INFLATION AND ECONOMIC GROWTH: EVIDENCE FROM LIBERIA

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DECLARATION

This research paper is my original work and has never previously been presented for the award of a degree at any other university

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ABSTRACT

This study set out to estimate the optimal level of inflation which is conducive for economic growth in Liberia and to determine and establish the direction of causality between economic growth and inflation. Using time series data for Liberia for the period 1960-2007, the study employs an optimization model to analyze the threshold level of inflation for Liberia. The study also utilizes the Johanson cointegration technique to determine the existence of a long-run cointegration between growth rate of gross domestic product, foreign direct investment, investment rate, inflation rate, exports and exchange rate.

The Granger-Causality test identifies a feedback or bilateral causality between inflation and economic growth and the results from the optimization model recommend a 19% optimal level of inflation, which is conducive for economic growth. The implication is that any inflation rate above this optimal level would affect economic growth negatively in the Liberian economy.
The long-run and short-run results indicate that growth rate of gross domestic product is positively affected by foreign direct investment, inflation rate, exports, exchange rate, investment rate and the dummy variable. On the other hand, the dummy variable for war is found to negatively influence growth rate of gross domestic product in Liberia. Moreover, a stability test suggests that the estimated parameters do not suffer from structural instability.

Given the ambiguous relationship between inflation and economic growth and the primary objective of the Liberian government as envisaged in its Poverty Reduction Strategy, the findings of the study provides policy makers, especially the monetary authority, in Liberia with the necessary information to formulate monetary policies that would target the reported- optimal level of inflation in the Liberian economy thereby stimulating economic growth. Besides, the findings suggest a bilateral causality between economic growth and inflation. Policy makers can rely on this finding to institute policies that would enhance price stability thereby attractive economic growth.

DEDICATION

In recognition of their unwavering and relentless mentorship and support that led to my educational success. 1 dedicate this research paper to my parents, Mr. Samuel Bellepea and Mrs. Betty Bellepea. and my wife, Mrs. Viola P. Bellepea-

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Irrespective of the numerous aforementioned recognitions, I take full responsibility for any flaws in the formulation of this paper. While it has been a delight assembling it, it is my conviction that it will contribute to the knowledge of financial issues, particularly those relating to inflation and economic growth in post-war Liberia.

LIST OF ACRONYMS/ABBREVIATIONS

IT	Inflation Target
IMF	International Monetary Fund
PRS	Poverty Reduction Strategy
LAMCO	Liberia Americo-Swedish Mining Company
NHDR	National Human Development Report
USD	United States Dollar
UNDP	United Nations Development Programme
GDP	Gross Domestic Product
CBL	Central Bank of Liberia
GNP	Gross National Product
ADB	Africa Development Bank
AD	Aggregate Demand
AS	Aggregate Supply
CPI	Consumer Price Index
CLS	Conditional Least Squares
IV	Instrumental Variable
TFP	Total Factor Productivity
LD	Liberian Dollar
ECM	Error Correction Model

ADF	Adjusted Dickey and Fuller
PP	Phillips- Perron
AIC	Akaike's Information Criteria
GLS	Generalized Least Squares
RSS	Residual Sum of Squares
LIGIST	Liberia Institute of Statistics and Geo-Information Services
ARCH	Autoregressive Conditional Heteroskedasticity

TABLE OF CONTENTS

List of Table

List of figure

List of Appendix

CHAPTER ONE

INTRODUCTION

1.1 Background

The relationship between inflation and economic growth remains a controversial issue in both theory and empirical findings in the world economy, especially in developing countries. This relationship has been debated in economics literature and these debates have shown differences in relation to the condition of world economy. Since the world economic crisis of 1929, Keynesian policies have been effective and in accordance with these policies, increases in the total demand have caused increases not only in products but also in prices. Nevertheless, inflation was not regarded as a problem in that period; instead the view that inflation had a positive effect on economic growth was even more widely accepted. Among these views is Phillips Curve which hypothesizes that high inflation positively affects the economic growth through creation of a low unemployment rate. By the 1970s, growth rates began to decrease in countries with high inflation rates and high inflation and hyperinflation became frequent in developing countries especially Latin American countries. The 1980s saw the emergence of views stating that inflation had negative effects on economic growth contrary to the earlier views.

