Analysis of the Determinants of Foreign Direct Investment in Rwanda (Period of 1970-2010): Econometric Approach

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Abstract:
Rwanda, as many developing countries, has tried to attract FDI by different ways. And the Foreign Direct Investment in Rwanda has been increasing during the past decade even though with slight variations so that it reached $42,332,000 in 2010. In fact, over the past 40 years, the value for this indicator has fluctuated between $118,671,700 in 2009 and $1,000 in 1994 (NISR, 2010; IMF, 2010). In an attempt to attract FDI, Rwanda has become one of the Africa´s countries with the highest degree of personal safety and lowest incidence of corruption. In this paper, we analyze the determinants of foreign direct investment in Rwanda. The results of the regression show that the inflation had a negative significant effect on FDI during the period of analysis (1970-2010). This is in accordance to a priori expectations that inflation has a negative effect on FDI which is depicted by the coefficient of LnCPI (-1.265). This coefficient implies that ten per cent (10%) increase in inflation led to 12.7 per cent decrease in inflow of FDI in Rwandan economy during the period of 1970-2010. This also has some reasons of being like it is. In fact, when the inflation is not stable and minimum, it constitutes an indicator of instability of the economy, fiscal and monetary policy that are not more competent, etc. It then increases the uncertainty in the eyes of foreign investors; and who are not eager to take risk, reduce their investment in the economy that seems instable.

Finally, the results of the regression show that foreign exchange rate had a positive and non-significant effect on FDI during the period of analysis (1970-2010). It is depicted by the coefficient of LnEXR (0.889) and is contrary to the hypothesized negative effect. However, this positivity of the effect of foreign exchange rate on FDI is not contradicting the theory, because as we saw in the literature, many studies on this matter reached conflicting results. What matters here is how one can try to explain the direction (whether positive or negative) of the effect of foreign exchange rate on FDI.

Keywords: *FDI, Rwanda*

1. General Introduction

1.1 Background of the Study

Foreign Direct Investment (FDI) consists of an investment involving a long term relationship and reflecting a lasting interest and control of a resident entity in one economy in an enterprise resident in an economy other than that of the foreign direct investor. An equity capital stake of 10 percent or more of the ordinary shares or voting power of an incorporated enterprise, or its equivalent for an unincorporated enterprise, is normally considered as a threshold for Foreign Direct Investment (UNCTAD, 2002). Foreign Direct Investment (FDI) is also an international flow of capital that provides a parent company or multinational

organization with control over foreign affiliates. Such an investment is important for the economic development of many economies, especially developing countries.

In most developing countries there is the dearth of capital for investment which has affected the economic situation of these nations. In order to ameliorate the situation, various governments of these nations have now focused much attention on investment especially foreign direct investment which will not only guarantee employment but will also impact positively on economic growth and development. Foreign Direct Investment is needed to reduce the difference between the desired gross domestic investment and domestic savings. It also brings new and more committed capital, introduces new technologies and management styles, helps create new jobs, and stimulates competition to bring down local prices and improve people's access to goods and services (Alex, 2011).

Foreign Direct Investment has played an effective role as a source of financing to a lot of developing countries. Data published by the United Nations showed a dramatic increase in FDI inflows to developing countries, jumping from US$ 24 billion in 1990 to US$ 178 billion in 2000 (UNCTAD, 2003). Although there was a decline to US$ 159 billion in 2002 (World Bank, 2003) it continued to remain a major and reliable source of investment funding for many of these countries. And by 2005, inflows of FDI around the world rose to $916 billion, with more than half of these flows received by businesses within developing countries. Foreign Direct Investment was US$ 1.24 trillion in 2010, and was estimated to 1.6 trillion in 2011. Developing and transition economies together attracted more than half of global FDI flows during this period (UNCTAD, 2006, 2011). In Rwanda, the FDI inflows were Rwf 203.9 billion in 2010 (BNR, 2011).

Although the impact of FDI on economic development is debatable, there are many empirical findings that support its positive contributions. Research by Mbekeani (1999) on the impact of FDI on domestic investment, exports and economic growth showed positive relationship in Mexico and Malaysia. Another research by Larrain, Luis and Andres (2001) showed positive effect of FDI generated by Intel in terms of net exports, investment, wages and benefits and local purchases for the Costa Rican economy. Thomsen (1999), in his study on the role of FDI in 69 developing countries, found that it not only stimulates economic growth but also has a larger impact than investments by domestic firms. Given the role attached to the Foreign Direct Investment, developing countries are thus competing to attract FDI into their economy. The problem is now not only how to attract FDI, but also how to maintain the existing one. Put differently, some factors should be in place in an economy so that foreign investors are attracted to invest there or they feel willing to maintain their existing investment within that economy.

It is in this context that Rwanda, as many developing countries, has tried to attract FDI by different ways. And the Foreign Direct Investment in Rwanda has been increasing during the past decade even though with slight variations so that it reached $42,332,000 in 2010. In fact, over the past 40 years, the value for this indicator has fluctuated between $118,671,700 in 2009 and $1,000 in 1994 (NISR, 2010; IMF, 2010). In an attempt to attract FDI, Rwanda has become one of the Africa´s countries with the highest degree of personal safety and lowest incidence of corruption. It has also started to rebuild its economy, and the Government is fully committed to building a peaceful, stable and prosperous nation through sustainable private sector led development. Much progress in reforming the investment climate has been achieved so far, even though much remains to be done (UNCTAD, 2006, BNR, 2011).

There are many factors that attract the movement of FDI throughout the world (Diaram et al. 2006, Linda S. Goldberg, 2007). These factors may differ significantly from one location to another depending on the attractiveness of the particular region or country.

The enormous growth coupled with huge differentials in FDI inflows to developing countries, particularly in the post 1990s period (Chakrabarti,2001), has produced an extensive body of empirical studies seeking to explain why some countries were more successful than others in attracting FDI (Moosa and Cardak, 2003). A preponderance of these studies analyzed the effect of macro-economic determinants, such as GDP, exchange rate policy, openness of the economy, etc on FDI inflows. The others have explored the impact of socio-political factors, such as political stability (country risk), corruption, political freedom, etc, on FDI inflows, (Dar et al. 2004). In the case of Rwanda, as elsewhere, these factors may contribute at one level or another to the FDI inflows.

1.2 Research Problem and research question

In many speeches of Rwandan authorities, business registration regulations, peace, anti-corruption measures, tax incentives on some investments are frequently highlighted as factors that attract mostly FDI into the country. However, the impact of such qualitative variables on FDI is not easy to investigate. Yet, you may even observe FDI flowing mostly to countries/regions where these variables are not effective. Recall again that such measures that are mostly highlighted are recent. Yet, when one goes back to the period before the Genocide of Tutsi in 1994 and some few years before 1994, he/she can see that FDI inflows were trending upward. For instance, FDI inflow was 60,000 USD, 3,000,000USD, 17,707,780USD and 21,047,060USD respectively in 1970, 1975, 1980 and 1988 (World Bank, 2011). Since 1989, FDI inflow began to decline from 15,508,620 USD to 1,000 USD in 1994. After 1994, FDI inflow started increasing from 2,212,202USD in 1995 to 8,319,041USD in 2000. Since then, FDI inflow fluctuated and reached 42,332,000USD in 2010, while it was 118,671,700USD in 2009.

Undoubtedly, many factors contributed to these FDI inflows since 1970-2010. Then there is need to find out which determinants, tested empirically, influenced the flow of FDI to Rwanda since 1970-2010. Or more specifically, the present study, by depicting some factors namely GDP growth, inflation and foreign exchange rate, asks the following question: how or to what extent do GDP growth, inflation and exchange rate contribute to the FDI inflows to Rwanda during the period of 1970-2010?

In fact, it has been observed that since that period, Foreign Direct Investment has been increasing, decreasing or stagnant (relatively) as far as Rwandan economy is concerned.

1.3 Research Objectives

The main objectives of this research are to examine and analyze the determinants of FDI in Rwandan economy, namely GDP growth, inflation and exchange rate for the period of 1970-2010. This study attempts to develop and test an empirical framework of the GDP growth, inflation and exchange rate as determinants of FDI in Rwandan economy.

This study aims also at uncovering the rate at which each factor considered (GDP growth, inflation and exchange rate) influences FDI inflow to Rwanda during the period of 1970-2010.

