MACRO-ECONOMIC VARIABLES AND ECONOMIC GROWTH IN RWANDA: AN EMPIRICAL ANALYSIS

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Abstract: The main objective of this study was to assess the link on causality between macro-economic variables and economic growth in Rwanda since 1997 up to 2015 using the evidence from unit root and co-integration test. The specific objectives of this study were; to evaluate the effect of consumer price index on economic growth, to determine the effect FDI growth on economic growth; to examine the effect of Money Supply on economic growth; to assess the effect of Interest rate growth on economic growth; to evaluate the effect of trade openness on economic growth; The results based on the Johansen co-integration tests and result to either a negative positive long-run relationship between macro-economic indicators and economic growth. Therefore, policies aiming at keeping macro-economic variables at a magnitude level should be supported in order to achieve economic growth.

Keywords: inflation, economic growth, interest rate, unemployment, foreign direct investment and money supply.

1.   INTRODUCTION

The debate concerning the relationship between Macro Economic variables and growth is continuously updated (Espinoza et al. 2010). It is well known that inflation, unemployment, money supply and imports always have a negative impact on economic growth, especially in the long-run perspective (De Gregorio 1993; Fischer 1993; Barro 1995). It is now widely accepted among economists, policy makers and central bankers that the main objective of macroeconomic policies is to achieve a high economic growth rate while maintaining a low inflation rate, unemployment, and money supply; it is also generally believed that high inflation, money supply, and unemployment are detrimental to medium and long-run economic growth. Not surprisingly, the existence and the nature of the relationship of macro-economic variables and economic growth have become the subject of an extensive body of theoretical and empirical studies (Temple, 2000). The debate revolves around the following questions: first, is the relationship between inflation, unemployment and money supply growth positive, negative or non-significant; second, how low should be macro-economic variables not to have an adverse effect on economic growth.

Macro-economic variables have become a leading topic of discussion in Rwanda and other countries of the world. It has become something of a platitude to say that sharp, continuous increase in price is among the serious macroeconomic tribulations of our time. Indeed, the problem is so great that unless it is brought under control, uncontrollable macro-economic variables destroy the very fabric of our society.

Macro-economic variables such as inflation and unemployment are generally used to describe a situation of high and sustained increase in the general price level of an economy. It is a social malady as well as a pervasive economic phenomenon. Besides, distorting prices, it erodes savings, discourages investment, stimulates capital flight, inhibits growth, and makes economic planning a nightmare and political unrest (Guy, Debelle et al, 1998). Governments consequently regard macro-economic variables as a plague and try to squelch it, by adopting sustained and consistent fiscal and monetary policies.

One of macro-economic goals in a society is economic growth as defined by Kuznet (1973) as a long term rise in the capacity to supply increasingly diverse economic goals to its population and this growing capacity is based on advanced technology, industry and the institutional and ideological adjustments that it demands. It therefore, implies the increase in the value of goods and services produced by an economy. Economic growth is conveniently measured as the percentage rate of increase in real Gross Domestic Product and it is usually calculated in real terms, i.e. inflation adjusted terms in order to net out the effect of inflation and unemployment on price of goods and services produced.

Barro and Grilli (1994), postulates that high rates of inflation and imports are caused by high rates of growth of money supply. They are of the view that changes in inflation and imports are sometimes attributed to fluctuations in real demand for goods and services or in available supplies (i.e changes in scarcity), and sometimes to change in the supply and demand for money.

Rwanda has been achieving low inflation whereby the country constantly registered low inflation and unemployment levels since the 1994 genocide except for some years due to mainly food shocks as well as external shocks. Thus, Kigabo (2015) reveals that in 2010, the country experienced high inflationary rates which were due to imported inflation such as oil prices and food prices particularly cereals, cooking oil, fish and sugar among others. In other items that fueled inflation were alcoholic beverages, transport and education.

2. LITERATURE REVIEW

Fisher effect is a fundamental theory of finance and economics in studies, which links interest rate, inflation and exchange rate. In the study, this theory is same as Purchasing Power Parity (PPP) theory, Fisher effect also ascribed on the changes in interest rate differentials to exchange rate.

In the study of Chaudhry et al. (2011), Fisher effect theory is used by researchers to examine on the relationship between inflation, exchange rate and interest rate for four countries within the period of 2003-2008 by using both yearly and quarterly data. There is a significant positive correlation between interest rate differential and changes in exchange rate.

Ricardian Theory: The fundamental concept on which all the theory of international trade is based is the principle of comparative advantage. This principle can be defined by the statement that trade is mutually advantageous whenever the relative prices of various commodities differ from country to country before trade by an amount great enough to over-offset the costs of transferring the commodities in question from one country to another. A country will export those goods that it produces relatively cheaply before trade in exchange and imports those goods that it produces relatively expensively before trade. This process of profitable exchange leads countries to specialize in the production of those commodities in which they have a comparative advantage. A country A has a comparative advantage in producing a good if the opportunity cost of producing that good in terms of other goods is lower in that country than it is in other countries. A persistent change to a trade deficit impedes the economic growth (Gokal and Hanif, 2004).

The Trade-off theory of capital structure derives from the concept that firms prefer to be financed by a combination of external debt and equity. In this way, they benefit from the positive consequences of having debt (tax shield, managerial discipline, FCF control, etc.) but at the same time they have to tackle the costs that are associated with the use of debt (financial distress, reduced pricing flexibility, bankruptcy, asset substitution, etc.). This tradeoff related to the effect of debt will determine the optimal debt to equity ratio of the firm (Kraus, A., and R.H. Litzenberger, 1973).

