IMPACT OF INFLATION VOLATILITY AND ECONOMIC GROWTH ON FOREIGN DIRECT INVESTMENT IN KENYA

BY

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DECLARATION

This research project is my original work and has not been presented for any other award in any other institution of learning

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APPROVAL
This research project has been submitted with my approval as the University Supervisor.

Supervisor

Signature ____________________________ Date ______________________

RACHEL SARGUTA
DEDICATION

I humbly dedicate this work to my family for their support that they accorded in the reign of my study
ACKNOWLEDGEMENT
I take this opportunity to first give thanks to Almighty God for His unfailing love and care
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ABSTRACT

Foreign Direct Investment (FDI) plays a very significant role in financial growth and development in Kenya. Economic growth and inflation are some of the factors assumed to have an influence on FDI in Kenya. The project therefore investigates the impact of the two factors on FDI. Data was obtained from the World Bank website for 1980-2012.

FDI is taken as the dependent variable whereas GDP and inflation are taken as independent variables. A linear regression analysis was used on the data to determine the relationship between inflation, GDP and FDI flows. The results suggest that there is no relationship between foreign direct investment and inflation, whereas there is a negative relationship exists between foreign direct investment and gross domestic product.
CHAPTER ONE: INTRODUCTION

1.1 Background Study
Foreign direct investment (FDI) is a direct investment into production or business in a country by an individual or company of another country, either by buying a company in the target country or by expanding operations of an existing business in that country or by mergers and acquisitions.

The 1980s witnessed increased flows of investment around the world. Total world outflows of capital in that decade grew at an average rate of almost 30%, more than three times the rate of world exports at the time, with further growth experienced in the 1990s. Despite the increased flow of investment, especially to developing countries, Sub-Saharan Africa still lags behind in attracting foreign direct investment. The uneven dispersion of foreign Direct Investment is a cause of concern since FDI is an important source of growth for developing countries. FDI brings not only increased access to foreign exchange, trade and employment, but also new products, information and technology.

Kenya is one of the economic leaders in Sub-Saharan Africa. It is dependent on Foreign Direct Investment for capital and employment. Kenya has invested heavily in key infrastructure like roads, energy, railway and port with the view of easing the investment environment. In September 2013, the value of foreign Direct Investments in Kenya was kshs.21.58 billion.

Kenya is a prime choice for foreign investors because of its excellent connectivity to major worldwide hubs. It also has an educated and skilled workforce, a strong infrastructure and is a member of regional trading blocs.
Given the objectives of the host countries to attract high-quality investments and to ensure benefits from such foreign activity, it is important to fully understand the factors influencing FDI inflows.

The primary of this project is on the role of inflation and economic growth among the factors that drive FDI. Inflation in Kenya increased by an average of 11.67% during the 1980s, followed by an increase of 13.93% on average between years 1990 and 1995. The trend of increasing inflation reversed in the late 1990s; the inflation on average decreased to 8.53% during the wake of the new millennium, a period during which the net FDI flows more than doubled.

Gross domestic product (GDP) is the market value of all final goods and services produced within a country in a given year. In Kenya, there was a constant GDP in the 1980s of about 4.54%. This rate declined sharply in the 1990s to an average of 2.1084%. Between years 2003-2007, there was an increase in the rate of up to 6.993%, a period during which the net FDI more than doubled.

It is therefore interesting to analyze whether the changes in inflation volatility and changes in GDP growth rates during the study period of years 1980-2012 might have contributed to changes in the net FDI to the Kenya economy.

1.2 STATEMENT OF THE PROBLEM
Inflation rate uncertainty and economic growth appear to be important factors investors take into consideration in their decision to invest in Kenya.

For years foreign investors have tried various screening mechanisms based on the country’s specific observable variables such as the inflation volatility of the country and economic growth.
It is therefore necessary to identify the relationship the FDI flows have with economic growth and inflation volatility.

1.3 OBJECTIVE
Determine whether GDP growth rates and inflation volatility have any relationship with the foreign direct investment, using regression analysis.

1.4 SIGNIFICANCE OF THE STUDY
- Investors
  The study is significant to current and potential investors who need to make decisions on whether to invest in Kenya.

- Academicians
  It is of importance to scholars who need information on FDI projects when doing research related to this study.
CHAPTER TWO: LITERATURE REVIEW
Faiza Saleem et. al (2013) investigated the impact on FDI due to growth and inflation of a country. The three variables used in the paper were FDI, gross domestic product and inflation. He used time series data regression to model the relationship. In this case, FDI was the response variable. In his conclusion, FDI is dependent on GDP rate and inflation rate in the economy of Pakistan. He concluded that FDI has direct relationship with inflation rate in that for every increase in inflation rate FDI will increase, and that there exist a negative relationship between GDP and FDI.