1.4 Hypotheses Development

Hypotheses are developed to examine the determinants of FDI in Rwandan economy. Except Tax incentives, registration formalities, peace and anti-corruption measures, infrastructural development, etc, which are qualitative in nature, some quantitative variables such as economic growth, inflation and exchange rate are expected to greatly influence FDI in Rwanda. In the line of the present study, we therefore formulate the following hypothesis:

H_1: The economic growth rates have direct effect on the inflows of FDI in Rwanda (Positive effect) during the period of 1970-2010. The corresponding null hypothesis (H0) is that there is no significant effect (the positive one) of economic growth rates on FDI inflows in Rwanda during the period of 1970-2010.

H_2: There is a negative effect of inflation on the inflows of FDI in Rwanda during the period of 1970-2010. Its corresponding null hypothesis (H0) is that the inflation has no significant effect (the negative one) on the inflows of FDI in Rwanda during the period of 1970-2010.

H_3: There is a negative effect of foreign exchange rate on inflows of FDI in Rwanda during the period of 1970-2010. Its corresponding null hypothesis (H0) is that foreign exchange rate has no significant effect (the negative one) on the inflows of FDI during the period of 1970-2010.

Proposed regression model

To test the hypothesis developed earlier, a multiple regression model will be employed. The regression model takes the following form:

$FDI = \beta_o + \beta_1 GDP + \beta_2 INFL + \beta_3 EXR + \varepsilon$

Where: FDI= is the dependent variable measured by the willingness of Foreign investors to invest in Rwanda.

GDP = is the independent variable measured in percentage increase of national output indicating whether Foreign investors agree or disagree whether the economic growth is an important factor influencing their investment decision. Economic growth is an important factor influencing positively FDI (Diaram et al. 2006). It measures the size of the home economy and it is included in order to control for the supply of FDI, as did Blonigen (1997). Thus, the expected sign is positive.

INFL= is the independent variable measured in percentage increase of consumer price indicating whether Foreign investors agree or disagree whether the inflation is an important factor influencing their investment decision. Inflation is an important factor influencing negatively FDI (Romer, 1990). Thus, the expected sign is negative.

EXR= is the independent variable measured in real exchange rate indicating whether Foreign investors agree or disagree whether the exchange rate is an important factor influencing their investment decision. It measures the worth of a domestic currency in terms of another currency. It is necessary to show how the strength of a nation's currency affects her inward FDI. Exchange rate is an important factor influencing negatively FDI (Linda S. Goldberg, 2007). Thus, the expected sign is negative.

ε = indicates the stochastic disturbance term.

1.5 Importance or significance of the Study

Rwanda needs FDI to complement domestic investment for the purpose of increasing its wealth in today's globalised world. FDI has enormous contribution to the economic development of many developing countries, Rwanda included. However, the scenario is fast changing, with many developing countries competing aggressively to attract FDI. Since the 1994, Rwanda has achieved remarkable political and social progress. It has become one of the Africa ´s countries with the highest degree of personal safety and lowest incidence of corruption. It has also started to rebuild its economy, and the Government is fully committed to building a peaceful, stable and prosperous nation through sustainable private sector led development. Much progress in reforming the investment climate has been achieved so far, even though more remains to be done. Three policy avenues to promote FDI and ensure that it contributes to achieving the national development goals have been put in place:

- Turn Rwanda into a centre of excellence in soft infrastructure and governance.
- Develop a skills attraction and dissemination programme.
- Put in place focused strategic initiatives (BNR, 2011).

The results of this research will be presented by the researcher as one of the requirements for the fulfillment of the Masters in Economics. They help the researcher to examine and analyze deeply the concept of FDI and some of its determinants such as GDP growth, inflation rate and exchange rate in the context of Rwandan economy.

The results of this research will also be useful to the decision makers so as to formulate relevant policy capable of attracting more FDI into Rwanda, by considering the factors analyzed such as GDP, inflation and exchange rate. Finally, the results of the present research will be helpful to the future researchers interested in FDI, especially in case of Rwanda.

1.6 Scope of the study

This research intends to cover the period of 1970-2010. This period is judged relevant when the researcher considers the time and financial means at his disposal. The requirement of the approach (Econometric Approach) to use and the availability of data are also taken into account.

Variables that are to be included in the model are FDI (dependent variable), GDP growth, inflation and exchange rate (independent variables).These variables have been chosen because they are quantitative in nature, and data on them are easily found. In addition, the impact of these independent variables (GDP growth, inflation and exchange rate) on dependent variable (FDI) can easily be estimated and tested empirically.

1.7 Methodological approach

The methodology of this study is especially based on econometric analysis. In this regard, we talked about specification of the model, where regression model showing the relationship between variables under study has been constructed.

We discussed about data processing and estimation, and finally a summary of estimation of the results is given. More details are given in chapter three.

This research comprises, besides this introduction, Literature Review, Research Methodology, Results discussion and interpretation, to finally conclude and give recommendations.

2. Literature Review

Traditionally, Foreign Direct Investment was a phenomenon that primarily concerned highly developed economies. In recent years, however, the increase in Foreign Direct Investment flows to developing countries turned out to be higher than the increase in Foreign Direct Investment flows to developed countries. Average annual Foreign Direct Investment flows to developing soared eight-fold, when comparing 1982-1987 and 1994-1999. As a result, developing countries attracted almost one-third of world-wide Foreign Direct Investment flows recently (Peter,2002).

Moreover, in relative terms, Foreign Direct investment plays a more important role in developing countries than in developed countries. In the former, Foreign Direct Investment inflows in 1994-1998 represented an average share of almost 10 percent of gross fixed capital formation, compared to 6 percent in developed countries (UNCTAD, 1999).

Various groups of developing countries participated to a strikingly different degree in the Foreign Direct Investment boom. South, East and South-east Asia emerged as the most important host region among developing countries. This group absorbed about half of Foreign Direct Investment flows to all developing countries in the 1990s and left Latin America considerably behind in terms of attractiveness to Foreign Direct Investment. Nevertheless, Latin America became an important host region of Foreign Direct Investment flows, when the average annual Foreign Direct Investment flows to this region more than quadrupled, when comparing 1988-1993 and 1994-1999.

Table1. Regional distribution of Foreign Direct Investment flows to developing countries, 1982-1999 (in percentage)

Period	Africa	LA	SEAs	WAs	CEE	others	ADgC
1982-1987	10	37	32	20	0	1	25.5
1988-1993	7	26	54	4	7	2	24.6
1994-1999	3.8	33.5	49.2	2.2	9.1	2.1	31.1

Source: UNCTAD, 1999

With LA: Latin America; SEAs: South, East and Southeast Asia ; WAs: West Asia ; CEE: Central and Eastern Europe and ADgC: All Developing Countries

For the three periods of the table above, the average of Foreign Direct Investment flows to developing countries is 27.1%. The highest level Foreign Direct Investment flow to developing countries reached is 31.1% (for the period 1994-1999). On average, Foreign Direct Investment was flowing mostly to SEAs and Latin America. It was declining in Africa and West Asia, while increasing in CEE.

A survey of Foreign Direct Investment in G-15 countries (UNCTAD, 2010) has shown FDI inflows for five years from 2004-2008. In terms of inflows, the top 10 recipients of Foreign Direct Investment are Brazil, Mexico, India, Nigeria, Chile, Egypt, Malaysia, Argentina, Indonesia and Iran respectively (See UNCTAD, 2009 for details).

Foreign Direct Investment has become a more important part of the economic picture of Developing countries and Developing countries find it desirable to attract Foreign Direct Investment. For this to happen, Developing countries can attract Foreign Direct Investment by controlling certain economic and political variables, thus making their country a more attractive investment than other countries. Although Developing countries are market-takers, reacting to global trends, they also can create and provide a suitable environment for growth by making intelligent decisions related to economic policy. In short, market trends and the well being of industrialized countries push capital to Developing countries, but Developing countries can also create an environment that attracts (pulls) investment, for example by publicizing their worthiness of investment (Calvo, 1993; Fernandez-Arias, 1994).

Developing countries cannot alter global trends or the economic welfare of the industrialized nations (or the push factors). They can then only focus on strengthening certain sectors or aspects of their own economy (concentrating on pull factors).