The popularized Okun's law which states that a fall in unemployment rate to 1%, will result to an increase in output by 3%, it is important that an economy should increase consistently to reduce unemployment, and that the growth of actual output must surpass that of the potential output. One should not overlook that Okun's law provides an important link between the labour and product markets. Okun's law is held to high esteem because of two most important economic variables which it buttressed to obviously related. Okun's law is very significant in policy administration, but the coefficient differs among countries, the general view is that countries should increase output to increase employment (Okun 1962). Stober (2015) in effort to validated Okun's law while assessing UK's unemployment-output relation ascertained that a GDP increase by 0.15% will reduce unemployment by 1%. Other author that concur to this law are Ball et al (2013), Moreno Galbis (2012), Freeman (2001) and Sogner and Staissny (2002). Sadiku et al (2015) reasoned the outcome of their model does not indicate any robustness in evidence and fail to confirm an inverse relationship between unemployment rate and economic growth as posted by evidence in Okun's law, hence, disposed the law while considering

the case of Macedonia between the period of 2000-2012, where they found no relationship between the two variables (economic growth and unemployment), they also discovered that none of the variables causes each other. Moosa (2008) considered 4 Arab countries in effort to validate Okun's law but found that output growth in these countries does not directly result to reduction in unemployment, hence, rendering Okun's law insignificant, statistically.

The search theory of unemployment argues that unemployment is a result of employers quitting their job to search for a new and better-paid job. This involves a certain optimum time spent searching in order to find the best paid job. While searching, the worker is unemployed. This seems to be a theoretical explanation of unemployment since only less than 10% of the unemployed actually quitted their own job.

The alternative micro-economic theory of unemployment is the insider-outsider theory. The focus in this theory is the turn over costs of labour. This means that there are significant costs involved in firing, hiring, and training workers. Not only are there exogenously determined costs but the insider can increase the costs of turn over by refusing to cooperate with hired outsider i.e those who already have a job gain market power over wages as a result of these costs, the employers are willing to give the workers higher wages because this is more profitable than the costly process of turnover.

The Traditional Keynesian model comprises of the Aggregate Demand (AD) and Aggregate Supply (AS) curves, which aptly illustrates the inflation – growth relationship. In the short run, the aggregate supply curve (AS) is upward sloping rather than vertical. Had the AS curve been vertical, changes on the demand side of the economy affects only prices but since it is upward sloping, changes in aggregate demand (AD) affects both price and output (Dornbusch et.al, 1996). Here, there are many factors that affect the inflation rate and the level of output in the short run. These include change in expectations, labor force, and price of other factors of production, monetary policy and fiscal policy.

In endogenous growth theories economic growth is generated by factors within production process. Endogenous growth model assumes that technological progress is endogenous. This assumption is contrary to neo classical growth theory. The other basic difference between the endogenous growth models and the neo classical economies is that in the neo classical growth theory capital is assumed to be diminishing on return while endogenous growth theory assumes that marginal product of capital is constant.

In endogenous growth theory, the rate of return on capital i.e. human capital and physical capital determine the growth rate .A tax on either form of capital induce a lower return. Macallum and Good friend (1987) said that the inflation rate (tax) lower both the return on all capital and the growth rate.

The Schumpeter's theory of Economic Development revolves around the nature of organizations' business innovation's nature of necessitating the use of capital through credit. Schumpeter's theory explicates the linkage of credit and innovation, describing them with the implication of causality. Schumpeter coined in the theory that capital made into existence from credit will be used by entrepreneurs to initiate new groupings and shifting the production to new paths, thus creating innovation. Bankers and lenders of bank notes and depositors' deposit hold the action of expanding the money supply, hence creating sources of innovation, development, and investment that require the use of capital (Foster, 1984).

The Harrod-Domar (Neo-Keynesian) Growth Model

This model is the dynamic version of Keynes's prescription that investment is the driving force of growth. Growth can be achieved only at a higher rate of investment if the labour force and technology are exogenously determined. According to this model investment is mainly financed by local saving. An increase in saving directly leads to an increase in investment and hence growth (Domar 1946).

Though the model does not explain well the relationship between growth and inflation, Domar mentioned that a failure to save, accumulate capital and invest leads to prolonged inflation and higher unemployment. This shows that unemployment and growth goes hand in hand with the level of investment (Domar 1947).

The Solow-Swan (Neo-classical) Growth Model

For Solow-Swan growth model, a short-run production function is used where labour and capital are production inputs. If one input of production is assumed to be fixed an increase in another input of production leads to a decline in output productivity. For example, an increase in capital in the production process leads to diminishing returns of output assuming labour as a fixed input of production (Solow 1956).

Technological advancement plays a crucial role in the economy according to the Neo-classical growth model. Technological advancement that increases productivity of capital and labour postpones the diminishing returns and it accelerates the speed of economic growth. Technical advancement is enough for the growth process and does not require high capital accumulation unlike the Harod – Domar model. With a given capital, higher technology gives higher output (Solow 1956).

(Balasubramanyam, Salisu, & Sapsford, 1996) from an annual cross-sectional data for 46 developing countries in a fixed effects model supported that the growth effect of FDI is positive in the export promoting countries but negative in the import substituting ones. Similarly, (Zhang, 2001), using cointegration and error correction techniques, found FDI enhances economic growth in Hong Kong, Indonesia, Singapore, Taiwan, and Mexico from 11 selected countries in the study; and for the other six countries without cointegration links, unidirectional causal effects were disclosed in five countries. Table 2 demonstrates the main findings of the literature reviewed in terms of the influencing factors in the FDIEG relation from 1994 to 2012.