Additionally, the issue of inflation has generated an enduring debate between structuralists and monetarists. The structuralist's believe that inflation is essential for economic growth. The structuralists view that inflation has a positive effect on growth is based on the contention that inflation is a mechanism which induces forced savings (Georgescu-Roegen 1970; Taylor 1979). First, the government of a developing country, faced with an inadequate fiscal system, may resort to borrowing from the central bank as a way of financing expenditures. Thus inflationary finance may increase capital formation if the government uses its inflation-tax revenues to increase real investment. As long as private sector investment does not fall one-for-one, inflationary finance may contribute to real growth. Second, nominal wages may lag behind prices because of slowly adjusting expectations, sluggish wage bargains, or systematic

governmental wage repression. If this is so, then inflation may increase growth in neoclassical fashion by shifting the income distribution in favour of higher saving capitalists and hence increase savings and growth. From a more general Keynesian perspective, inflation may increase growth by raising the rate of profit, thus increasing private investment.

Nevertheless, the monetarists see inflation as detrimental to economic progress. There are two aspects to this debate: (a) the nature of the relationship if one exists and (b) the direction of causality. Friedman (1973:41) succinctly summarized the inconclusive nature of the relationship between inflation and economic growth as follows: "historically, all possible combinations have occurred: inflation with and without development, no inflation with and without development"[2]. Mundell (1971) and Taylor (1979) supported the view that inflation has negative effect on growth. This position might be labeled the distortionary inflation view. Inflation may (with the help of government policies) create a variety of output-reducing inefficiencies (Baer 1967). First, inflation in a country with a fixed exchange rate will lead to a deteriorating trade balance and to speculative capital outflows in anticipation of devaluation. If the government succumbs to the temptation to introduce or strengthen exchange controls, the resulting inefficiencies may reduce output and growth (Bhagwati 1978). Second, because of the political power of urban workers, the government may impose food price controls in the face of inflation. Shortages and inefficiencies will arise as agricultural investment is reduced. Third, inflation is likely to reduce the efficiency of the financial system. Because the government often controls nominal interest rate, inflation increases excess demand for loanable funds, forcing tighter credit rationing by financial institutions, which in turn produces various inefficiencies (McKinnon 1973). Fourth, high inflation in the midst of the usual sort of tax policies may lead to a misallocation of investment funds towards "less productive"[1] uses (e.g. real estate), thereby lowering the growth rate. Finally high and variable inflation may increase the cost and riskiness of productive investment, reducing investment and growth.

[2] See Hossain and Chowdhury (1996) for a survey of the literature.
See Mckinnon (1973), Money and Capital in Economic Development.

Nevertheless, a third possibility is that inflation may be neutral- that is; there may be no causal link between inflation and growth. Anticipated inflation has no effect on output in, for example, the Lucas supply framework (Lucas 1972, 1973).

There are therefore three plausible hypotheses about causal relations between inflation and economic growth and about the sign of any relationship that is discovered: the structuralist position, the distortionary inflation position, and the neutrality view. Some of these views are usually considered by developed country governments and lending institutions as they engage developing country financial problems.

On the other hand, inflation targeting (IT) has recently become the dominant monetary policy prescription for both the developing and developed countries alike. Emerging market governments in many developing countries, like Liberia, are increasingly pressured to follow IT as part of an IMF-led stabilization package and the routine rating procedures of the international finance institutions. Nevertheless, the common expectation of IT is that price stability would ultimately lead to higher employment and sustained economic growth. This has however, failed to materialize.

The Liberian economy has experienced a major devastation in all sectors as a result of its 15 year civil war. The civil war which started in 1989 ended in 2005 with special general and presidential elections that ushered in a new government in 2006. According to the Liberian government's Poverty Reduction Strategy (PRS-2007), the primary objective of the government has been to revamp the economy thereby stimulating saving, investment, employment, reducing poverty, reducing inflation and above all achieving economic growth.

