world data bank on world development indicators and Kenya National Bureau of Statistics (KNBS)

### 3.3. Estimation Techniques

The study seeks to respond to three objectives. The first objective was to determine the magnitude of FDI volatility in Kenya from 1970-2011, this was achieved by modelling volatility using EGARCH methodology. The second objective which was to establish the effects of FDI volatility on economic growth was achieved by first running unit root test which will test for data stationarity using ADF tests to test for stationarity, then autoregressive distributed lag (ARDL) cointegration test was done to test whether FDI volatility

positively or negatively effects economic growth and whether the effects are short run or long run. Objective three which was the policy implications of the findings, was achieved by making appropriate recommendations based on the empirical findings of the study. The model was analyzed using STATA version 12 package.

## 4. Empirical Estimation and Results

### 4.1. Descriptive Statistics

Analyses of the descriptive statistics enable us to determine whether the data is normally distributed. The most common measures are mean, median, skewness and kurtosis. In normally distributed data, the mean and the median should be equal, for the variables in this study the mean and the medians of lngdpgr, lnfdi, lntot, and lnpop are almost equal hence normally distributed. Whereas the mean and the median of ehat2 (FDI volatility) are not the same thus are not normally distributed. The standard deviation of foreign direct investment (FDI) is given by 1.203536, which will represent FDI volatility in this study. This can be seen in table 4.1 below.

Table 4.1. Summary Statistics

Variables	Mean	Median	Standard Deviation	Max	Min
lngdpgr	1.158595	1.481605	.8662637	-1.609438	2.217027
lnfdi	17.18966	17.18281	1.203536	14.50866	20.40718
lntot	-.6398196	-.6122882	.2602134	-1.091721	-.0482069
lnpop	-3.65507	-3.640854	.3209816	-4.439301	-3.012428
ehat2	1.417793	.5430126	2.169245	.0006784	10.79462

Skewedness is the tilt in the distribution and should be within the -2 and +2 range for normally distributed series. In a positively skewed distribution the mean is typically higher than the median, whereas in negatively skewed distribution the mean is lower than the median. Skewedness for a normal distribution is zero. In this study the variable lngdpgr and ehat2 are normally distributed since their skewness are close to zero, while lnfdi, lntot and lnpop are within the above stated range thus also normally distributed. Kurtosis on the other hand is the peakedness of a distribution and should be within -3 and +3 range when the data is normally distributed. It is a measure of whether the distribution is peaked or flat relative to normal distribution. Data set with high kurtosis tend to have distinct peak near the mean, decline rather rapidly and have heavy tails. Data set with low kurtosis tend to have a flat top near the mean rather than a sharp peak. Kurtosis is also a measure of how outlier-prone a distribution

is. Kurtosis for a normal distribution is 3. Distributions that are more outlier prone have kurtosis less than 3. None of the variable has a kurtosis of 3 meaning that the data is not normally distributed.

Table 4.2. Skewness/Kurtosis tests for Normality

variable	Pr(skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
lngdpgr	0.0002	0.0249	14.51	0.0007
lnfdi	0.4707	0.4354	1.19	0.5523
lntot	0.9170	0.4477	0.61	0.7384
lnpop	0.2654	0.2700	2.62	0.2697
ehat2	0.0000	0.0000	30.52	0.0000

The Jarque-Bera (JB) statistics test on the other hand is used to test for normality of the series. It utilizes the mean based coefficients of skewness and kurtosis to check normality of variables used. It measures the difference of the

skewness and kurtosis of a series from those of a normal distribution. The null hypothesis ( $H_0$ ) is that residuals are normally distributed, therefore reject  $H_0$  if  $JB > \chi^2(2)$  or if  $p < 0.05$ .

**4.2. The Magnitude of FDI Volatility**

The magnitude of FDI was determined by the standard deviation of Foreign Direct Invest volatility in this case the standard deviation of Infdi. Therefore the magnitude is 1.204 as indicated in table 4.1.