Hackbarth, Miao, and Morellec (2006) is one of the first papers to show that macroeconomic conditions have implications to firms' financing policies. The paper studies the impact of macroeconomic conditions on credit risk and capital structure choice. They argue that the default policy used to maximize shareholder's value is characterized by a different threshold for each state and which are inversely related to macroeconomic conditions. Furthermore, they analyze the impact of macroeconomic conditions on the capital structure changes, and the debt capacity. Finally, their model predicts that the market leverage should be countercyclical.

In Ghana, Kenya and Zimbabwe, Bigsten et al. (2000a) found that exports had a positive effect on productivity growth. Ahmed et al.(2008) observed that trade liberalization had a positive and significant effect on financial and trade related reforms and these worked to enhance market efficiency, reduced distortions in price and fostered Africa's competitiveness and access to the global market; thus promoting inflow of capital and expansion of exports. In the 1970s, Africa already had a growing fiscal deficit, a current account imbalance and an overvalued exchange rate and all these were supported by project aids and loans at an interest rate of zero or even negative due to bad decisions made by governments to ration credit and foreign exchange instead of increasing the money supply. This resulted in weak market institutions (Yu et al., 2011). GDP growth rates in Africa have shown little or no improvement, but countries that adopted trade liberalization and export-led growth strategies have seen some improvement (Ahmed et al., 2008).

Barreto and Howland, (1993), corrected a fundamental error in the literature examining the Okun's Law relationship between the unemployment rate and the rate of growth of output. Since Okun's original work, biased estimates of the Okun Coefficient on Unemployment, output gaps, and potential GNP have been reported by authors who mistakenly assume that unbiased coefficient estimates of the reverse regression are reciprocals of their direct regression analogues. Okun's (1962) original work states that a one percent point reduction in unemployment rate would increase output by approximately 3 percent. Therefore to avoid the waste of unemployment, the economy must continually expand.

Feenstra and Kee (2008) developed a model allowing to link, across countries and over time, relative export variety to total factor productivity using a GDP function. They tested this relationship on the basis of exports to the US for a panel of 48 countries over the period 1980-2000 using three stage least squares regressions. Their empirical results indicated that there is a positive and significant relationship between export variety and average productivity. Furthermore, computing the gains from trade in the monopolistic competition model of Melitz (2003), Feenstra (2010) shows that countries with a greater export over GDP ratio will experience higher gains in terms of GDP per capita growth, from export variety. Once again, these results suggest that, in addition to the trade dependency ratio, the structure of countries' exports matters regarding the growth effect. Hence, our measurement of trade openness should also consider this variety dimension.

Moru. J (2005) posited that the unemployment caused by the movement of labour forces from agriculture production to secondary production in Nigeria amongst the unskilled labour constitutes disaster to the economic development in furtherance of the effects of unemployment to the Nigerian economy and attainment of economic growth; estimates indicate that attaining high economic growth is possible if Nigerian can scale up its ability to effectively use its resources, through sustainable growth over time, improved policies, increased trade and investment, improvement in human capital development. CBN bullion (2004) however, it is noted that in the attempt to raise resources for economic growth the government has proposed an international financial facility.

Chowdhury and Mavrotas (2006) took a different route by testing for Granger Causality using the Toda and Yamamoto (1995) specification, thereby overcoming possible pre-testing problems in relation to tests for co-integration between series. Using data from 1969-2000, according to their findings, FDI did not "Granger-cause" GDP in Chile, whereas there is a bi-directional causality between GDP and FDI in Malaysia and Thailand.

Jyun-Yi, Wu and Hsu Chin-Chiang (2008) they analyzed whether the FDI promote the economic growth by using threshold regression analysis. According to their analysis it shows that FDI alone play uncertain role in contributing to economic growth based on a sample of 62 countries during the period observed from 1975 to 2000 and find that initially GDP and human capital are important factor in explaining FDI. Further, FDI is found to have a positive and significant impact on growth when host countries have a better level of initial GDP and human capital.

The impact of FDI on the economy along with the determinants for the first time was analyzed by Santiago (1987). The study explains various determinants of FDI in the field of exports for Puerto Rice for the year 1979. According to the study it was found that low cost labor17 is not a major determinant of FDI. It is also revealed that the larger the size of the firm, the bigger the volume of foreign investments in that industry. Other than that, the course of foreign investments in the host country is strongly influenced by macro-economic performance of the country.

Firebaugh (1992) lists several additional reasons why FDI inflows may be less profitable than domestic investment and may even be detrimental. The country may gain less from FDI inflows than domestic investment, because of multinationals are less likely to contribute to government revenue; FDI is less likely to encourage local entrepreneurship; multinationals are less likely to reinvest profits; are less likely to develop linkages with domestic firms; and are more likely to use inappropriately capital-intensive techniques. FDI may be detrimental if it "crowds out" domestic businesses and stimulates inappropriate consumption pattern hence negatively impacting the economic growth.

Biwott et al (2013) trade openness has a significant and robust role to play on economic growth. Zeren and Ari (2013) found bidirectional causality between growth and openness for G7 countries and that there was a positive relationship between the two variables using the same sample data, thus an increase in openness increases growth and vice versa. Yeboah et al (2012) used a cross country approach and Cobb-Douglas production function to estimate the impact of different variables on growth. Still their results that trade openness and growth have a positive relationship.