Given the ambiguous relationship between inflation and economic growth as summarized above, and the primary objective of the Liberian government as envisaged in its Poverty Reduction Strategy, this study aims to examine and explain the relationship between inflation and economic growth in Liberia using data covering the period 1960 to 2008.

1.2 An Overview of the Liberian Economy

The political situation in Liberia has a historical bearing starting from the founding of the country in 1847 by the ex-slaves from America. The descendents of the ex-slaves also known as the "Congos" dominated national politics from then on. In spite of the economic boom of the 1950s and '60s, little effort was made to develop the country, in terms of social and industrial infrastructure and in terms of literacy. The resources of the country were used by a privileged few. leaving the country underdeveloped and in abject poverty^

The Liberian economy has been operating in a capitalistic pattern, with some attributes of mixed economic activities but at an infinitesimal level since Liberia attained its independence in 1847. The economy began attracting potential investors in the 1940s when the Government of President William V.S. Tubman launched its "Open Door Policy" to attract foreign investment, create employment and above all, accelerate economic growth. The emerging results were in terms of massive employment, relative alleviation of poverty and significant growth as evidenced by the establishment of viable concession companies such as Bong Mines, National Iron Ore Company and the Liberia Americo-Swedish Mining Company (LAMCO), (NHDR, 1999). This significant development continued until the 1980s when the economy began declining due to a "coup de tat" that ushered in a military regime. While steady economic growth rate averaging 4 to 7% was witnessed in the 1960s, GDP growth rate declined from 5% in the early 1970s to less than 1% in the 1980s and the external debt rose from USD750 million to **USD1**.4 billion in 1985 (IPRSP, 2006). Thereafter, the country continued to experience intermittent political instability, which eventually led to the closure of some major investments thus stalling the process of growth.

The "coup de tat" of 1980 brought an abrupt end to the uninterrupted rule of the "Congos". The succeeding military administration did not fundamentally change the course of state rule. The same exclusionary policies of the past were adopted, not only against the "Congo" people but it

[4] See NHDR PP. 2-3(1999).

took a tribal/ethnic dimension. The military Government stayed in power for five years and was later transformed into civilian administration in 1985 for another five years/

The precipitating uncertainties following the 1980 coup gave rise to massive capital flight. The accompanying socio-economic crisis hastened the decline of the economy, non-payment of debt servicing arrears, and negative growth. Private investors disinvested from the country, and productivity declined dramatically (UNDP-Liberia Report 2000-2003).

The repressive practices of the new military and police forces against the Liberian people led to a rebel invasion in 1989. The civil war led to near collapse of all democratic and socio-economic institutions in Liberia. Basic socio-economic infrastructure, including roads and bridges, market facilities, schools, health facilities, water and sanitation, and farm and other services of livelihood were destroyed or abandoned. Consequently poverty increased massively, and today, approximately 76.2% of the Liberian people live below the national poverty line of US$365.00 per annum; unemployment is estimated at 85%; access to water and sanitation is 26% respectively; health services (urban 90%, rural 37%), education, 70%; housing 20%, and HIV/AIDS prevalence stands at 8.2%, and is on the increase (UNDP, 2000-2003).

The civil war officially ended in 1997, and was followed by elections in the same year. According to UNDP (2000), following these events, the country's GDP estimated at US$508 million was just about 50% of its pre-war level (1987) of US$1 billion; the per capita income dropped from US$340.00 pre-war to US$199.00 (2000). Another civil war erupted in 1999, which totally devastated the little progress made by the previous administration. The war did not end until international peacekeepers finally ousted Taylor in 2003 and established the basis for stability, peaceful elections, and the beginning of recovery.

By 2005, average income in Liberia was just one-quarter of what it had been in 1987, and just one-sixth of its level in 1979. In nominal terms, GDP per capita was $160 in 2005 (Radelet, 2007). Following the elections in 2005 and the inauguration of the new government, the pace of economic recovery accelerated; economic growth reached 7.8% and 9% in 2006 and 2007

[55] **Ibid p.2**

respectively, but declined to 7% in 2008. This was possibly due to the global economic meltdown and the rise in food and fuel prices (Republic of Liberia, 2008).