There are numerous pull factors that can influence inflows of FDI to Developing countries. Because FDI is a long term, often-costly investment for a multinational corporation, the multinational firm usually considers numerous economic and state-specific criteria when weighing investment options. Thus, past and present economic stability, current economic welfare, current economic capacity, level of human capital, wages, and technological capacity are the factors that play a large role in the in the multinational corporation's decision to invest in.

Along with the current state of the economy, the past economic stability of a nation is obviously an important factor. Foreign investors will have more confidence that a nation that has done well in the past will also be likely to do well in the future. This adaptive expectations model of FDI simply states that if an economy has done well in the past, then the investors should have more confidence that it will have economic success in the future as well.

In addition to macroeconomic stability, the consistency of exchange rates is also important. The foreign investment of a multinational corporation many times is issued to supplement the firm in the host country. As a result, consistent exchange rates are necessary for a multinational corporation to repatriate fractions of its FDI profit to the home country. As a result, predictable exchange rates are a plus for the investing multinational corporation.

The human capital of a Developing country constitutes another important factor for a multinational corporation when considering investing in a Developing country. Obviously, when investing for long term in another country, a multinational corporation will most likely have to utilize the labor in the host country. As a result, the multinational corporation seeks a large, efficient, educated population to harbor its investment. In turn, the more educated a population is, the more likely its state will attract FDI.

Another factor that is important is the market size. Regarding the history of FDI in developing countries, various empirical studies have shown that the size and growth of host country markets were among the most important FDI determinants. Traditionally, FDI was the only reasonable means to penetrate local market in various developing countries. For instance, exporting to Latin America was no promising alternative to investing there as local industries were heavily protected (Nunnenkamp, 1997). FDI was used to circumvent import barriers. However the situation has changed considerably when many countries have liberalized their import regime, thereby enabling multinational corporations to choose between exporting or undertaking FDI. As a consequence, purely market-seeking FDI may decline (UNCTAD, 1996). It should be taken into account that the possible decline of market-seeking FDI is largely restricted to FDI in manufacturing industries. On the other hand, market-seeking FDI received a major push by opening of services industries to FDI. The bulk of FDI in services, which accounts for a rising share in overall FDI, is market-seeking almost by definition, as most services are not tradable in the sense of cross-border transactions. Arguably, the decline of the market-seeking FDI in manufacturing may also be counteracted by regional integration. Policy-makers over the world consider regional integration to be instrumental in inducing FDI. The basic argument underlying this hope is that regional integration increases market size and enhances economic growth (IDB and IRELA, 1996; UNCTAD, 2000).

Briefly, the determinants of FDI include many factors such as infrastructural facilities, favorable fiscal, political, trade and exchange rate policies. The degree of openness of the domestic economy, tariff policy, credit provision by a country's banking system, the economy's growth potentials, market size and macroeconomic stability (Alex, 2011). Other factors like higher profit from investment, low labor and production cost, political stability, enduring investment climate, functional infrastructure facilities and favorable regulatory environment also help to attract and retain FDI in the host country (Ekpo, 1995).

For this research will not deal with all the factors, the only determinants we are interested in are economic growth rate, inflation and exchange rate.

As far as the effect of economic growth of FDI is concerned, the inflow of Foreign Direct Investment could potentially react to the vitality of the domestic economy. Bell and Pavitt (1993) observe that Foreign Direct Investment has generally been a consequence of growth in domestic investment and rapid industrialization in developing countries. Empirical evidence indicates that foreign firms increase investment in response to the expansion of sales associated with the rise in GDP. Bandera and White (1968) found a statistically significant correlation between US FDI and the European income, and conclude that a motive to invest abroad can be summarized as a desire to penetrate a growing market defined in terms of the level and the growth of income in the host countries.

Studying the relationship between FDI and economic growth in Malaysia, Karimi (2009) wrote that apart from policy factors, it is generally believed that sound macroeconomic management, sustained economic growth, and the presence of a well functioning financial system have made Malaysia an attractive prospect for FDI as published by the Ministry of Finance of the country in 2001.

Choe (2003) detecting two-way causation between FDI and growth, found the effects being more apparent from growth to FDI. This has been done using data on 80 countries for the period 1971-1995. Chowdhury and Mavrotas (2005) examined the causal relationship between FDI and economic growth for three developing countries, namely Chile, Malaysia and Thailand. They found that it is GDP that causes FDI in the case of Chile and not vice versa, while for both Malaysia and Thailand, there is a strong evidence of a bi-directional causality between the two variables.

However, Duasa (2007) examined the causality between FDI and output growth in Malaysia, the study found no strong evidence of causal relationship between FDI and economic growth. This indicates that, in the case of Malaysia, FDI does not cause economic growth, vice versa. But FDI does contribute to stability of growth as growth contributes to stability of FDI.

Many studies on the FDI and economic growth causal relationship (Borensztein, De Gregorio and Lee, 1998; De Mello, 1999, etc.) as well as the economic growth and FDI causality (Billet, 1991; Horisaka, 1993; Bajorubio and Sosvilla-Rivero, 1994; Elbadawi and Mwenga, 1997; Chowdhury and Mavrotas, 2003, Osinubi, 2009, etc.) found that large economies with rapid economic growth provide multinational corporations with opportunities to generate greater profits which, then, becomes an inducement to FDI inflow. Similarly, it could be suggested that small economies with weak growth rates are unable to attract significant amounts of FDI. Or put differently, small states with strong economic growth would be able to attract larger inflows of FDI.

All the above discussions about the economic growth and FDI show that results on bilateral causality are mixed. This indicates that the relationship between economic growth and FDI is not straightforward. It varies across countries and time periods. In the present study, the aim is to test whether the economic growth determines or not FDI in Rwandan economy. Though, having a look on the other direction would be also necessary, it is not the concern of the present study .

From the discussion above, assuming that the economic growth determines FDI, the relationship would be positive.

This relationship between economic growth and FDI is also confirmed by Jason (Ibid) when studying the determinants of FDI in developing countries. In fact, he said that if a country has consistently shown the propensity for growth, then it should attract high levels of FDI. However, if the past growth of a developing country has been sluggish, it is likely that the future growth will be the same. As a result, the expected relationship between average past economic growth and FDI should be positive.

2.1 Macro-economic environment of Rwanda

This section deals with a brief view of the macro-economic environment of Rwanda recently, especially the aspects related to the present work.

According to National Bank of Rwanda (2011), Rwanda is very proactive and forward looking country and has a vision to a middle income economy, services and knowledge based economy by 2020. Rwanda has a steady GDP growth rate 8.6% average year-on-year from 2005-2011, third year GDP growth rate highest

among major African economies and neighboring countires. The country is characterized by a stable inflation and exchange rate, friendly business climate and qualified as high reformer by World Bank Doing Business rankings 2010.

Rwanda's growth emanated mainly from the recovery of industry and services sectors which recorded respectively an increase of 8.4% and 9.6% of the value added in 2010. Agriculture sector also grew by 4.9%. GDP per capita in nominal terms registered an increase of 3.9%, from USD 519 in 2009 to 540 in 2010 (BNR, Annual Report, 2011) In 2010, Services maintained its first position in the structure of GDP with 46.7% of GDP at constant prices of 2006, followed by Agriculture sector that accounted 32.2% and the industry sector that took 15.0% of GDP.

In 2010, due to better performance in food production, a decline in import prices, and stable Rwandan Franc (RWF) against US dollar (USD), Rwanda has continued to experience low inflation, a sustained trend observed since the third quarter 2009. Annual headline inflation stood at 0.2% in December 2012 from 5.7% in December 2009. The annual average inflation was 2.3% in December 2010 after 10.3% in December 2009. The underlying inflation which excludes fresh foods and energy from the overall consumer price index, on annual average was 5% in December 2010 against 8.5% in December 2009.

The Government's overall macro-economic strategy continued to concentrate on reinforcing economic growth by stimulating domestic sources of growth, promoting higher productivity and helping to stabilize the economy.

It is in this Rwanda economic environment that investment in general and Foreign Direct Investment is evolving.

2.2 Foreign Direct Investment in Rwanda

In 2010, Foreign Direct Investment inflows were RWF 203.9 million, dominated by loans from shareholders in resident enterprises. This contributed 66.4 percent and equity capital accounted for 52.4 percent, and negative retained earnings (loss) of 18.7 percent.

Concerning the distribution of FDI among sectors, in 2010, ICT was the largest sector in attracting 46.3 percent of foreign investment. It was followed by Mining with 18.1 percent, wholesale and retail trade with 12.4 percent and manufacturing with 8.2 percent. Finance and insurance ranked second for 2008-2009, dropped to fifth position in 2010.