Ayyub, Chaudhry, and Farooq (2011) examined the relationship among inflation and economic growth in Pakistan. Inflation is constructive and important result of economic growth. Khan and Senhadji (2011) examined the impact of macroeconomic variables on GDP by using ordinary least square method (OLS). The annual data is used from 1960-1998. The study concluded that inflation puts forth negative and significant effect on growth.

Akram and was (2012) examined the relationship between unemployment and economic growth, the rate of recognition to the private sector development was the principal for alleviating unemployment. Thus, the assessment is that unemployment has a negative significant impact on economic growth in the long run.

Sabir and Tahir (2012) examined the impact of macroeconomic variables on GDP growth by using multiple regression technique. For this purpose data is taken from 1981-2010. The study concluded that government should bring consistency in macroeconomic variables which reduce poverty, increase agriculture growth and decrease inflation. The study found that inflation has negative impact on GDP.

Shahzad and Al-Swidi (2013) evaluated the effect of macroeconomic variables on GDP. The data is used from the period 1991-2011. By applying the unit root test and regression analysis the study found that economic growth, exports, imports, have significant positive influence on foreign direct investment inflow. Inflation has significant and negative influence on in-vestment. The political stability has positive relation with economic growth.

Dholakia and Sapre (2011) studied the trade-off between inflation and economic growth in India for the period 1950 – 2009. Specifically the study aims to estimate the short-run aggregate supply curve, analyze the inflation unemployment trade-off and address inflationary expectations. To estimate the short-run trade-off between inflation and growth, the regular Phillips Curve based on adaptive expectations is used. For the period under study, a trade-off between the two variables exists in India enabling them to capture the speed of the recovery. The finding of the analysis also reveals that there exists a positively sloped short run aggregate supply curve responsive to market prices showing that the economy is being more exposed to the international market.

Lupu (2012) examined the interdependence between Interest rate and economic growth in Romania for the period 1990 – 2009. The two decades are analyzed separately using a quantitative and ideological approach. During the first period, i.e. 1990 – 2000, high and volatile inflation was a major source of macro-economic instability that led to the fall of GDP. However, starting from the year 2000 Romania has taken measures to control interest rates that led to positive results. From the year 2001 – 2009 the country has witnessed lower level of interest rates accompanied by higher economic growth. Thus, according to the study of Lupu, there exists a negative relationship between interest rate and economic growth.

3. METHODOLOGY

The empirical analysis of macro-economic indicators on economic growth in Rwanda that addressed the objectives of the study. Accordingly, an econometric model was developed as shown in this below. The model utilized an empirical analysis of macro-economic indicator on economic growth thus applied to significant effect that enables a steady economic growth.

This research used quantitative research because this study was systematic empirical investigation of observable phenomena via statistical, mathematical or numerical data or computational techniques. The objective of quantitative research was to develop and employ econometric models, theories and/or hypotheses pertaining to phenomena. The process of measurement is the key to quantitative research because it provides the fundamental connection between empirical observation and mathematical expression of quantitative relationships. Most quantitative research falls into two areas: studies that describe events and studies aimed at discovering inferences or causal relationships. Descriptive studies aimed at finding out "what is," so observational and survey methods are frequently used to collect descriptive data (Borg and Gall, 1989).

The research relied mainly on the quarterly secondary data. The sample size is quarterly data from 1997 q_1 to 2015 q_4. The dependent variable is Real GDP, while the Independent variables are Consumer Price Index, Foreign Direct Investment, Unemployment, Money Supply, Trade Openness and Interest Rate as an intervening variable. The data is secondary data and obtained from various data sources of institutions such as National Institute of Rwanda, National Bank of Rwanda, Ministry of Finance and Economic Planning, Ministry of Trade and Industry, IMF and World Bank among others. Time series data of Consumer Price Index were collected from the National Institute of Statistics Rwanda, while as; time series data of Money Supply (M3), exports and imports were obtained from BNR and the Real Growth Domestic Product and Foreign Direct Investment data were obtained from Ministry of Finance and Economic Planning.

The research examined the economic growth and macro-economic indicator association using econometric techniques such as correlation analysis, econometric graphs and the diagnostic test was carried out to ensure that the data is reliable and is not affected by issues such as serial correlation or heteresdostecity. Therefore to investigate the relationship between macroeconomic variables and economic growth, the research used the model of Barro (1991), Levine and Renelt (1992) and Sala-i-Martin (1997) which also investigated the relationship between Macroeconomic variables and economic growth in different countries as below:

$$y = f(c, o, p, x, y, z) \qquad\qquad 3.1$$

Where y is the real GDP, x is the measure of inflation and z is the control variable.

3.1 Economic growth model

On the same note, developed the economic growth model in line with the objectives and the study of Gillman and Harris (2010):

$$y = \beta_0 + \beta_1 cpi + \beta_2 FDI + \beta_3 Ms + \beta_4 U.emp + \beta_5 T.open + \beta_6 IR + \mu \qquad\qquad 3.2$$

Where:

y : Real GDP

cpi : Consumer Price Index

FDI : Foreign Direct Investment

Ms : Money Supply (m_3)

$U.emp$: Unemployment

$T.open$: Trade Openness= (Export +Import)/GDP

IR : Interest Rate

μ : Error term

β_0 : Intercept

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_4, \beta_5 and \beta_6$: Slopes

These explanatory variables were selected based on macro-economic theoretical framework and empirical growth literature. In many theoretical growth models such as Harrod (1938) and Domar (1946) population growth and capital accumulation are considered as essential determinants of economic growth. International trade theories, on the other hand, suggest that a country engages in trade because it benefits from the trade economically. Due to this reason, openness of the economy to the rest of the world was considered as one contributor to the economic growth of a country (Salvatore 2004: 62-71). Depending on the structure of the economy different empirical studies include different variables that can potentially affect the growth of the economy. In this growth model, government expenditure was included as one of explanatory variables since the economy of the country under this study is highly partially dependent on the government spending.