As the Liberian economy imploded, poverty increased sharply, and today more than 75% of Liberians live below the poverty line of $1 per day. Unemployment and underemployment are high, as ex-combatants, returning refugees and internally displaced persons struggle to find work. Refugees returning to their farms lack seeds, fertilizers and tools and in some cases face uncertain land tenure. Schools, hospitals, and clinics were badly damaged, and most government buildings were left in shambles. Today, there are less than 50 Liberian physicians to cover the nation's public health needs, equivalent to one for every 70,000 Liberians. Government finances collapsed in tandem with the economy. Government revenue fell to less than US$85 million a year between 2000 and 2005, translating into public spending of only about US$25 per person per year, one of the lowest levels in the world. However, the government revenue authority has recorded some increment in revenue generation in 2007/2008 fiscal period. At the same time, years of mismanagement left a huge external debt burden, mostly as a result of large borrowing and expenditures in the 1980s and steady accumulation of arrears since then. Liberia's total debt is today estimated at about US$4.5 billion, equivalent to about 800% of GDP and 3,100% of exports. Domestic debt and arrears total at least $304 million with an additional US$ 17 million in claims deemed contestable. Nevertheless, the present administration has made some progress, including obtaining a waiver on external debt (Radelet 2007).

Prior to 1989, twelve banks existed in the country but most closed down while some were declared insolvent during the war period. At the moment, only six commercial banks are operational: ECOBANK (Liberia) Limited, Liberia Bank for Development and Investment, International Bank (Liberia) Limited, Global Bank (Liberia) Limited and First International Bank (Liberia) Limited. In 1999. the National Bank of Liberia was transformed to the Central Bank of Liberia to effectively conduct the country's monetary policy. Banking activities are being restored in the rural areas to boost trade and investment after almost 15 years of non-banking there. Inflation is reported by the monetary authority to reach 20% as at 2008 (CBL, 2008).

The 2008 census puts the population of Liberia at 3.476,608. However, Liberia growth potential is favorable and high. Liberia has a rich natural resource base, including fertile lands for agriculture and tree crops, extensive forestry resources, iron ore, gold, diamonds, and the ocean and coastal areas. Natural resource-based industries have the potential to create significant numbers of jobs, provide substantial budget revenues, and initiate rapid growth. To cultivate the favorable growth potential of Liberia and to meet the challenge of achieving rapid, inclusive, and sustained growth, Liberia must take advantage of the near-term opportunities from agriculture and natural resource-based activities and establish the foundation for diversification into processing downstream products, and other manufacturing and service exports over time. Doing so will not be easy, but according to Radelet (2007), 'four sets of actions stand out as key priorities to accelerating economic growth: building infrastructure (most especially roads), adroitly managing natural resources and the potential side effects of their production, keeping business and production costs low through a favorable business climate, and building strong training and education programs to develop workers with appropriate skills"[6] The Allen-led government has considered this recommendation in her Poverty Reduction Strategy and is under implementation currently.

The treads of growth and inflation in Liberia over the period 1965-2005 is captured in Figure 1.