Ehimare(2011) studied the effect of inflation and exchange rate on foreign direct investment in Nigeria and its relationship with economic growth. A linear regression analysis was used to determine the relationship between inflation, exchange rate FDI inflows and economic growth. His conclusions were that inflation has no effect on FDI but foreign exchange does. The study also revealed that FDI was not a major contributor to economic growth.

Kiat (2007) did a study on the effect of inflation on foreign direct investment in South Africa. He used regression analysis on economic data collected from 30 countries, to determine the relationship between FDI inflows and inflation. The research found that inflation has a negative impact. The relationship is more significant in developed economies than those in the lesser developed economies, but this can be attributed to more volatile economic environment.
CHAPTER THREE: METHODOLOGY

3.1 Data transformation

A time series is defined by the values $X_1, X_2, \ldots, X_n$ of a variable $X$ at times $t_1, t_2, \ldots, t_n$ Thus $X$ is a function of $t$, denoted by $\{X(t)\}$

Our data is time dependent and therefore there is need to make it stationary so as to be able to carry out regression analysis

Our time series data is of the form

$$X_t = m_t + s_t + \varepsilon_t$$

Where,

- $m_t =$ trend component
- $s_t =$cyclic and the seasonal component
- $\varepsilon_t =$error component

We shall have to remove the trend component so that $X_t$ becomes stationary.

Trend is the long term sweep or general direction of movement in a time series.

When $X_t$ is stationary it is defined as an independent and identically distributed (iid) random variable with zero mean. Hence our observation will be completely independent of time.

Data transformation will be achieved through differencing the original data.
The backward difference operator is defined as,
\[
\nabla X_t = X_t - X_{t-1} = (1 - B)X_t
\]

Where B is the backward shift operator, that is,
\[
BX_t = X_{t-1}
\]

Powers of the operators B and \( \nabla \) are defined as
\[
B^j(X_t) = X_{t-j} \quad \text{and} \quad \nabla^j(X_t) = \nabla(\nabla^{j-1}(X_t)), \quad j \geq 1, \quad \text{with} \nabla^0(X_t) = X_t.
\]

If the operator \( \nabla \) is applied to a linear trend function,
\[
m_t = c_0 + c_t t
\]

Then we obtain the constant function,
\[
\nabla m_t = m_t - m_{t-1} = c_0 + c_t t - (c_0 + c_1(t-1)) = c_1.
\]

In the same way any polynomial trend of degree k can be reduced to a constant by application of the operator \( \nabla^k \). Hence ending up with a stationary process \( \nabla^k X_t \), k is the order of differencing.

3.2 ACF plot

The autocorrelation functions (ACF) plot is used to identify whether the residuals obtained after differencing are indeed stationary. If the ACF plots exhibit spikes that do not come down to zero with increasing lags then the data is not stationary.

The autocovariance function is given by
\[ \gamma_k = \text{cov}(X_t, X_{t+k}) \]
\[ = E[X_t - \mu_t][X_{t+k} - \mu_{t+k}] \]

Where \( \mu_t \) and \( \mu_{t+k} \) are the mean for \( X_t \) and \( X_{t+k} \) respectively.

The autocorrelation function is given by

\[ \rho_k = \frac{\gamma_k}{\gamma_0}, \text{ where } \gamma_0 = \text{cov}(X_t, X_t) = \text{var}(X_t) \]

The ACF plot (correlogram) is the plot of \( \rho_k \), \( k=0,1,2.. \) versus the lag

### 3.3 Regression Analysis

Regression analysis is a statistical tool for the investigation of relationship between variables.

Usually, the investigator seeks to ascertain the causal effect of one variable upon another. To explore such issues the investigator assembles data on the underlying variables of interest and employs regression to estimate the quantitative effect of the causal variables upon the variable that they influence.

The multivariate regression model is given by:

\[ y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_i x_i + \varepsilon \]

\( y \) = the response/ dependent variable

\( x_i \) = the \( i^{th} \) independent variable

\( \beta_0 \) = the intercept

\( \beta_i \) = The regression coefficients of the \( i^{th} \) independent variable

\( \varepsilon \) = the noise term
In this work

\( y \) represents the FDI, and \( \beta \)’s are the parameters to be estimated so that to identify the linear relationship between the explanatory variables and FDI.

I will use eight more explanatory variables other than economic growth and inflation volatility. This is because FDI is affected by a number of factors; Mahmut (2008). However our interest in this work is to study the effect of GDP and inflation on FDI. It is important to include the eight factors to ensure that the regression model has a good fit.