The data was transformed into natural logarithms as below in order to allow elasticities:

$$ly = \beta_0 + \beta_1 lcpi + \beta_2 lfdi + \beta_3 lMS + \beta_4 lu.emp + \beta_5 lT.open + \beta_6 lir + \mu \qquad 3.3$$

The study aimed at analyzing the effects of macro-economic indicators especially inflation on economic growth in Rwanda. The specific objectives were to determine whether Consumer Price Index, Foreign Direct Investment, Money Supply, Unemployment and Trade Openness affects economic growth.

4.   DATA SUMMARY

4.1 Descriptive data Summary

To come up with conclusions regarding the characteristics of data in use, it was important to run the following pre- tests that follow after OLS equation in 4.1 has been transformed into equation 4.2 in order to allow for elasticities in the data.

1. $y = \beta_0 + \beta_1 cpi + \beta_2 FDI + \beta_3 Ms + \beta_4 U.emp + \beta_5 T.open + \beta_6 IR + \mu$ 4.1

2. $y = \beta_0 + \beta_1 cpi + \beta_2 FDI + \beta_3 Ms + \beta_4 U.emp + \beta_5 T.open + \beta_6 IR + \mu$ 4.2

The summary statistics for the series of the data set is given in table 4.1 bellow.

Table 4.1 Descriptive Summary

	LRGDP	LUNEP	LOPN	LFDI	LIR	LMS	LCPI
Mean	6.489714	1.102068	2.444327	1.379397	4.748857	0.270059	4.393686
Median	6.481960	0.924656	2.430418	1.370421	4.750188	0.295714	4.382152
Maximum	7.073270	2.078066	1.500584	1.075873	4.775411	0.019183	4.906089
Minimum	5.926926	0.486738	3.411248	1.832581	4.687404	0.517515	3.875359
Std. Dev.	0.400043	0.471323	0.647001	0.197371	0.020268	0.129116	0.388961
Skewness	0.054617	0.975908	-0.004509	-0.510401	-1.311552	0.153384	0.018832
Kurtosis	1.592919	2.767493	1.491380	3.003930	5.534418	2.536669	1.400101

Jarque-Bera	1.576848	3.058717	1.801845	0.832252	10.53230	0.244453	2.027533
Probability	0.454561	0.216675	0.406195	0.659597	0.005163	0.884948	0.362850
Sum	123.3046	20.93930	-46.44221	-26.20854	90.22828	-5.131129	83.48003
Sum Sq. Dev.	2.880623	3.998623	7.534984	0.701194	0.007394	0.300079	2.723229
Observations	19	19	19	19	19	19	19

The first two rows in the table show the average value of the series as a mean and the middle values of the series as the median. For all the series, the value of means and medians are close to each other indicating minor symmetry. Standard deviation is difficult to interpret in absolute terms. However, it can be interpreted in relative terms by comparing the standard deviation for two different distributions, i.e., the distribution with smaller standard deviation exhibits less dispersion and larger standard deviation shows higher dispersion. Accordingly, in Table 4.1, is a LIR less dispersed series with the value of 0.0202 while LOPN is the highly dispersed series with a value of 0.664. The larger the dispersion between the values is the higher the standard deviation that shows greater volatility in trade openness. The volatility in trade openness refers to the uncertainty in further trade liberalization.

Skewness measures the asymmetry of the distribution of the series around the mean. Symmetric distribution has zero skewness value. Thus, among the values of skewness in Table 4.1, only LCPI is close to symmetric distribution with the value of 0.018. Series such as LFDI and LIR are negatively skewed implying that these distributions have a long left tail. On the other hand, LRGDP, LCPI, LMS and also LEMP are positively skewed implying that these distributions have a long right tail and LOPN is negatively skewed implying that these distributions have a long right tail.

The row under Skewness in the above table, measures the flatness and peakedness of the distribution of the series. A normal distribution has a kurtosis value of 3 and hence LFDI is said to be near the normal distribution with the kurtosis value of 3.0. Other series such as LPOP, LMS, LRGDP and LOPN have flatter distribution (platykurtic) with kurtosis value less than 3 while LIR has peaked (leptokurtic) distribution relative to the normal since they have a kurtosis value higher than 3.

However, using Skewness and kurtosis may not necessarily guarantee a clear explanation in regard to the normality of the data. Therefore the study employed the use of Jarque Berra statics which in the above table 4.1 is in the row below kurtosis. For simpler interpretation of the Jarque Berra normality test, the study forms the hypothesis and employs further the use of its probability as below;

H_0 : Residuals are normally distributed if probability of Jarque-Bera statistics $> 5\%$

H_1 : Residuals are not normally distributed if probability of Jarque-Bera statistics $< 5\%$

The probability of Jarque Bera statistics from the figure 4.1 above is 45%, 21%, 40%, 65%, 88%, 36% for LRGDP, LUNEP, LOPN, LFDI, LMS and LCPI respectively which are greater than 5%, hence the study failed to reject the null hypothesis implying that the residuals are Normally distributed. However in the case of LIR, the probability was found to be 0.5% which is less than 5% hence the study rejected the null hypothesis implying that this variable is not normally distributed.