Since  $\text{Log}\sigma_t^2$  is modeled, then the significant advantage of EGARCH modelled is that even if the parameters are negative,

*Table 4.3. ARCH family regression*

Infdi	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Infdi cons	17.12167	.2333147	73.38	0.000	16.66438	17.57896
egarch	-.5215932	2.635906	-0.20	0.843	-5.687873	4.644687
arch	.2094297	.1739045	1.20	0.228	-.1314168	.5502762
garch	.1297414	.8318228	0.16	0.876	-1.500601	1.760084
cons	-.0464819	.6240079	-0.07	0.941	-1.269515	1.176551

From the above results the coefficients 0.2094297, 0.1297414, -0.5215932 are the arch, garch, and the egarch parameters respectively. Thus the estimated equation will be given by;

$$\text{Log}\sigma_t^2 = -0.046 + 0.209 \frac{\left| \frac{\epsilon_t - 1}{\sqrt{\delta_t - 1}} \right|}{g\delta_{t-1}^2} + -0.522 \frac{\epsilon_t - 1}{\sqrt{\delta_t - 1}} + 0.1297 \ln \sigma_{t-1}^2 \quad (5)$$

The  $\alpha = 0.209$  parameter represents a magnitude effect or the symmetric effect of the model.  $\beta = 0.1297$  Measures the persistence in conditional volatility and it is relatively large, then volatility takes a long time to clear out following a crisis in the market. Since it is relatively small, it implies that conditional volatility does not take a long time to clear. Therefore FDI volatility does not take a long time to clear. The parameter  $\gamma = -0.522$  measures the leverage effect, and since its  $\gamma < 0$ , it implies that positive shocks (good news) generate less volatility than negative shocks (bad news). Thus good

$\sigma_t^2$  will be positive. The  $\alpha$  parameter represents a magnitude effect or the symmetric effect of the model.  $\beta$  Measures the persistence in conditional volatility irrespective of what is happening in the market. When  $\beta$  is relatively large, then volatility takes a long time to clear out following a crisis in the market (Alexander, 2009). The parameter  $\gamma$  measures the leverage effect, its important in testing asymmetries in the model. If  $\gamma < 0$ , then positive shocks (good news) generate less volatility than negative shocks (bad news). When  $\gamma > 0$ , then positive innovation generate more destabilizing effects than the negative news. And if  $\gamma = 0$ , then the model is symmetric.

news on FDI inflows in Kenya generates less FDI volatility than the bad news about FDI.

**4.3. Unit Root Test Results**

In order to investigate the stationary properties of the time series, the presence of unit root was tested. That is, whether the variables are integrated of order 1, I (1), implying that they are stationary. This was achieved by applying augment Dickey-Fuller (ADF) test. The null hypothesis of the unit root implies non-stationarity, such that if the null hypothesis is rejected then the series is stationary. Therefore no differencing in the series is necessary to induce stationarity. The ADF test is widely used due to the stability of its critical values as well as its power over different sampling experiments. Unit root test results are reported in table 4.4 below.

*Table 4.4. Unit root test: levels*

Variable	ADF	1%	5%	10%	Remarks	
Ingdpgr	No trend	-4.142	-3.655	-2.961	-2.613	Stationary
	With trend	-4.219	-4.251	-3.544	-3.206	Stationary
Infdi	No trend	-2.384	-3.668	-2.966	-2.616	non stationary
	With trend	-2.772	-4.270	-3.552	-3.211	non stationary
Intot	No trend	-1.759	-3.648	-2.958	-2.612	non stationary
	With trend	-2.675	-4.242	-3.540	-3.204	non stationary
lnpop	No trend	-1.503	-3.648	-2.958	-2.612	non stationary
	With trend	-2.568	-4.242	-3.540	-3.204	non stationary
ehat2	No trend	-4.504	-3.655	-2.961	-2.613	Stationary
	With trend	-5.159	-4.251	-3.544	-3.206	Stationary

From the above results Ingdpgr and ehat2 are stationary at levels, while Infdi, Intot and lnpop are not stationary at levels.

Therefore we test their stationarity at first difference. The unit root test results for the first difference are reported in



table 4.4 below

**Table 4.5. Unit root test: First difference.**

Variable	ADF		1%	5%	10%	Remarks
Infdi	no trend	-4.537	-3.696	-2.978	-2.620	stationary
	with trend	-4.490	-4.306	-3.568	-3.221	stationary
Intot	no trend	-5.933	-3.648	-2.958	-2.612	stationary
	with trend	-6.998	-4.242	-3.540	-3.204	stationary
lnpop	no trend	-7.482	-3.648	-2.958	-2.612	stationary
	with trend	-7.409	-4.242	-3.540	-3.204	stationary

After the first difference the entire variable i.e. Infdi, Intot and lnpop are stationary.

#### 4.4. Cointegration Test Results

After establishing the order of integration of time series, cointegration test has to be done. Cointegration techniques are used to establish valid long-run relationship between variables. The Autoregressive Distributed Lag Bound test for cointegration was adopted in this study. Before conducting the bounds test, the order of integration for each variable was ascertained by Augmented Dickey-Fuller (ADF), as shown above. This was to ensure that the variables are not I (2) stationary, to avoid spurious results because the bounds test is based on the assumption that the variables are I (0) or I (1). The results indicate from table 4.3 and 4.4 that all our variables are either I (0) or I (1). Since we have established that the order of integration of the variables is zero or one, the ARDL bound test methodology can be applied in our model.