The eight factors include:

1. Exchange rate
2. Exchange rate volatility
3. Interest rate
4. Interest rate volatility
5. Annual trade balance
6. Season
7. Inflation rate
8. GDP rate

Once we have decided that the assumptions of stationarity are satisfied, we now try and obtain

\[ \hat{\beta}_0, \hat{\beta}_1, \hat{\beta}_2, \ldots, \hat{\beta}_i \]

such that the regression line

\[ \hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \hat{\beta}_2 x_2 + \ldots + \hat{\beta}_i x_i, \]

provides the best possible fit to the given data.
3.4 Method of Least Squares, $\varepsilon_i$

Consider a multiple linear regression model with $k$ predictor variables:

$$y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \ldots + \beta_kx_k + \varepsilon$$

The $k$ predictor variables $x_1, x_2, \ldots, x_k$, have $n$ levels. Therefore, $X_{ij}$ represents the $i^{th}$ level of the $j^{th}$ predictor variable $x_j$.

Observations, $y_1, y_2, \ldots, y_n$ recorded for these $n$ levels can be expressed in the following way:

$$
\begin{align*}
y_1 &= \beta_0 + \beta_1x_{i1} + \beta_2x_{i2} + \ldots + \beta_kx_{ik} + \varepsilon_i \\
y_2 &= \beta_0 + \beta_1x_{21} + \beta_2x_{22} + \ldots + \beta_kx_{2k} + \varepsilon_2 \\
    & \ldots \\
y_i &= \beta_0 + \beta_1x_{i1} + \beta_2x_{i2} + \ldots + \beta_kx_{ik} + \varepsilon_i \\
    & \ldots \\
y_n &= \beta_0 + \beta_1x_{n1} + \beta_2x_{n2} + \ldots + \beta_kx_{nk} + \varepsilon_n
\end{align*}
$$

The above can be represented in a matrix notation as follows:

$$y = X\beta + \varepsilon$$

Where

$$
\begin{align*}
y &= \begin{pmatrix}
y_1 \\
y_2 \\
\vdots \\
y_n
\end{pmatrix}, \quad X &= \begin{pmatrix}
1 & \cdots & x_{i1} \\
1 & \cdots & x_{i2} \\
\vdots & \ddots & \vdots \\
1 & \cdots & x_{nk}
\end{pmatrix}
\end{align*}
$$
The matrix $X$ is referred to as the design matrix. It contains the information about the levels of the predictor variables at which the observations are obtained. The vector $\beta$ contains all the regression coefficients. To obtain the regression model, $\beta$ should be known. $\beta$ is estimated using the least square methods. The following equation is used:

$$\hat{\beta} = (X'X)^{-1}X'y,$$

Knowing the estimates, $\hat{\beta}$, the multiple linear regression model can be estimated as:

$$\hat{y} = X\hat{\beta}.$$

The estimated regression model is also referred to as the **fitted model**.

The observations, $y$, maybe different from the fitted values $\hat{y}$ obtained from this model. The difference between these two values is the residual, $\varepsilon$

$$y - \hat{y} = \varepsilon$$
3.5 The Assumption of normality in the residuals

The least square estimates $b_0, b_1, \ldots, b_k$ are unbiased estimators provided that the residuals are normally and independently distributed. The Q-Q plot and histogram will be used to identify normality in the residuals.

3.6 Test of Hypothesis

The t-test is used to check the significance of individual regression coefficients in the multiple linear regression models.

The hypothesis statements to test the significance of a particular regression coefficient, $\beta_j$, are:

$H_0: \beta_j = 0$
$H_1: \beta_j \neq 0$

The test statistic for this test is based on the t-distribution. The test statistic used for this test is:

$$T_0 = \frac{\hat{\beta} - \beta}{s_\varepsilon(\beta)},$$

$s_\varepsilon(\beta)$ is the standard error of the least square estimate.

The value of $s_\varepsilon(\beta)$ is calculated as follows:

$$s_\varepsilon(\beta) = \sqrt{\frac{\sum_{i=1}^{n} \varepsilon_i^2}{\sum_{i=1}^{n} (x_i - \bar{x})^2}}$$
The test statistic, $T_0$, follows a $t$-distribution with $(n-2)$ degrees of freedom, where $n$ is the total number of observations. The null hypothesis, $H_0$, is accepted if the calculated value of the test statistic is such that:

$$-t_{\alpha/2,n-2} < T_0 < t_{\alpha/2,n-2},$$

where $-t_{\alpha/2,n-2}$ and $t_{\alpha/2,n-2}$ are the critical values of the two sided hypothesis.

3.7 The $R$-squared statistic

The $R^2$ statistic is defined as the coefficient of determination. We interpret $R^2$ to be the proportion of variability explained by the regression line. In one extreme case where the regression line fits the data perfectly, we have $R^2 = 1$. In other extreme case where the regression line provides no information about the response, we have $R^2 = 0$. The coefficient of determination is constrained by the inequalities $0 \leq R^2 \leq 1$, with larger values implying a better fit. (Frees 2010)
CHAPTER FOUR: DATA ANALYSIS

4.0 FDI data
The following are the time plots and ACF plots, respectively for the FDI data,

After the first differencing, the spikes in the ACF plot come down to zero. This proves that our FDI data attains stationarity after first differencing.