Once we have finished going through the literature review about the Foreign Direct Investment, the next chapter deals with the methodology of collecting data, processing them, analyzing them to come up with the results of the study.

3. Research Methodology

3.1 Introduction

This chapter describes the methodology that has been used in this research. Time series data are used for this research. An econometric model is developed to analyze how economic growth, inflation rate and exchange rate determine Foreign Direct Investment in Rwanda since 1970 to 2010. This means that the variables to be used include Foreign Direct Investment (FDI) as a dependent variable, gross domestic product (economic growth), inflation and exchange rate as independent variables. Model is developed to analyze gross domestic product (economic growth), inflation and exchange rate as determinants of Foreign Direct Investment.

3.2 Model specification

This study is based on the assumption that gross domestic product (economic growth), inflation and exchange rate determine Foreign Direct Investment in Rwanda. Hence the model:

$$FDI = f(GDP, INFL, EXR)$$

Where:
FDI= inflow of Foreign Direct Investment
GDP= Gross Domestic Product (economic growth)
INFL. = Inflation rate or Consumer price index
EXR. = Exchange rate
The equation above shows that FDI is dependent on GDP (economic growth), INFL. (inflation) and EXR. (exchange rate).
The theoretical statistical form of the model is thus:

$$FDI_t = \beta_0 + \beta_1 GDP_t + \beta_2 \beta INFL_t + \beta_3 EXR_t + \varepsilon_t$$

Where:
β_0 = the intercept for the equation above
β_1 = the parameter estimate of GDP (economic growth)
β_2= the parameter estimate of INFL. (inflation)
β_3 = the parameter estimate of EXR. (exchange rate)
ε_t= residual term

However, because the effects of the independent variables (GDP, INFL, and EXR) of the model above on the dependent variable (FDI) are expressed in terms of percentages (constant elasticities), the model is transformed into log-linear model to correctly describe the relationship between FDI, Gross Domestic Product (GDP), inflation (INFL) and Real exchange rate (EXR).

Then these constant elasticities of FDI with respect to Gross Domestic Product (GDP), inflation (INFL) and foreign exchange rate (EXR) are given by β_1, β_2 and β_3 respectively. Hence, the log-linear model used is

$\mathrm{LnFDI_t} = \beta_0 + \beta_1 \mathrm{LnGDP_t} + \beta_2 \mathrm{LnINFL_t} + \beta_3 \mathrm{LnEXR_t} + \varepsilon_t$,where Ln is natural logarithm.

As the literature review has suggested, there is a positive relationship between GDP (economic growth) and inflow of FDI, other things being equal. Hence, the sign of β_1, once estimated is expected to be positive (+). The literature review suggested also that inflation (INFL) and exchange rate (EXR) affect negatively the inflow of FDI. That is why β_2 and β_3 are expected to have negative signs (-), once estimated.

3.3 Estimation procedure

The ordinary least squares (OLS) equation technique is the estimation procedure used for this research. As a justification for this method is the simplicity of its computational procedure in conjunction with optimal properties of the estimates obtained and these properties are linearity, unbiased and minimum variance among a class of unbiased estimators.

3.4 Technique to adopt in the data analysis

To analyze the data, the econometric method is the approach employed for the research. Undoubtedly, the method will facilitate the model specification, parameter estimation and appropriate econometric tests. By doing this, we have to remember that we are dealing with time series data. We need to draw meaningful inferences. This necessitates that our time series be stationary.

3.5 Stationarity and stationary tests

Stationarity of a data series, as said above, is a prerequisite for drawing meaningful inferences in a time series analysis. In fact, the regression of a non-stationary time series on another non-stationary time series may produce a spurious regression. Generally, a data series is called stationary series if its mean and variance are constant over a given period of time and the covariance between the two time periods does not depend on the actual time at which it is computed but it depends only on lag amid the two time periods. The correlation between a series and its lagged values are assumed to depend only on the length of the lag and not when the series started. This property is known as stationarity and any series obeying this is called a stationary time series.

To test the stationarity of a series, unit root tests have been applied. The stationarity of the time series has been verified by using graph and also by applying Augmented Dickey Fuller (ADF) test.

3.5.1 The use of a graph

The graph of a series, once plotted, shows whether the series is stationary or not. This is done by considering the fluctuations of the graph.

3.5.2 Augmented Dickey Fuller (ADF) Test

Our research makes use of Augmented Dickey-Fuller (ADF) test which is a modified version of Dickey Fuller (DF) test. ADF test is superior to DF test as it makes a parametric correction in the original DF test for higher-order correlation by assuming that the series follows an AR (p) process. The approach of ADF test takes care of higher-order correlation by adding lagged difference terms of the dependent variable to the right-hand side of the regression. The specification of Augmented Dickey-Fuller test used in the study is given below:

$$\Delta Y_t = \beta_0 + \beta_1 t + \lambda Y_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta Y_{t-i} + \upsilon_t$$

Where $\Delta Y_t = Y_t - Y_{t-1}$ and i=2, 3…p; while β_0, β_1 and λ are the parameters to be estimated, t is the trend and υ_t is white noise error term such that each υ_t is identically, independently and normally distributed with a zero mean and constant-finite variance.

Y represents each variable for which the unit root test is conducted namely FDI, GDP, INFL and EXR in the present research.

The hypotheses to be tested by ADF are the following:

Null hypothesis, H_0: $\lambda=0$ that a series, say Y_t, has a unit root. That is a series is non-stationary.

Alternative hypothesis, H_1: $\lambda\neq0$ that a series has not a unit roots. That is, a series is stationary.

The above hypotheses show that testing the presence of a unit root is testing the statistical significance of the coefficient of Y_{t-1}, which is λ.

The decision rule is the following:

If the value of the ADF statistic is less than the critical value at the conventional significance level, let say five per cent significant level (5%), then the series Y_t is stationary and vice versa. We reject H_0, and conclude that the series is stationary. Otherwise, we fail to reject H_0, and say that the series in non-stationary.

Equivalently, the hypothesis testing may be done by only comparing the probability value to 5%.

If the probability value is greater than 5%, then the hypothesis of unit root (H_0) is accepted. That is the series Y_t is non-stationary. Otherwise, the hypothesis of the stationarity of the series (H_1) is accepted.

Once the stationary tests are carried out they lead us to the cointegration tests.

3.6 Cointegration tests

According to Gujarati (2004), "the concept of cointegration was first introduced by Granger (1981) and elaborated further by Engle and Granger (1987)." Engle and Granger cointegration (long-run relationship) test requires that:

- Time series, say Y_t and X_t, are non-stationary in levels but stationary in first differences, that is $Y_t \sim I(1)$ and $X_t \sim I(1)$
- There exists a linear combination between these two series that is stationary at level, that is $v_{it} = (Y_t - \hat{\alpha} - \hat{\beta} X_t) \sim I(0)$

Thus, the first step for the cointegration testing is to determine the degree of integration of the variables included in the model. If all the series are stationary, let say at first difference, they are I(1). Then we can move to the second step of checking the cointegration. This step involves applying two-step residual test of Engle and Granger. In the first step we apply OLS to the regression equation in which all variables are found to be integrated of the same order, for example I(1). The second step involves testing whether the residual term from the cointegrating equation is stationary, that is $u_t \sim I(0)$. If it is found to be stationary, this leads to the conclusion that long-run cointegration holds between the series.

3.7 Error Correction Model (ECM)

The theory of a cointegration arises out of the need to integrate short-run dynamics with long-run equilibrium. In cases where the data exhibit the presence of unit roots, short-run dynamic properties of the model can only be captured in an error correction model when the existence of cointegration has been demonstrated.

If time series are I(1), then one could run regression in their first differences. However, by taking first differences, we lose the long-run relationship of the data we are analyzing. This implies that one needs to use variables in levels as well. Given that the series are found to be cointegrated, there must exist then an associated Error Correction Mechanism (ECM), according to Engle and Granger (1987). An advantage of an Error Correction Model is that it incorporates variables both in their levels and first differences. By doing this, Error Correction Model captures the short-run disequilibrium situations as well as the long-run equilibrium adjustments between variables.