To implement the bound test procedure, Equation (4) is modelled as a conditional ARDL- error correction model (ECM)

Where  $\beta_0$  is a drift component and  $\epsilon_t$  is white noise. The first step in the ARDL approach is to estimate Equation (4) using ordinary least square (OLS). The second step is to trace the presence of cointegration by restricting all estimated coefficients of lagged level variables equal to zero. That is, the null hypothesis of no cointegration ( $H_0: \alpha_1 = \alpha_2 = \lambda_3 = \gamma_4 = \gamma_5 = 0$ ) is tested against the alternative ( $H_1: \alpha_1 \neq \alpha_2 \neq \lambda_3 \neq \gamma_4 \neq \gamma_5 \neq 0$ ) by the mean of F-test with an asymptotic non-standard distribution. Two asymptotic critical value bounds provide a test for cointegration when the independent variables are  $I(d)$  with  $0 < d < 1$ . The lower bound assumes that all the variables are I (0), and the upper bound assumes that they are I (1). If the computed F-statistics lies above the upper level of the bound, the null is rejected, indicating cointegration. If the computed F-statistics lies below the lower level bound, the null cannot be rejected, supporting the absence of cointegration. If the statistics fall within the band, inference would be inconclusive. After confirmation of the existence of a long run relationship between the variables in the model, the long run and short run models can be derived using information criteria such as the Schwartz Bayesian or the Akaike information criteria.

The ARDL approach to cointegration does not require the pre-testing of the variables, included in the model, for unit root unlike other techniques such as the Johansen approach (Pesaran *et al.*, 2001). However, as remarked by Ouattara

(2004), if the order of integration of any of the variables is greater than one, for example a I(2) variable, then the critical bounds provided by Pesaran *et al.* (2001) are not valid. They are computed on the basis that the variables are I(0) or I(1). Therefore, it is necessary to test for unit root to ensure that all the variables satisfy the underlying assumption of the ARDL methodology before proceeding to the estimation stage. This has been established by the unit root test conducted earlier, which shows that the variables are integrated of order one I(1) and zero I(0). Therefore ARDL methodology is applied.

#### 4.5. Estimation Results

##### 4.5.1. Long Run Relationship

Equation (4) is estimated for Kenya using annual data covering the period of 1970- 2011. Before testing the existence of a long run relationship among our variables it is important to decide the order of the lag of the ARDL. Results based on information criteria (Akaike, Schwartz and Bayesian) suggest that the process is an AR (1).

Table 4.6 reports results of the bound test for the existence of a long run relationship. The F-statistics is above the 5 per cent critical bounds computed by Pesaran *et al.* (2001), thus implying that the null hypothesis of no cointegration can be rejected. Put differently, there exists a long relationship among the variables of our model.

**Table 4.6. Bounds Tests for the Existence of Cointegration**

F-statistics	5% Critical values	
	I (0)	I (1)
4.902	2.476	3.646

Table 4.7 shows results of the long run estimate based on the Schwartz Bayesian criteria. The selected ARDL (0, 1, 1, 1, and 0) passes the standard diagnostic tests. The results show that foreign direct investment affects positively (0.144) but insignificantly, the real GDP growth rate. This implies that FDI flows to Kenya have a positive stimulating effect on economic growth, though not statistically significant. The estimate of the human capital variable, proxied by secondary school and tertiary institution enrolment, bears a positive sign (1.786) but statistically insignificant. This confirms the predictions of the endogenous growth theory on the importance of human capital for economic growth as proposed by Borensztién *et al.* (1998). Finally, trade openness, measured as the sum of exports and imports as a ratio of GDP, have the estimated coefficient of negative (-0.05) and statistically insignificant. Therefore it does not have a significant effect on

real GDP growth rate. Whereas foreign direct investment volatility (ehat2) have an estimated coefficient of negative (-0.026), which is statistically insignificant. Therefore foreign direct investment volatility has negative impact on economic growth.