4.2 Unit Root Test

As indicated in the earlier chapter, the study has to make sure that all the variables included in different models are stationary in order to have consistent results and avoid spurious regressions. To this end, the time series properties of the variables have been investigated and the order of integration of each variable has been determined by the application of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests with "constant" and "constant and trend". These tests are complementary, as the PP generalizes the ADF test and provides robust estimates in the presence of serial correlation, time dependent heteroscedasticity and structural break in the time series. When the study applied the unit root tests to the I(1) of all variables, both tests reject the joint null hypothesis for each variable at 5 per cent level. Thus, from all of the tests, the unit roots tests indicate that each variable is integrated of I(1).The results of both unit root tests are presented in Table 4.2.

Table 4.2 Unit Root

Variables	Augmented Dickey-Fuller		Phillips-Perron (PP) test		Remarks
	Probability - Level	Probability - 1st difference	Probability - Level	Probability - 1st difference	
LRGDP	0.9531	0.0420**	0.9515	0.0473**	I(1)
LMS	0.9832	0.0003**	0.8903	0.0001**	I(1)
LOPN	0.6736	0.0261**	0.9285	0.0298**	I(1)
LUNEP	0.9608	0.0000**	0.4132	0.0000**	I(1)
LFDI	0.1666	0.0000**	0.1915	0.0341**	I(1)
LCPI	0.7676	0.0000**	0.9032	0.0023**	I(1)
LIR	0.1385	0.0001**	0.1585	0.0001**	I(1)

Note: ** denotes the rejection of null hypothesis at 5% level of significance

4.3 Lag Selection

After checking the integration of the seven variables at order one I (1), the study selected the optimal lag length of underlying Vector Auto Regression (VAR henceforth) using the conventional model selection criteria. Various selection criteria are available, including the sequential modified Likelihood Ratio (LR) criterion, the Final Prediction Error (FPE) criterion, the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SIC) and the Hannan-Quinn Information (HQC) criterion. There is no unanimity among researchers about the best criterion (or set of criteria) to use, but Ivanov and Kilian (2005) establish on the basis of experimental evidence that "for quarterly VAR models, the Hannan-Quinn Criterion (HQ) appears to be the most accurate criterion with the exception of sample sizes smaller than 120, for which the Schwarz Information Criterion (SIC) is more accurate" and, furthermore, that "sequential Lagrange-multiplier and likelihood ratio tests cannot be recommended". In a very influential paper, Hamilton and Herrera (2004) argue strongly in favour of the sequential testing procedure, especially when there is some a priori knowledge (based on previous studies) about the lag length.

The study didn't have any prior knowledge of lag length so the study did not use the LR criterion. For the cases of Rwanda, the observations are less than 120 therefore this study used both the HQ and the SIC. These criteria in table 4.3 below established that the optimal lag length is five.

Table 4.3 Lag Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	412.3062	NA	4.20e-14	-13.77309	-13.56182	-13.69062
1	1365.804	935.9137	2.19e-21	-30.55109	-29.07217	-29.97378
2	1156.445	332.4289	5.59e-24	-39.5647	-33.81089	-35.48532
3	943.2572	340.2344	1.73e-26	-42.43404	-38.41982	-40.86705
4	1532.342	334.2322	179.3333	-46.32420	-40.43343	-43.54533
5	1235.423	283.8764	1.852e-20	-36.55747	-43.45553	-42.54767

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

4.4 Cointegration Test

The cointegration tests based on multivariate Johansen approach (1988) which uses two statistic tests namely: Trace test and Max-Eigen value. For this purpose, the study uses the Johansen (1988, 1991) and Johansen and Juselius' (1990)

cointegration test procedure. Results of the Johansen cointegration tests are displayed in below tables 4.4, 4.5 for Trace test and Max-Eigen value respectively. The Trace test and Max-Eigen value) suggest the existence of 6 cointegrating vectors at 5% level of significance.

Table 4.4 Trace Statistics

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.993580	697.4276	125.6154	0.0001
At most 1 *	0.853313	354.1387	95.75366	0.0000
At most 2 *	0.779593	223.6158	69.81889	0.0000
At most 3 *	0.593562	120.7807	47.85613	0.0000
At most 4 *	0.385526	59.55863	29.79707	0.0000
At most 5 *	0.317534	26.44334	15.49471	0.0008
At most 6	0.006807	0.464469	3.841466	0.4955

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table 4.5 Eigenvalue Statistics

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.993580	343.2890	46.23142	0.0000
At most 1 *	0.853313	130.5229	40.07757	0.0000
At most 2 *	0.779593	102.8351	33.87687	0.0000
At most 3 *	0.593562	61.22209	27.58434	0.0000
At most 4 *	0.385526	33.11528	21.13162	0.0007
At most 5 *	0.317534	25.97888	14.26460	0.0005
At most 6	0.006807	0.464469	3.841466	0.4955

Max-eigenvalue test indicates 6 cointegrating eqn (s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Therefore, both tests of Johansen approach in table 4.4 and 4.5 above reveal the existence of six co-integrating vector in the LCPI and LRGDP series. This shows the existence of a long-run relationship between inflation and economic growth. Hence, the result of the Johansen's approach confirms the results obtained from the Engle-Granger co-integration approach. The VECM is used to correct the disequilibrium in the cointegration relationship, as well as to test for long and short-run causality among cointegrated variables.