The Error Correction Model used in this research is described as follows:

$$D(LnFDI_t) = \beta_0 + \beta_1 D(LnGDP_t) + \beta_2 D(LnINFL_t) + \beta_3 (LnEXR_t) + \beta_4 e_{t-1} + \varepsilon_t$$

D: is the first difference operator defined as $D(X_t) = X_t - X_{t-1}$

Where ε is the error term, and β_4, the coefficient of the residuals (e) that must be negative and less than one unit, is the feedback effect or adjustment effect that shows how much of the disequilibrium is being corrected, that is the adjustment rates of FDI (dependent variable) to return to the long-run equilibrium after a change in any independent variable (GDP, INFL or EXR) that is expected to influence FDI. In fact, β_4 measures the speed at which prior deviations from equilibrium (as a result of shocks) are corrected after a shock. Using the ECM, the estimates of the parameters are generally consistent and efficient (Henry and Richard, 1983). As such the model is estimated under different assumptions of the error term.

The above ECM equation that $D(LnFDI_t)$ is explained by the lagged e_{t-1} and D(LnGDP), D(LnCPI) and D(LnEXR). Here, e_{t-1} is thought of as an equilibrium error (or disequilibrium term) occurred in the previous period.

This ECM necessitates that we first estimate the long-run relationship between variables using OLS.

During this research, other tests like T-test, R^2 (coefficient of determination) and F-test have been taken into account when the long rung regression equation has been done.

3.8 Sources of data for the study

For the present study, annual time series data on the variables under study covering forty-one year period 1970-2010 are used in this study for estimation of the model. Foreign Direct Investment is the dependent (explained) variable, while economic growth (GDP), inflation (INFL) and exchange rate (EXR) are independent (explanatory) variables.

Data were collected from various sources: International Monetary Fund and World Bank's websites, NBR's reports, NISR's publications.

4. Data Analysis and Interpretation of the Results

4.1 Tests of stationarity

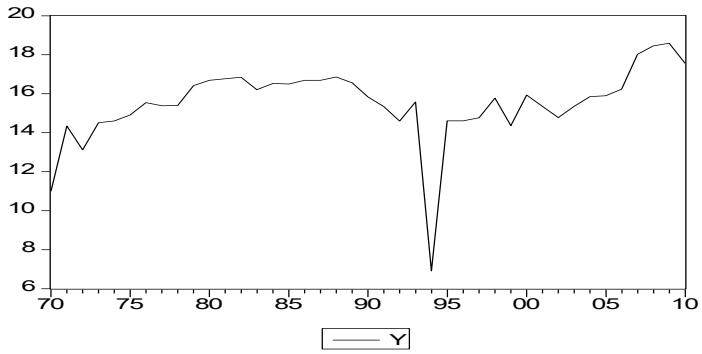
These stationarity tests include informal test (made by using a graph) and formal test that is done by using ADF test. To conduct such tests, we begin by testing the sationarity of variables in level (different options are available, but only test in level with intercept and trend is done).

4.1.1 Tests of stationarity of series in level

The use of a graph (informal test) and ADF Unit Root Test are done for each series. Here LnFDI is represented by Y, LnGDP by X1, LnCPI by X2 and LnEXR by X3 (this is done by generating series in Eviews for simplicity purpose). The level of significance considered is 5% throughout the whole work.

a) Tests of stationarity of LnFDI in level (with intercept and trend)

Figure1. Graph of LnFDI



Source: Drawn by the Researcher using Eviews 3.1

This graph of LnFDI looks like trending upward. This shows that the series is non-stationary in level.

Table2. Augmented Dickey-Fuller Unit Root Test on LnFDI

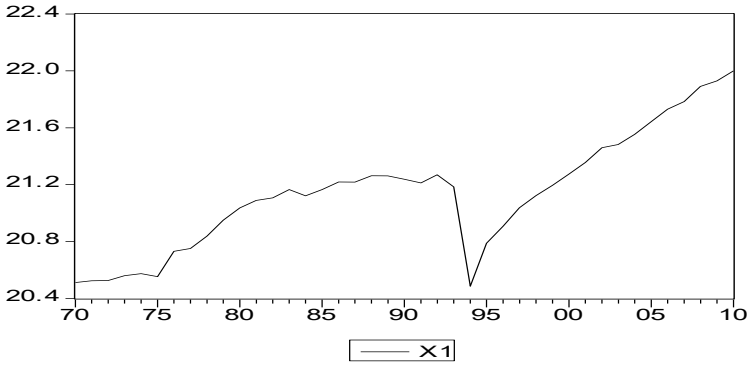
ADF Test Statistic	**-2.370858**	1% Critical Value*	-4.2092
		5% Critical Value	**-3.5279**
		10% Critical Value	-3.1949
*MacKinnon critical values for rejection of hypothesis of a unit root.			

Source: Researcher's calculation using Eviews 3.1

Since **-2.370858>-3.5279,** the Null hypothesis (H_0) is accepted that LnFDI is non-stationary in level.These two tests (informal, and ADF Unit Root test) lead to the same result of non-stationarity of the series LnFDI in level.

b) Tests of stationarity of LnGDP in level (with intercept and trend)

Figure2. Graph of LnGDP



Source: Drawn by the Researcher using Eviews 3.1

This graph of LnGDP is trending upward. This shows that the series is non-stationary in level.

Table3. Augmented Dickey-Fuller Unit Root Test on LnGDP

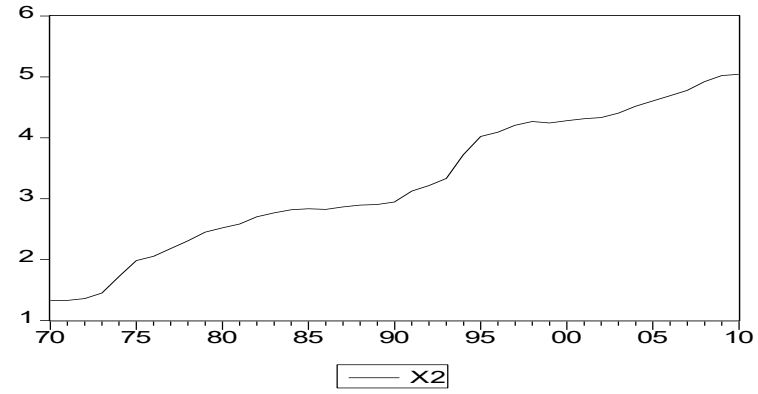
ADF Test Statistic	**-1.618198**	1% Critical Value*	-4.2092
		5% Critical Value	**-3.5279**
		10% Critical Value	-3.1949
*MacKinnon critical values for rejection of hypothesis of a unit root.			

Source: Researcher's calculation using Eviews 3.1

Since **-1.618198>-3.5279,** the Null hypothesis (H_0) is accepted that LnGDP is non-stationary in level. These two tests, informal and ADF Unit Root test, lead to the same result of non-stationarity of the series LnGDP in level.

c) Tests of stationarity of LnCPI in level (with intercept and trend)

Figure3. Graph of LnCPI



Source: Drawn by the Researcher using Eviews 3.1

This graph of LnCPI is trending upward. This shows that the series is non-stationary in level.

Table4. Augmented Dickey-Fuller Unit Root Test on LnCPI

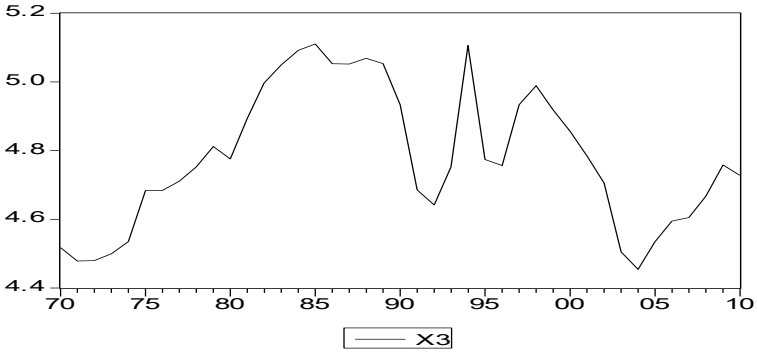
ADF Test Statistic	**-3.098043**	1% Critical Value*	-4.2092
		5% Critical Value	**-3.5279**
		10% Critical Value	-3.1949
*MacKinnon critical values for rejection of hypothesis of a unit root.			