**Table 4.7. Estimates of the Long Run Coefficients- ARDL (0, 1, 1, 1, 0)**  
Dependent variable: real GDP growth rate.

Variables	Coefficients	t-ratios	p-values
constant	0.743	2.69	0.012
Llmgdpgr	0.313	1.74	0.094
LD1lnfdi	0.144	-1.09	0.285
D1lntot	-1.311	-0.68	0.501
D1lnpop	2.24	1.64	0.112
ehat2	-0.026	-0.36	0.718

**4.5.2. Short Run Dynamics**

**Table 4.8. Estimates of the Error Correction Model**

Variables	Coefficients	t-ratios	p-values
constant	-0.0115	-0.03	0.977
lmgdpgr	1.007	3.09	0.005
lnfdi	0.133	-1.08	0.289
lntot	-1.593	-0.88	0.385
lnpop	1.786	1.28	0.212
ehat2	-0.018	-0.27	0.790
ECM (-1)	-0.936	-2.52	0.018

The fact that the variables in our model are cointegrated provides support for the use of an error correction model mechanism (ECM) representation in order to investigate the short run dynamics. Estimation results, still based on the Schwartz Bayesian information criteria, are presented in Table 4.8. The  $R^2$  is 0.38 suggesting that such error correction model fits the data reasonably well. More importantly, the error correction coefficient has the expected negative sign (-0.938) and is highly significant. The negative parameter of the error correction term helps strengthen the finding of a long run equilibrium relationship among the variables in the model.

The results in Table 4.8 suggest that foreign direct investment has a positive and statistically insignificant effect on the real GDP growth rate. The impact of trade openness is negative and statistically insignificant, therefore does not have a significant impact on growth. Labour force appears to have positive but statistically insignificant impact on growth, in the short run. The size of the coefficient of the error correction term (-0.936) suggests a relatively higher speed of adjustment from the short run deviation to the long run equilibrium. This implies that, 94 per cent of the deviation from long run growth is corrected every year.

**4.6. Post-Estimation Diagnostics**

**4.6.1. Breusch-Godfrey Test for Autocorrelation**

This test was adopted to test for serial correlation because it is applicable in both situations where lagged dependent variable is included, unlike Durbin Watson which is used to test for first order serial correlation. The null hypothesis of no serial correlation is tested against the alternative of autocorrelation presence and you reject null if P value is less

than or equal to 0.05. From the table the P-value is 0.432 which is less than 0.05 and therefore we do not reject the null hypothesis of no serial correlation meaning the residuals of the model adopted for the study has no problem of autocorrelation.

**4.6.2. Breusch —Pagan/Cook-Weisberg Test Results for Heteroscedasticity**

Heteroscedasticity is a situation of unequal or non stationary variance and its presence renders the usual t-test and F-test invalid. The null hypothesis of constant variance is tested against the alternative of no constant variance and the null hypothesis is rejected if the P value is less than or equal to 0.05 and from the table the P value is 0.0108 meaning that we do not reject the null hypothesis. Since 0.0108 is less than 0.05.

**4.6.3. Ramsey RESET Test**

The study adopted Ramsey RESET test as the regression specification error test which is a general test for two main types of misspecifications namely inclusion of irrelevant variables as well as exclusion of relevant variables in the regression model. The null hypothesis of the model has no specification errors i.e. the equation is correctly specified is tested against the alternative hypothesis of the model has specification errors omitted and you reject the null if p value is less than or equal to 0.05. From the table above P-value is 0.3964 which is greater than 0.05 and therefore we do not reject the null hypothesis meaning that the model that was adopted by the study had no omitted variables.

**4.7. Discussion of the Results**

The residuals ECM (-1) was generated and tested for Stationarity at levels and turned out to be stationary and therefore said to be cointegrated. The value of  $R^2$  is 0.3787 implying that approximately 37.87% of all the changes in the dependent variable are brought about by the changes in the explanatory variables (the explanatory power is about 37.87%). The value of Durbin Watson test is 1.72139 which can be approximated to 2 meaning that there is no problem of serial correlation of the residuals.

From the results presented in table 4.8 the coefficient of the error term ECM (-1) is negative and significant and this confirms the expected results from economic theory. The ECM (1) coefficient of -0.936 is interpreted as speed of adjustment to the long run equilibrium. Therefore, this implies that approximately 94% of all the deviations in the past will be corrected (adjusted to the equilibrium) during the present period. The high value of the error term indicates that the economic agents remove a large percentage of disequilibrium in each period.

The coefficient of foreign direct investment was positive but statistically insignificant; both in the long run and short run, thus confirming our a priori expectation of the study. This means foreign direct investment is a crucial determinant of growth in GDP in Kenya. The coefficient of 0.133 indicates that a 1% increase in foreign direct investment will lead to an

increase in real GDP growth rate by approximately 0.133% holding all other factors constant in the short run. These findings were in agreement with the findings of a study by Lensink and Morrissey (2002). Therefore foreign direct investment should be attracted as it is a critical ingredient for stimulating investment and economic growth.