4.5 Johansen Long Run Results

From the table 4.6 below, the long-run results indicates that LMS proxied by broad money, LCPI, LGE, LOPN all have a negative and significant impact on economic growth. This means that any increase in the mentioned variables without clear monetary watch would affect the economy in the long run. While LINV and LEMP have a positive effect meaning that any increase of LINV majorly would result in a positive and a significant impact on the economy in the long run.

The result in the table below clearly indicates that in the long-run, inflation has a negative impact on economic growth. In addition, increase in money supply (LMS) would harm the economy in the long-run as well, this would significantly lead to rise in the prices of domestic goods and services leading to an increase in cheap imports from abroad. This is the reason why LOPN is also negative, as imports would subsequently widen further.

Table 4.6 Long Run Results

Variables	Coefficients	Standard Errors	T-Statistics	Conclusion
LMS	-0.3275	0.0950	-3.4473	Significant
LFDI	0.14475	0.08029	1.8028	Significant
LCPI	-0.23025	0.36056	-0.6385	Significant
LEMP	0.07222	0.03696	1.9571	Significant
LIR	-3.2136	0.66063	-4.8644	Significant
LOPN	-0.1035	0.22361	-0.4606	Significant

4.6 Error Correction Model (short run results)

Although cointegration indicates presence of Granger causality, at least in one direction, it does not indicate the direction of causality between variables (Odhiambo 2004b). The direction of the Granger causality can only be detected through the error-correction model (VECM) derived from the long-run cointegrating vectors. In addition to indicating the direction of causality amongst variables, the ECM enables us to distinguish between short-run and long-run Granger Causality. The F-test and the explanatory variables indicate the 'short-run' causal effects, whereas the 'long-run' causal relationship is implied through the significance of the t-test of the lagged error-correction term. The results of the error-correction model between the three proxies of financial development and economic growth are displayed in Table 4.7 below. The coefficient of the lagged error correction term (-0.28) is negative and statistically significant at the 5 percent level. This indicates that deviations from the short run to the long run are corrected by 28% percent quarterly adjustments. This simply means that if there could be a problem with the economic growth, inflation could be used to correct it within one year. The negative and significant coefficient is an indication of cointegrating relationship among LGDP, LMS, LCPI, LINV, LEMP, LOPN and LIR. This confirms to Guiso, et, al. (2002) while examining individual regions of Italy, found that controlled consumer price index enhances the probability that an individual starts a business, increases industrial competition, and promotes the growth of firms.

Table 4.7 Short Run Results

Error Correction:	D(LRGNP)	D(LEMP)	D(LOPN)	D(LFDI)	D(LIR)	D(LCPI)	D(LMS)
CointEq1	-0.283527	0.355702	0.952962	1.749064	0.166302	-0.129327	0.082302
	(0.09394)	(0.27939)	(0.56554)	(0.67830)	(0.06722)	(0.11196)	(0.25399)
	[-3.01829]	[1.27315]	[1.68504]	[2.57858]	[2.47388]	[-1.15513]	[0.32404]
C	0.006021	0.006325	0.029078	-0.037502	0.001611	0.021964	-0.020005
	(0.00373)	(0.01109)	(0.02245)	(0.02693)	(0.00267)	(0.00444)	(0.01008)
	[1.61468]	[0.57028]	[1.29513]	[-1.39265]	[0.60383]	[4.94169]	[-1.98401]

In general, the findings from the Johansen's approach of co-integration and vector error correction are similar to the findings of Engle-Granger co-integration tests and the ECM. Both techniques reveal that there exists a long-run relationship between macroeconomic variables and economic growth. The error correction model of single equation and multivariate equation also show that in the short-run the economy converges to the equilibrium point in both cases. The two techniques have similar results on the speed of adjustment to the long run equilibrium path of the model. The negative long-run relationship between Macro-economic indicator-inflation and growth does mean that inflation is bad for economic growth as mentioned in the literature review. The findings of these studies also show that the growth of the economy explains more than the quarter of the increase in the general price level. From this one can conclude that there is a negative positive relationship between economic growth and Macro-economic variables. On the other hand, inflation expectation and the real effective exchange rate also affect the rate of inflation significantly.

Since one of the aims of the study is to carry out the short-run relationship and the short-run dynamics, the results conclude that in the short-run, the relationship between the two variables is insignificant. However, regarding the dynamics the negative sign on the error correction term shows that in cases of any deviation of inflation in the short-run, it will be adjusted to its long-run equilibrium path. Concerning the speed of adjustment based on the Engle-Granger approach 28% of the deviation of inflation from its long-run path is adjusted in each quarter. On the other hand, based on the vector error correction model, it is 28% of the deviation of inflation from its long-run path that is adjusted in each quarter. There is not much difference between the two approaches of co-integration and error correction models.

5.   CONCLUSIONS AND POLICY RECOMMENDATIONS

In general it can be concluded that macroeconomic-indicators especially inflation and unemployment are harmful to economic growth in the long-run, it is evident in Rwandan case that an increase in money supply would lead to an increase in the quantity of money in the economy, which would subsequently lead to an rise in consumer price index otherwise meaning that the prices of domestic good and services would rise too. On the same note, domestic goods and services will be expensive leading to more imports of cheap foreign goods and services and reduced exports from Rwanda. The conclusion is in line with the works of Khan and Senhadji (2001) whose findings show that money supply is the major factor for the rising inflation and that an increase in GDP has a price reduction effect. Just like in this study it appears that there exist a negative relationship between macro-economic variables (inflation) and economic growth. This view is further supported by the work of Singh and Kalirajan (2003) in the case of India and concluded that developing countries must work hard to reduce inflation as much as possible, in spite of the multiple objectives that distract their focus from targeting inflation.