Source: Researcher's calculation using Eviews 3.1

Since **-3.098043>-3.5279,** the Null hypothesis (H_0) is accepted that LnGDP is non-stationary in level. These two tests, informal and ADF Unit Root test, lead to the same result of non-stationarity of the series LnGDP in level.

d) Tests of stationarity of LnEXR in level (with intercept and trend)

Figure4. Graph of LnEXR



Source: Drawn by the Researcher using Eviews 3.1

The graph above of LnEXR is more fluctuating, making it difficult to visualize the trend. However, the series is non-stationary at level.

Table5. Augmented Dickey-Fuller Unit Root Test on LnEXR

ADF Test Statistic	**-2.363338**	1% Critical Value*	-4.2092
		5% Critical Value	**-3.5279**
		10% Critical Value	-3.1949
*MacKinnon critical values for rejection of hypothesis of a unit root.			

Source: Researcher's calculation using Eviews 3.1

Since **-2.363338>-3.5279,** the Null hypothesis (H_0) is accepted that LnGDP is non-stationary in level. These two tests, informal and ADF Unit Root test, lead to the same result of non-stationarity of the series LnGDP in level.

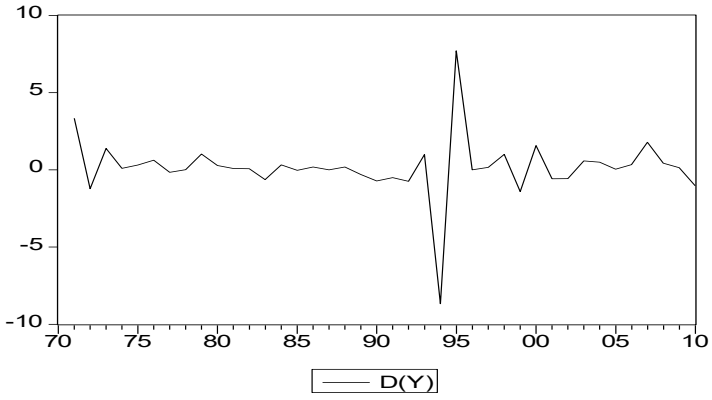
Given that all the series are found non-stationary in level, it is necessary to test the stationarity in first difference.

4.2.2 Tests of stationarity of series in first difference

The two tests that have been used in testing the stationarity of series in level are also used to test the stationarity in difference. This is also done for each series to include in the model.

a) Tests of stationarity of D(LnFDI) (with intercept and trend)

Figure5. Graph of D(LnFDI)



Source: Drawn by the Researcher using Eviews 3.1

The figure above shows that D(LnFDI) fluctuations are stable. It fluctuates around zero. Then D(LnFDI) is stationary.

Table6. Augmented Dickey-Fuller Unit Root Test on D(LnFDI)

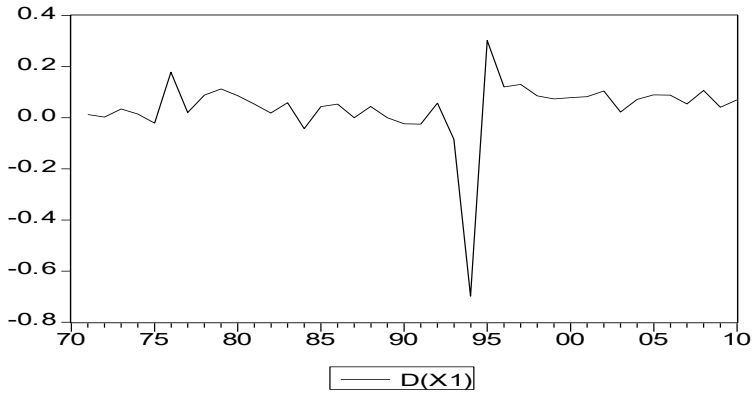
ADF Test Statistic	**-9.677244**	1% Critical Value*	-4.2242
		5% Critical Value	**-3.5348**
		10% Critical Value	-3.1988
*MacKinnon critical values for rejection of hypothesis of a unit root.			

Source: Researcher's calculation using Eviews 3.1

Since **-9.677244<-3.5348**, D(LnFDI) is stationary. Based on both tests, we conclude that the series LnFDI is integrated of order one [LnFDI~I(1)].

b) Tests of stationarity of D(LnGDP) (with intercept and trend)

Figure6. Graph of D(LnGDP)



Source: Drawn by the Researcher using Eviews 3.1

The figure above shows that D(LnGDP) fluctuations are stable. It fluctuates around zero. Then D(LnGDP) is stationary.

Table7. Augmented Dickey-Fuller Unit Root Test on D(LnGDP)

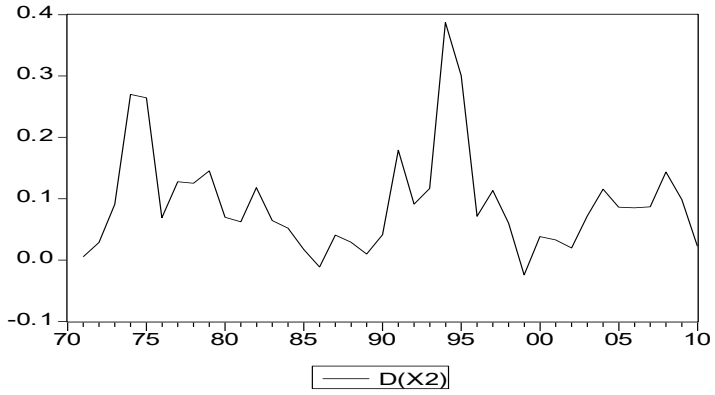
ADF Test Statistic	**-7.619559**	1% Critical Value*	-4.2242
		5% Critical Value	**-3.5348**
		10% Critical Value	-3.1988
*MacKinnon critical values for rejection of hypothesis of a unit root.			

Source: Researcher's calculation using Eviews 3.1

Since **-7.619559<-3.5348**, D(LnGDP) is stationary. Based on both tests, we conclude that the series LnGDP is integrated of order one [LnGDP~I(1)].

c) Tests of stationarity of D(LnCPI) (with intercept and trend)

Figure7. Graph of D(LnCPI)



Source: Drawn by the Researcher using Eviews 3.1

The figure above shows a slight stability in the fluctuations of D(LnCPI). Then, it is quite difficult to conclude whether D(LnCPI) is stationary or not by only considering the graph.

Table8. Augmented Dickey-Fuller Unit Root Test on D(LnCPI)

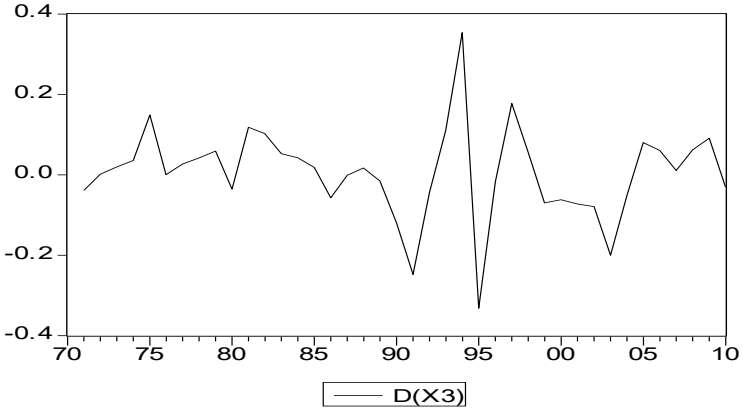
ADF Test Statistic	**-7.039066**	1% Critical Value*	-4.2242
		5% Critical Value	**-3.5348**
		10% Critical Value	-3.1988
*MacKinnon critical values for rejection of hypothesis of a unit root.			

Source: Researcher's calculation using Eviews 3.1

Since **-7.039066<-3.5348**, D(LnCPI) is stationary. Based on ADF test, we conclude that the series LnCPI is integrated of order one [LnCPI~I(1)].

d) Tests of stationarity of D(LnEXR) (with intercept and trend)

Figure8. Graph of D(LnEXR)



Source: Drawn by the Researcher using Eviews 3.1

The figure above shows that D(LnEXR) fluctuations are stable. It fluctuates around zero. Then D(LnEXR) is stationary.

Table9. Augmented Dickey-Fuller Unit Root Test on D(LnEXR)

ADF Test Statistic	**-7.361129**	1% Critical Value*	-4.2242
		5% Critical Value	**-3.5348**
		10% Critical Value	-3.1988
*MacKinnon critical values for rejection of hypothesis of a unit root.			