The coefficient of labour force is positive but statistically insignificant both in the long run and short run, implying that labour force does not have any significant impact on real GDP growth rate for the period under study. These finding was in agreement Borensztein et al (1998) who argued that an educated labor force (human capital) is necessary for absorption of new technology and management skills.

The coefficient for trade openness was negative both in the short run and long run, against the a priori expectation of the study of positive however it was not significant at any level meaning that trade openness does not have any impact and therefore could not explain real GDP growth rate in Kenya during the study period. This scenario could have been brought about by trade imbalance, in that there are more imports than exports in Kenya.

The coefficient of foreign direct investment volatility was negative but statistically insignificant both in the short run and in the long run, thus confirming our a priori expectation of the study. Under the theoretical framework volatility increases the cost of innovation; therefore have negative effects on growth. This conforms to the findings of other studies (Alpasla 2011, chee-Keong & Liew 2011, Dausa, 2007, Lensink & Morrissey 2002). The coefficient of -0.018 in the short run indicates that a 1% increase in foreign direct investment volatility will lead to decrease in real GDP growth rate by approximately 0.018% holding all other factors constant. These findings were in agreement with the findings of a study by Lensink and Morrissey (2002). Therefore foreign direct investment volatility has a negative effect on growth though not significant.

## 5. Summary of the Findings, Conclusions and Policy Recommendations

### 5.1. Summary of the Findings

The purpose of the study was to establish the effect of FDI volatility on economic growth in Kenya. Real GDP growth rates were used as the dependent variable while foreign direct investment, foreign direct investment volatility, trade openness and labour force were used as the independent variables. The descriptive analysis indicates that all series are normally distributed. The ADF test was used to check for unit root. The ADF test revealed that foreign direct investment and foreign direct investment volatility were stationary at levels, while foreign direct investment, trade openness and labour force were stationary at first differences. The SBIC information criterion was used to identify the optimal lags of various series. The ARDL bound test for cointegration was used to establish the long run relationship of the variables. The results show that the variables have a long run relationship.

An error correction model (ECM) was used to estimate the empirical model. The findings show that foreign direct investment and labour force have a positive impact on economic growth though not statistically significant. While foreign direct investment volatility and trade openness have a negative impact on growth. The variables were statistically insignificant and had the expected signs except for trade openness. Post-estimation results explain that the choice of model was accurate. The Ramsey RESET test shows that the model was correctly specified. The Breusch-Godfrey test shows there is no serial correlation in the variables. The Durbin Watson test also indicates absence of serial correlation. There is no problem of heteroskedasticity as revealed by Breusch-Pagan test results.

### 5.2. Conclusion

This study has investigated the impact of foreign direct investment volatility on economic growth in Kenya over the period of 1970-2011, using endogenous growth model borrowed from Barro and Sala-i-Martin. (1995) and following Borensztein *et al* (1998), and the bounds approach to cointegration developed by Pesaran *et al.* (2001). A number of findings were presented in this study. Firstly, the econometric evidence suggested that the variables included in the underlying model are bound together in the long run. Secondly, results based on the long run and short run estimates showed that foreign direct investment and labour force (POP) have a positive and statistically insignificant effect on GDP growth rate. While, foreign direct investment volatility and trade openness had a negative and statistically insignificant effect on economic growth. Thirdly, the error correction estimates (short run) indicated that changes in foreign direct investment and labour force have a positive and statistically insignificant effect on the GDP growth rate while the other variables in the model appear to have an insignificant impact.

Therefore, this study contributes to literature by not only establishing the effects of foreign direct investment on economic growth, but also by incorporating the effects of foreign direct investment volatility on economic growth. Since foreign direct investment has a positive effect on growth but statistically insignificant. It confirms the findings of Lensink and Morrissey (2003), which they argued that foreign direct investment has a positive effect on growth, though it is weaker for developing countries. While foreign direct investment volatility has a negative effect on growth, though not significant.

### 5.3. Policy Implication and Recommendation

What are the policy implications of these results for Kenya? First the government will have to continue to attract FDI given its role in the growth process and the government should continue to promote private investments. Given the complementarity between private domestic investment and FDI, in terms of promoting growth, joint ventures should be encouraged. Foreign Direct Investment should be encouraged in sectors with potential competitive advantages and where

complementarity with domestic investments is likely to be high. Also, the government will have to promote effectively the development of technological and human capital capabilities in order to attract FDIs in higher-value added activities, as well as to ensure Kenya can assimilate these technologies effectively. Also FDI volatility may capture the growth retarding effects of the unobserved variables. As a result economies with high economic uncertainty tend to have variable economic growth rates and may not attract foreign investors. The uncertainty associated with FDI reduces the expected return on investment, therefore reduces growth.

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