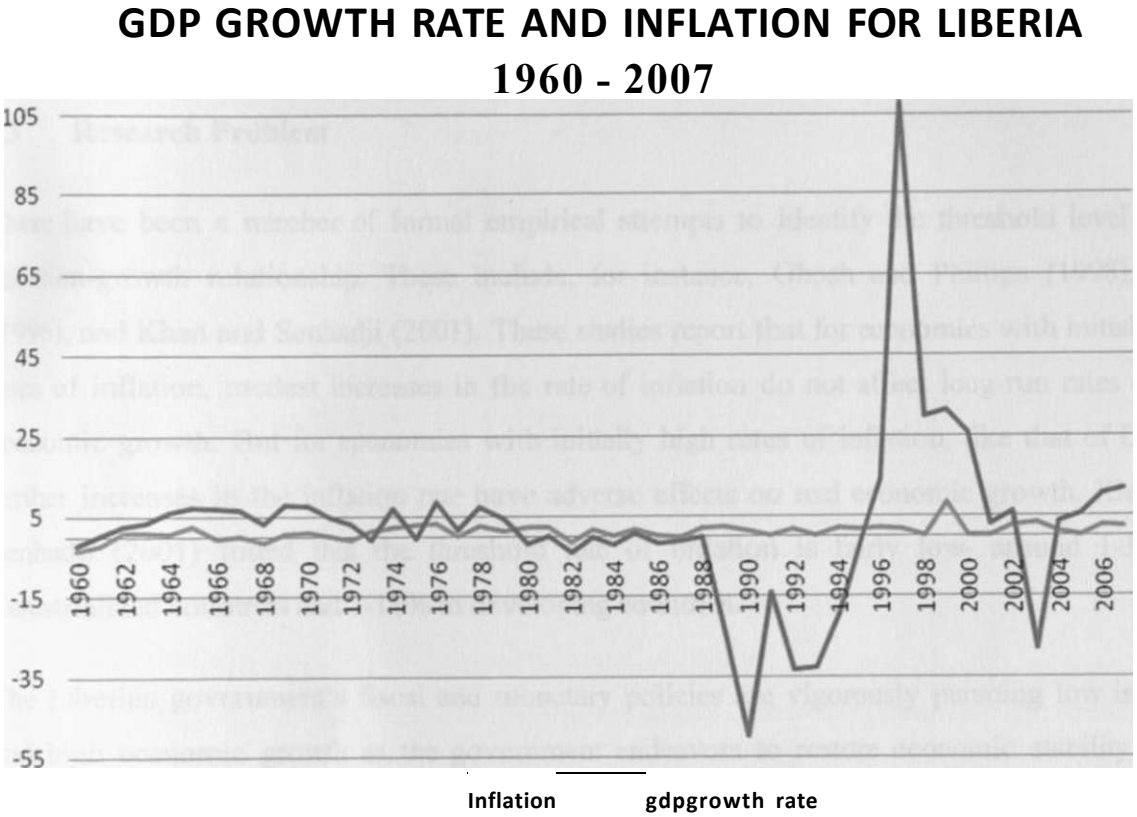
1.2.1 Growth Rate and Inflation Rate Trend for Liberia

Figure 1 shows the trend of economic growth rate and inflation for Liberia for the period 1960-2007. Growth rate for the period 1965-1970 increased slightly averaging 6.5% while inflation rate averaged 0.5%. The period 1971-1975 witnessed fluctuations in growth rate and inflation rate. The fluctuations continued up to the 1990s. As can be seen from Figure one, the fluctuation took a dramatic trend when growth rate recorded negative figure between the period 1985-1995 and inflation rate continued increasing and reached a remarkable high level in 2000. However, growth rate improved significantly recording positive digits for the period 1996-2000 but again

[0] See Steve Radelet. "Reviving Economic Growth in Liberia". Center for Global Development Working Paper Number 133, November 2007, p-18

declined from 2001 to 2005. Similarly, inflation rate declined in the period 2001-2005. These could be attributed to the following factors:

Figure 1: Growth Rate and Inflation Rate Trend for Liberia: 1960-2007



Source: World Bank's Global Development Network Growth Database and the IMF International Financial Statistics.

- The Global economy experienced recession in the 1970s as a result of an increase in the price of oil.
- Most mining concessions had depleted the iron ore deposits and the confidence of most investors was waning as a result of the change in the political leadership in 1970 and 1980.

- The country witnessed a bloody civil war in the 1990s.
- Cessation of hostility in 1995 and general and presidential elections conducted in 1997 which ushered in a legitimate government.
- Creation and policy interventions by the Central Bank of Liberia in 1999 following the elections.

13 Research Problem

There have been a number of formal empirical attempts to identify the threshold level in the inflation-growth relationship. These include, for instance, Ghosh and Phillips (1998), Sarel (1996), and Khan and Senhadji (2001). These studies report that for economies with initially low rates of inflation, modest increases in the rate of inflation do not affect long-run rates of real economic growth. But for economies with initially high rates of inflation, like that of Liberia, further increases in the inflation rate have adverse effects on real economic growth. Khan and Senhadji (2001) found that the threshold rate of inflation is fairly low- around 1-3% for industrialized countries and 7-11% in developing countries.