Source: Researcher's calculation using Eviews 3.1

Since **-7.361129<-3.5348**, D(LnEXR) is stationary. Based on both tests, we conclude that the series LnEXR is integrated of order one [LnEXR~I(1)].

Having conducted all statonarity tests (informal and ADF Unit Root Test) for each of the series, we reached to the following results:

LnFDI~I(1), LnGDP~I(1), LnCPI~I(1) and LnEXR~I(1). This means that all the variables of the model are integrated of order one, meaning that they all are stationary in first difference.

4.3 Cointegration Tests

As said in the methodology, to be cointegrated, the series must first be integrated of the same order, which is the case for the series under study. In fact, they all are integrated of order one (see section above).

Another test that needs to be conducted is the ADF on the residuals of the long-run model. Once they are found stationary in level [u_t~I(0)], then it can be concluded that the cointegration relationship exists between the variables in question.

Table10. Augmented Dickey-Fuller Unit Root Test on residuals (R)

ADF Test Statistic	**-5.255895**	1% Critical Value*	-4.2412
		5% Critical Value	**-3.5426**
		10% Critical Value	-3.2032
*MacKinnon critical values for rejection of hypothesis of a unit root.			

Source: Researcher's calculation using Eviews 3.1

Since **-5.255895<-3.5426,** the hypothesis of the stationarity of the residuals is accepted. Then we conclude that the variables LnFDI, LnGDP, LnCPI and LnEXR are cointegrated at 5% level of significance.

4.4 The estimated FDI Long-run Model

The estimation of the Long-run model helps in disussing some classical tests like t-Test and F-test, discussing about R^2 (coefficient of determination), but also in making a deeper analysis.

Table11. OLS results of Foreign Direct Investment Regression Model

Method: Least Squares				
Sample: 1970 2010				
Included observations: 41				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-111.0270	17.15892	-6.470512	0.0000
X1	5.980405	0.814152	7.345564	0.0000
X2	-1.265312	0.295472	-4.282334	0.0001
X3	0.888599	0.965007	0.920821	0.3631
R-squared	0.629800	Mean dependent var		15.51143
Adjusted R-squared	0.599784	S.D. dependent var		1.950044
S.E. of regression	1.233649	Akaike info criterion		3.350298
Sum squared resid	56.30995	Schwarz criterion		3.517476
Log likelihood	-64.68111	F-statistic		20.98200
Durbin-Watson stat	1.689039	Prob(F-statistic)		0.000000

Source: Researcher's calculation using Eviews 3.1

From the regression results, the R-squared (R^2) value of 0.63 shows that at 63 per cent the explanatory variables explain changes in the depedent variable. This means that at 63% the independent variables (GDP, INFL and EXR) explain changes on Foreign Direct Investment (FDI). This simply means that Gross Domestic Product, inflation and foreign exchange rate explain the behavior of Foreign Direct Investment at 63%. The probability of F-statistic [Prob(F-statistic)] less than 0.05 implies that all the variables' coefficients in the regression result are all statistically significant to FDI.

The Durbin-Watson (DW) as shown in the regression analysis is 1.69 (close to 2) which shows that there is probability of non autocorrelation.
The results obtained from the regression shows that there is positive impact of Gross Domestic Product (GDP) on Foreign Direct Investment (FDI) with a coefficient of 5.98. This positivity in the coefficient of Gross Domestic Product (GDP) is in conformity to the economic a priori expectation of a positive impact of GDP on FDI.

Again, the regression results show that inflation (INFL) has a negative effect on FDI with a coefficient of -1.27. This negativity in the coefficient of inflation is in conformity to the economic a priori expectation on a negative impact of inflation on FDI.

Finally, the regression results show that foreign exchange rate (EXR) has a positive effect on FDI with a coefficient of 0.89. This positivity in the coefficient of foreign exchange rate, though not the same as hypothesized, conforms to some studies as the literature review revealed.

4.5 Test of hypothesis

This section of the research implies testing the significance of the numerical values of the parameter estimates of the OLS regression. Here, the t-statistics and values are required.

4.5.1 Testing the significance of Gross Domestic Product (GDP)

Hypothesis 1

Recall: H_0: $\hat{\beta}_1=0$: There is no significant effect of Gross Domestic Product (GDP) on the inflows of FDI in Rwanda during the period of 1970-2010.

H_1: $\hat{\beta}_1\neq0$: There is significant effect of Gross Domestic Product (GDP) on the inflows of FDI in Rwanda during the period of 1970-2010.

Decision: Accept H_0 if $t_{0.05}>t_{Statistic}$ or the associated probability is greater than 0.05 and

Reject H_0 and accept H_1 if $t_{0.05}<t_{Statistic}$ or the associated probability is less than 0.05

Where $t_{0.05}=1.96$, and $t_{Statistic}=7.35$ (the associated probability is 0.00)

7.35>1.96

Therefore, we reject H_0 and accept H_1, implying that Gross Domestic Product had significant effect on FDI in Rwandan economy within the period of 1970-2010.

4.5.2 Testing the significance of inflation (INFL)

Hypothesis 2

Recall: H_0: $\hat{\beta}_2=0$: There is no significant effect of inflation on the inflows of FDI in Rwanda during the period of 1970-2010.

H_1: $\hat{\beta}_2\neq0$: There is significant effect of inflation on the inflows of FDI in Rwanda during the period of 1970-2010.

Decision: Accept H_0 if $t_{0.05}>t_{Statistic}$ or the associated probability is greater than 0.05 and

Reject H_0 and accept H_1 if $t_{0.05}<t_{Statistic}$ or the associated probability is less than 0.05

Where $t_{0.05}=1.96$, and $t_{Statistic}=-4.28$ (the associated probability is 0.00) and /t/=4.28 (/t/ is absolute value)

4.28>1.96

Therefore, we reject H_0 and accept H_1, implying that inflation had significant effect on FDI in Rwandan economy during the period of 1970-2010.

4.5.3 Testing the significance of foreign exchange rate (EXR)

Hypothesis 3

Recall: H_0: $\hat{\beta}_3=0$: There is no significant effect of foreign exchange rate on the inflows of FDI in Rwanda during the period of 1970-2010.

H_1: $\hat{\beta}_3\neq0$: There is significant effect of foreign exchange rate on the inflows of FDI in Rwanda during the period of 1970-2010.

Decision: Accept H_0 if $t_{0.05}>t_{Statistic}$ or the associated probability is greater than 0.05 and

Reject H_0 and accept H_1 if $t_{0.05}<t_{Statistic}$ or the associated probability is less than 0.05

Where $t_{0.05}=1.96$, and $t_{Statistic}=-4.28$ (the associated probability is 0.36)

4.28>1.96

From this, we fail to reject H_0 and accept H_1, implying that foreign exchange rate did not have significant effect on FDI in Rwandan economy during the period of 1970-2010.

4.6 Error Correction Model

Another aspect of this research is the analysis of the short-run model. It represents dynamic error correction representations of the series.

The results of the ECM as obtained by OLS using Eviews3.1 are represented in the table below.

Table12. Error Correction Model Results

Method: Least Squares				
Sample(adjusted): 1972 2010				
Included observations: 39 after adjusting endpoints				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-0.979091	0.266778	-3.670062	0.0008
D(X1)	11.49601	1.494978	7.689752	0.0000
D(X2)	6.898726	1.990489	3.465845	0.0015
D(X3)	-3.060332	1.601171	-1.911308	0.0644
ERROR(-1)	-0.312994	0.144640	-2.163950	0.0376
R-squared	0.797760	Mean dependent var		0.082434
Adjusted R-squared	0.773967	S.D. dependent var		2.010840
S.E. of regression	0.956012	Akaike info criterion		2.867116
Sum squared resid	31.07457	Schwarz criterion		3.080393
Log likelihood	-50.90875	F-statistic		33.52932
Durbin-Watson stat	2.008469	Prob(F-statistic)		0.000000

Source: Researcher's calculation using Eviews 3.1

The main result of interest is the coefficient of the error correction variable [ERROR (-1)]. The table above shows that the coefficient of ERROR (-1) is significant with the appropriate (negative) sign. It shows that 31 per cent disequilibrium in inflows of FDI in the previous year is corrected in the current year. This significance indicates the existence of a long-run equilibrium relationship between inflows of FDI and the factors that affect it (Adebiyi, 2002).