4.1 Inflation volatility data
The following are the time plots and ACF plots, for the inflation data
After the first differencing, the spikes in the ACF plot come down to zero. This proves that our inflation volatility data attains stationarity after first differencing.
4.2 GDP growth rate data
The following are the time plots and ACF plots, for the GDP growth rate data

The ACF plot portrays that there is no trend in the GDP data because most spikes do come down to zero very fast. This implies that the GDP data we have is independent of time component.
4.3 Residual Analysis
The response variable= FDI
Explanatory variables= inflation rate, Inflation volatility, GDP growth rate, GDP rate, foreign exchange rate, foreign exchange volatility, trade balance, interest rate, interest rate volatility and political seasons

| coefficients     | Estimate | Standard Error | t-value | Pr(>|t|) |
|------------------|----------|----------------|---------|----------|
| (Intercept)      | 1.28     | 2.785e-01      | 0.339   | 0.738    |
| Inflation rate   | -0.3     | 2.079e-02      | -1.111  | 0.27908  |
| FX rate          | -0.4     | 4.362e-02      | -0.672  | 0.50921  |
| GDP rate         | 0.74     | 6.854e-02      | 0.794   | 0.436    |
| Interest rate    | 0.09     | 5.826e-02      | 0.030   | 0.976    |
| Season           | -0.85    | 3.345e-01      | -0.695  | 0.49485  |
| Trade balance    | -0.006   | 2.839e-06      | -0.221  | 0.82755  |
| FX volatility    | 6.97     | 3.093          | 2.253   | 0.03508 *|
| Interest volatility | -5.61     | 6.54          | -0.858  | 0.40077  |
| Inflation volatility | 0.52     | 3.142e-02      | 1.246   | 0.22649  |
| GDP growth rate  | -0.19    | 1.268e-03      | -3.013  | 0.00663 **|

---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 1
Residual standard error: 0.7635 on 21 degrees of freedom
Multiple R-squared:  0.5576,    Adjusted R-squared:  0.3469
F-statistic: 2.646 on 10 and 21 DF,  p-value: 0.02892

The $R^2$ statistic is 0.5576 which indicates that the explanatory variables explain 55.76% of the variability in FDI.

The results show that for each unit increase in inflation volatility, FDI increases by 0.52 units and for each unit increase in economic growth, FDI decreases by 0.19 units.

The regression equation of the analysis is:

$$ FDI = 1.28 - 0.3I - 0.4f + 0.74G + 0.09i - 0.85s - 0.006T + 6.97 f_v - 5.6i_v + 0.52f_v - 0.19GG $$
Where,

\( I = \) Inflation rate
\( f = \) FX rate
\( G = \) GDP rate
\( i = \) Interest rate
\( s = \) Season
\( T = \) Trade balance
\( fv = \) FX volatility
\( iv = \) Interest volatility
\( Iv = \) Inflation volatility
\( GG = \) GDP growth rate
4.4 Checking Normality in Residuals

The residuals assume a normal distribution since the points are symmetrically distributed around the diagonal line.
4.5 Tests for Significance
We now test the significance of the numerical values of the least square estimates using the test statistics.

**Inflation**
$H_0 : \beta_9 = 0$: There is no significant effect of inflation on FDI

$H_1 : \beta_9 \neq 0$: There is a significant effect of inflation on FDI

Decision: **Accept** $H_0$ if $t_{0.05} > t_{\text{statistic}}$

Reject $H_0$ and accept $H_1$ if $t_{0.05} < t_{\text{statistic}}$

$t_{0.05,21} = 1.721$

$t_{\text{statistic}} = 1.246$

$1.721 > 1.246$

From this we accept $H_0$ that inflation had no significant effect on FDI during the period of analysis.

**GDP growth rate**
$H_0 : \beta_{10} = 0$: There is no significant effect of GDP growth rate on FDI

$H_1 : \beta_{10} \neq 0$: There is a significant effect of GDP growth rate on FDI

Decision: **Accept** $H_0$ if $t_{0.05} > t_{\text{statistic}}$

Reject $H_0$ and accept $H_1$ if $t_{0.05} < t_{\text{statistic}}$

$t_{0.05,21} = 1.721$
\[ t_{statistic} = -3.013 \text{ and } /t/ = 3.013 \]

1.721 < 3.013

From this we accept \( H_1 \). GDP growth rate had a major effect on FDI inflow during the period of analysis.

4.6 Conclusions

By using regression analysis, we conclude that GDP had major effect on the FDI inflows in Kenya during the period analysis and that it has a negative impact on FDI. However, though inflation had a positive impact on FDI, it was not statistically significant.
References