The Liberian government's fiscal and monetary policies are vigorously pursuing low inflation and high economic growth as the government endeavors to restore economic stability in the country. At present, inflation stands at 20% and economic growth which slightly rose to 9% in 2007 declined to 7% in 2008 as a result of the melt-down in the global economy (Republic of Liberia, 2008). Liberia is currently under pressure from the international lending agencies (IMF, the World Bank, and ADB) to reduce its inflation rates in order to boost economic growth, but two extensive recent works (Bruno and Easterly, 1998 and Paul, Kearney and Chowdhury, 1997) do not shed much light on the right approach to do so. Given that there is no empirical evidence of the relationship between inflation and economic growth in Liberia, this study attempts to answer the following research questions:

(i) Does inflation stimulate economic growth?

(ii) Is there a statistically significant threshold level of inflation above which inflation affects growth differently than at lower inflation rates?

(iii)How low should inflation be to influence economic growth?

(iv)Or put differently; is there a level of inflation at which the relationship between inflation and economic growth becomes positive?

(v) What is the direction of causality?

These questions are examined using new econometric methods for threshold estimation and inference[7].

1.4 Objectives of the Study

The primary objective of the study is to examine the nature of the relationship between inflation and economic growth in the Liberian economy.

The specific objectives of the study are to:

1. Estimate the optimal level of inflation in Liberia.
2. Determine and establish the direction of causality
3. Draw up policy recommendations to inform macroeconomic policy initiatives in Liberia.

The study tests the null and alternate hypotheses of $//_0 = 0$ and $//, :y_2 * 0$, where y_2 is threshold effect. As Khan (2001) puts it, if a relationship between inflation and economic growth exists, then it should be possible in principle to estimate the inflexion point, or threshold, at which the sign of the relationship between the two variables would switch. Answers to these questions obviously depend on the nature and structure of the economy and hence varies from country to country. Consequently, this study endeavors to address these questions as it investigates the inflation-economic growth relationship in the context of Liberian economy

[7] These techniques have been developed by Bruce Hansen. See Hansen (1999, 2000).

thereby providing empirical basis upon which sound economic policy would be formulated and implemented.

1.5 Justification of the Study

An important debate has centered on the effects of inflation on economic growth. A central question in this debate has been whether inflation contributes to or detracts from economic growth. Felix (1961), Seers (1962), Baer (1967), Georgescu-Roegen (1970), and Taylor (1979, 1983) have advanced a structuralist argument that inflation contributes favorably to real growth. Alternatively, Campos (1961), Harberger (1963), and Vogel (1974) have argued that the inefficiencies produced by inflation reduce real growth.

At present, the Liberian government is under tremendous pressure to pursue inflation targeting and economic growth; but there exist no empirical evidence which dichotomizes the relationship between inflation and economic growth within the perspective of the Liberian economy. Hence, the uniqueness of this study is that, it tends to situate this relationship within the Liberian economy perspective thereby providing empirical evidence upon which macroeconomic policies would be formulated.

1.6 Organization of the Study

In Chapter One, an introduction of the study is presented; accounting for the background and overview of the Liberian Economy. The chapter also provides the problem statement, objectives, and justification of the study. Chapter Two discusses the theoretical and empirical literature as well as an overview of literature. Methodological issues are addressed in Chapter Three. The latter chapter presents model specification and model estimation as well as data collection technique and data analysis. Additionally, empirical results and interpretations are provided in Chapter Four and finally, Chapter Five presents the study's summary, conclusion and policy recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical Literature

2.1.1 Classical Framework

The Classical Growth Theory was propounded by Adam Smith. He postulated a supply side-driven model of growth in a production function expressed as follows:

Y=f{A,L,K,T)

Where Y is output, ***A*** is productivity, ***L*** is labour, ***K*** is capital and ***T*** is land, so output was related to labour, capital and land inputs. As a consequence, output growth function can be expressed as:

g, = HgA>gt>g,>g,)

Where output growth *(g_v)* was driven by population growth ($g,$), investment (g_t), land growth *(g,)* and increases in overall productivity (g_A).