4.7 Interpretation of Regression Results

The interpretation of the Regression results focuses mainly on the long-run effects of the explanatory variables (GDP, inflation and foreign exchange rate) on explained variable which is FDI. It focuses on short-run effects of such variables as well.

4.7.1 Long-run effects

The results of the long-run regression equation are as follows:

$$LnFDI = -111.027 + 5.980LnGDP - 1.265LnINFL + 0.889LnEXR$$

From the long-run regression results for GDP, inflation and foreign exchange rate on FDI (see table 11), it can be seen that GDP had a positive significant effect on FDI during the period of analysis (1970-2010). This is in accordance to a priori expectations that GDP has a positive effect on FDI which is depicted by the coefficient of LnGDP (5.980). This coefficient implies that ten per cent (10%) increase in GDP led to 59.8 per cent increase in inflow of FDI in Rwandan economy during the period of 1970-2010. It is the same result found by different researchers in their respective studies (Bandera and White, 1968; Bell and Pavit, 1993; Karami, 2009; Osinubi, 2009, etc). This can be explained by different reasons. In fact, when Rwandan economy experiences a sustained economic growth, it is an indicator of good economic performance, macroeconomic stability, a growing capacity of a market size of the economy, and even good governance that allows people to conduct productive activities in a peaceful climate. Bearing this in mind, foreign investors react positively to an increase in GDP growth by investing in the economy.

The results of the regression also show that the inflation had a negative significant effect on FDI during the period of analysis (1970-2010). This is in accordance to a priori expectations that inflation has a negative effect on FDI which is depicted by the coefficient of LnCPI (-1.265). This coefficient implies that ten per cent (10%) increase in inflation led to 12.7 per cent decrease in inflow of FDI in Rwandan economy during the period of 1970-2010. This also has some reasons of being like it is. In fact, when the inflation is not stable and minimum, it constitutes an indicator of instability of the economy, fiscal and monetary policy that are not more competent, etc. It then increases the uncertainty in the eyes of foreign investors; and who are not eager to take risk, reduce their investment in the economy that seems instable.

Finally, the results of the regression show that foreign exchange rate had a positive and non-significant effect on FDI during the period of analysis (1970-2010). It is depicted by the coefficient of LnEXR (0.889) and is contrary to the hypothesized negative effect. However, this positivity of the effect of foreign exchange rate on FDI is not contradicting the theory, because as we saw in the literature, many studies on this matter reached conflicting results. What matters here is how one can try to explain the direction (whether positive or negative) of the effect of foreign exchange rate on FDI.

As Campa's model (1993) showed, the firm's decision whether or not to invest abroad depends on the expectations of future profitability. In such a case, the higher the level of the exchange rate (measured in units of foreign currency per host currency) and the more it is rising, the more it will be expectations of future profits from entering a foreign market. Therefore, an appreciation of the host currency will increase FDI into the host country.

If we assume that this would be the case for FDI flowing into Rwanda during the period under study, then this future profitability is seen in a broader perspective of Rwanda integrating with other countries of the region (East African Community, and other regional organizations), provided that their currencies do not appreciate more than Rwandan currency relative to US dollar. Then it would be profitable to the foreign investors for them to invest in Rwanda so as to benefit from the larger market of the region.

4.7.2 Short-run effects

The results of the ECM regression equation are as follows:

$$D(LnFDI_t) = -0.979 + 11.496D(LnGDP_t) + 6.898D(LnINFL_t) - 3.060D(LnEXR_t) - 0.312e_{t-1}$$

As it can be seen from the table 12, the short-run coefficients of $D(LnGDP_t)$ and $D(LnINFL_t)$ are all statistically significant implying that there are short-run effects of Gross Domestic Product and inflation on FDI in Rwandan economy. This means that the FDI reacts immediately to the change in one of the two factors (GDP and inflation). The short-run coefficient of D(LnEXR) is not statistically significant implying that there is no short-run effect of foreign exchange rate on FDI in Rwandan economy.

Interestingly, the coefficient of the error correction variable (e_{t-1}) is significant with the appropriate (negative) sign. It shows that 31 per cent disequilibrium in inflows of FDI in the previous year is corrected in the current year. It demonstrates the importance of all the variables, especially GDP and inflation in explaining the inflow of FDI into Rwandan economy.

5. Conclusion and Recommendations

5.1 Conclusion

The present work outlined different points that guided the researcher throughout the research process. Literature review has been elaborated to support the analysis of the data and the interpretation of the

results. The methodology showed how data collected are processed, regressions are done using Eviews 3.1, and how the results were to be analyzed and interpreted so as to test the hypotheses set.

The data were analyzed and the results interpreted to end with drawing conclusion and recommendations. The objectives of the research were:

- To examine and analyze the determinants of FDI in Rwandan economy, namely GDP growth, inflation and exchange rate for the period of 1970-2010
- To develop and test an empirical framework of the GDP growth, inflation and exchange rate as determinants of FDI in Rwandan economy
- To determine the rate at which each factor considered (GDP growth, inflation and exchange rate) influences FDI inflow to Rwanda during the period of 1970-2010.
- The hypotheses to be tested were:
- **H_1:** The economic growth rates have direct effect on the inflows of FDI in Rwanda (Positive effect) during the period of 1970-2010. The corresponding null hypothesis (H0) is that there is no significant effect (the positive one) of economic growth rates on FDI inflows in Rwanda during the period of 1970-2010.
- **H_2:** There is a negative effect of inflation on the inflows of FDI in Rwanda during the period of 1970-2010. Its corresponding null hypothesis (H0) is that the inflation has no significant effect (the negative one) on the inflows of FDI in Rwanda during the period of 1970-2010.
- **H_3:** There is a negative effect of foreign exchange rate on inflows of FDI in Rwanda during the period of 1970-2010. Its corresponding null hypothesis (H0) is that foreign exchange rate has no significant effect (the negative one) on the inflows of FDI during the period of 1970-2010.

The results of the regression confirmed the two first hypotheses, because the coefficients were found to be statistically significant at 5 per cent level, and they are in accordance with a priori expectations. The third hypothesis was not confirmed because the coefficient was not statistically significant at 5 per cent level, and it was positive, contrary to the hypothesized negative effect.The results of the ECM showed that Gross domestic Product and inflation have short-run effects on FDI, and foreign exchange rate does not. From these results, it has also seen that 31 per cent disequilibrium in inflows of FDI in the previous year is corrected in the current year.

5.2 Recommendations

Rwandan still needs to increase more investment, especially from abroad, so as to boost her economy. To attract more FDI into Rwandan economy, maintain the existing one, and also increase its performance, the following recommendations are formulated:

- The government, through monetary and fiscal authorities, should develop, implement and maintain measures that will ensure that inflation (and foreign exchange rate) is sustained at levels that will ensure increasing level of inflow of FDI in Rwanda
- The country should keep on maintaining macroeconomic and political stability so as to encourage productive activities to take place and increase GDP that is one of the major determinants of FDI in Rwanda
- The government should increase transparency in economic policy because by doing this, it reduces transaction costs thereby increasing the incentives for foreign investment
- The country should continue to favor science and technology which would provide the economy with the required skills that FDI requires
- Adequate supporting infrastructure (telecommunication, transport, power and water supply, etc) should be improved and spread countrywide

- The government should continue enhancing good governance and anti-corruption measures, because it guarantees the credible mechanism for the protection of property rights since foreign investors prefer to make investment in countries with very good legal and judicial systems where the security of their investments is guaranteed
- With the use of the existing foreign investors and information technologies, news papers, etc, the government should create awareness of various investment opportunities existing in Rwanda
- The Rwandan economy should be diversified and reduce the dependence on a few primary commodities. This would reduce external trade country risk and increase the attractiveness of the economy to foreign direct investment in the other economic sectors (industry and services)
- The government should keep on enhancing trade liberalization which constitutes a sign to commitment to outward-looking, market-oriented economy that increases trading opportunities thereby attracting foreign investors willing to take advantage of the new trading opportunities
- Appropriate measures should be maintained to keep better sound our financial system
- Regional integration should be enhanced to increase the market size and help attract investors currently constrained in part by the small size of domestic markets
- The government should keep on making more effort in encouraging more cooperation in infrastructure development projects (telecommunication, transportation, power generation, provision of water, etc) at regional level. This should make available these facilities at lower costs thereby increasing trade and attracting foreign investors.

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