The study recommends that Rwandan policy makers should continue controlling macro-economic indicators such as inflation, this is based on the fact that a negative relationship between macro-economic indicators and economic growth could be attributed to the fact that inflation increases the cost of living, "ceteris paribus". Consumers in an attempt to maintain the same standard of living will forego current savings and increase purchase of foreign goods and services; hence the possibility of a negative relationship between Trade Openness which mark you in this study has greater magnitude than any other variable. In other words, higher inflation would mean that people will need more money for expenses which will lead to cash withdrawals and a reduction in the level of deposits in general and a further reduction in LRGDP in the long run. Therefore, the research recommends that the Rwandan policy makers continue keeping macro-economic indicators such as inflation, unemployment at a minimum level for the economy to grow in the short run.

This study achieved its general and specific objectives and the null hypothesis have been rejected meaning that all variables namely; cpi, fdi, ms, $u.emp$, $t.open$, ir have a unidirectional cause to economic growth in Rwanda. Such conclusions are in line with (Levine, 2008).

REFERENCES

[1] Abel, A.B and Bernanke, B.S. (1995). Macroeconomics 2nd Edition. New York: Addison-Wesley Publishing Company.

[2] Abbott, A. & De Vita, G., 2011, 'Revisiting the Relationship between Inflation and Growth: A Note on the Role of Exchange Rate Regimes', Economic Issues 16(1), 37 – 52.

[3] Alfaro, L., Chanda, A., Kalemli-Ozcan, S., & Sayek, S. (2004). FDI and economic growth: the role of local financial markets. Journal of international economics, 64(1), 89–112.

[4] Akintoye, R.I. (2008). "Reducing Unemployment Through the Informal Sector: A Case Study of Nigeria" European Journal of Economics, Finance and Administrative Science ISSN 1450 2275, Issue 11.

[5] Aitken, B. J. and A. Harrison. 1999. "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela." American Economic Review 89: 605-618.

[6] Ahmed, S. and Mortaza, M. G., 2005, 'Inflation and growth in Bangladesh: 1981-2005' Policy Analysis Unit Working Paper, Series WP0604, 1 – 22.

[7] Ambler, S., 2008, 'The Cost of Inflation in New Keynesian Models', Bank of Canada, winter 2007-2008, 5– 14.

[8] Ajetomobi, J.O and Ayanwale, A.B. (2004). Education Allocation, unemployment, & Economic growth in Nigeria; 1970-2004.

[9] Akhtar, M. H. (2000). The Determinants of Foreign Direct Investment in Pakistan: An Econometric Analysis. The Lahore Journal of Economics, 5(2), 1-22.Akinboade, O. A., Siebrits, F. K., & Roussot, E. N.

[10] Asaminew, E., 2010, 'Inflation and Growth: An estimate of the Threshold Level of Inflation for Ethiopia', Proceeding of the Ninth International Conference on the Ethiopian Economy, Ethiopian Economics Association, Addis Ababa, July 21 -23, 2011.

[11] Balasubramanyam, V.N., Salisu, M., & Sapsford, D. (1996). Foreign direct investment and growth in EP and IS countries. *The Economic Journal*, *106*(434), 92-105.

[12] Barro, R.J. (1991), "Economic Growth in a Cross-Section of Countries" .Quarterly Journal of Economics, 106:407-43.

[13] Ball, L., Mankiw, N.G., & Romer, D., 1988, 'The New Keynesian Economics and the Output-Inflation Trade-off', Brookings paper on Economic Activity, 1988(1), 1 – 90.

[14] Bruno, M. and Easterly, W. (1998). "Inflation Crises and Long-Run Growth". Journal of Monetary Economics, 41:3-26.

[15] Bruno, M. & Easterly, W., 1996, 'Inflation and Growth: In Search of a Stable Relationship' Federal Reserve Bank of St. Louis, May/June 1996, 139 – 145.

[16] Carkovic, M. and R. Levine. 2002. "Does Foreign Direct Investment Accelerate Economic Growth?" University of Minnesota, Working Paper.

[17] De Gregorio, J. (1996). "Inflation, growth and Central Banks: theory and evidence". Ministry of Finance Paper, Santiago Chile.

[18] Dorrance, G.S. (1966). "Inflation and growth: the statistical evidence". IMF Staff Papers, 13: 82-102. International Monetary Fund.

[19] Drukker et al. (2005). "Threshold effects in the relationship between inflation and growth: a New Panel Data Approach". Paper Presented in the 11th International Conference on Panel Data, February 2005.

[20] Easterly, W. (1999). "The lost decades: explaining developing countries stagnation, 1980-1998". World Bank, 1999.

[21] Fisher, S. (1993). "The Role of Macroeconomic Factors in Growth" .Journal of Monetary Economics, 32: 485-512.

[22] Frimpong, J.M. and Oteng-Abayie, E.F. (2010). "When is inflation harmful? Estimating the threshold effect for Ghana" .American Journal of Economics and Business Administration, 2:225-232.

[23] Gillman, M. Harris, and L.Matyas. (2004). "Inflation and growth: Explaining a negative effect" .Empirical Economics, 29: 149-167.

[24] Hodge, D., 2005, 'Inflation and Growth in South Africa', Cambridge Journal of Economics 36(2), 163 –180.