Smith viewed savings as a creator of investment and hence growth, therefore, he saw income distribution as being one of the most important determinants of how fast (or slow) a nation should grow. The link between inflation and its tax effects on profits levels and output were not specifically articulated in classical theories. Nevertheless, the relationship between the two variables is implicitly suggested to be negative, as indicated by the reduction in firms' profit levels through higher wage costs.

2.1.2 Monetarism

The monetary theory was propounded by Milton Friedman, and it basically emphasized several key long-run properties of the economy. The Quantity Theory of Money linked inflation and economic growth by equating the total amount of spending in the economy to the total amount of money in existence. The theory proposed that inflation was the result of an increase in supply or velocity of money at a rate greater than the rate of growth in the economy. In summary, monetarism suggests that in the long-run. prices are mainly affected by growth rate in money, while having no real effect on growth. Inflation occurs if the growth in the money supply is higher than the economic growth rate.

2.1.3 Endogenous Growth Theory

The endogenous growth theory describes economic growth as being generated by factors within the production process, for instance, economies of scale, increasing returns or induced technological change. According to this theory, the economic growth rate depends on one variable: the rate of return on capital. Variables like inflation decrease the rate of return and this in turn reduces capital accumulation thereby reducing the growth rate. Other models of endogenous growth explain growth further with human capital. The implication is that growth depends on the rate of return to human capital, as well as physical capital. The inflation acts as a tax and hence reduces the return on all capital and the growth rate.

The finding of nonlinearity in the relationship between inflation and growth does not accord well with standard macroeconomic models. Nevertheless, recent studies provide some interesting insights about this relationship. Huybens and Smith (1998, 1999) argued that even predictable increases in the rate of inflation could impede economic growth by interfering with the ability of the financial sector to allocate resources effectively. Additionally, an increasing number of theoretical studies have attempted to explain how predictable changes in the rate of inflation affect the financial system and, therefore, long-term growth in a nonlinear way. In particular,

Azariadas and Smith (1996) and Choi et al. (1996) demonstrated that only when inflation exceeds certain "critical"[8] rates do informational frictions necessarily play a substantial role.

2.2 **Empirical Literature**

The investigations into the existence and nature of the link between inflation and growth has a long history. Although economists now widely accept that inflation has a negative effect on economic growth, researchers did not detect this effect in data in 1950s and the 1960s. A series of studies in the IMF Staff Papers around 1960 found no evidence of damage from inflation (Wai, 1959; Bhatia, 1960; Dorrance, 1963, 1966). Johanson (1967) found no conclusive empirical evidence for either a positive or a negative association between the two variables. Therefore, a popular view in the 1960s was that the effect of inflation on growth was not particularly important.

This view prevailed until the 1970s, when many countries, mainly in Latin America, experienced hyperinflation or chronic inflation. Numerous empirical studies were devoted to finding the effects of inflation in high-inflation countries. These studies repeatedly confirmed that inflation had a significant negative effect on economic growth, at least at sufficiently high levels of inflation. Therefore, today, the dominant view regarding the effects of inflation has changed dramatically. Many studies have estimated a negative relationship between inflation and economic growth. Nevertheless, other studies have established the opposite.

Khan and Senhadji (2001) scrutinized the issue of the existence of 'threshold*[9] effects in the relationship between inflation and growth, using econometric techniques. Their study considered whether there is a statistically significant threshold level of inflation above which inflation affects growth differently than at a lower rate. It also examined whether the threshold effect is similar across developing and industrial countries[10]. The authors used data sets from 140 countries and used growth rate in GDP recorded in local currencies and inflation measured by

' See selected materials in Azariadis and Smith (1996), Choi et al. (1996).

[9] See Khan and Senhadji (2001).

" Comprising both industrial and developing countries.

percentage change in consumer price index (CPI). In order to test for the existence of a threshold effect, a log model of inflation was estimated. With the threshold level of inflation unknown, the authors estimated it using conditional least squares (CLS) along with the other regression parameters. Empirical findings suggested that inflation levels below the threshold levels of inflation have no effect on growth, while inflation rates above the threshold have a significant negative effect on growth. The authors' findings were that the threshold is lower for industrialized countries (1-3%) than it is for developing countries (7-11%). The thresholds were statistically significant at 1% or less, implying that the threshold estimates were very robust.

Additionally, studies examining this kind of relationship have increased especially in the 1990s. These studies starting with Kormandi and Meguire (1985), Grimes (1991), Fischer (1993), DeGregorio (1993), Gylfason and Herbertsson (2001), Valdovinoz (2003), and Guerrero (2004) have revealed that inflation has negative effects on economic growth. In a study carried out by Kormandi and Meguire(1985) using data for 47 sample countries covering 1950-1977, it is observed that an increase in inflation by 1% reduces the economic growth by 0.57%. Fischer (1991) has stated that macroeconomic policy preferences like budget deficits and foreign exchange systems are important for economic growth. In a study carried out by Fischer (1993), it is reported that a negative relationship exists between economic growth and inflation and budget deficits. He found the direction of causality to flow from macroeconomic policies (such as inflation and budget deficits) to economic growth. According to Fischer's study (1993), inflation reduces growth, investments and productivity; public deficits reduce both capital accumulation and productivity increases.

Ghosh and Philips (1998) used a data set of 3,603 annual observations on real per capita GDP growth, and period average consumer price inflation, corresponding to 15 countries, over the period 1960-1996. The objective of the authors was to determine whether the inflation-growth correlation is robust. They also checked for non-linearity of the relationship. Their results revealed a negative relationship between inflation and growth. They found that, at very low rates of inflation (2-3% a year or lower), inflation and growth are positively correlated. Otherwise, inflation and growth are negatively correlated, but the relationship is convex. The authors also

found a threshold at 2.5% and a significant negative effect above this level. Similarly, the empirical results by Nell (2000) suggest that inflation within the single-digit zone may be beneficial, while inflation in the double-digit zone appears to impose slower growth.

Sarel (1996) used panel data set of 248 observations from 87 countries (including both industrial countries and developing countries) over the period 1970-1990, to test whether inflation has a negative effect on growth. In addition, the study examined the level of inflation at which the structural break occurs. The finding was that there is evidence of a structural break. The break was estimated to occur when the inflation rate is 8%. It was found that below this rate, inflation does not have any influence on growth or at best there may be a slight positive effect. Moreover, the author found out that when inflation rate is above 8%, the estimated effect of inflation on economic growth is negative, significant and robust.

Bruno and Easterly (1996) found no evidence of any relationship between inflation and growth at annual inflation rates of less than 40%. Nevertheless, they found a negative, shorter to medium term relationship between high inflation (more than 40%) and growth.

Using data for 21 countries covering the period 1961-1997, Grimes (1991) found a positive relationship between inflation and economic growth for the short term and a negative relationship between them for the long term. In his study covering 12 Latin American countries between 1950 and 1985, DeGregorio (1993) found a negative relationship between inflation and economic growth. Gomme (1993) found a negative relationship between inflation and economic growth.

Barro (1995) examined the five-year average data of 100 countries over the period 1960-90 using Instrumental Variable (IV) estimation method. Using different instrumental variables, he obtained a robust estimation result showing that an increase in average inflation by 10 percentage points per year would slow the growth rate of real per capita GDP by 0.2-0.3 percentage points per year. He argued that although the adverse influence of inflation on growth appeared small, the long-term effects on standards of living were actually substantial. Motley (1998) using data for the period 1960 -1990 found that an increase in inflation by 5% reduced economic growth by

0.1-0.5%, which is a fitting result for that period. Gylfason and Herbertsson (2001) review data onl70 countries between 1960 and 1992; they found both economically and statistically significant and strong relationship between inflation and economic growth. In his study covering 8 Latin American countries, Valdovinoz (2003) found a negative relationship using panel data for the period 1970 -2000. Guerrero (2004) conducted a study examining the countries which experienced hyperinflation in the previous periods and he hypothesized that inflation has a significant and strong negative relationship with economic growth even before reaching a certain threshold value.

In examining the cause of the negative relationship between inflation and growth, in addition to studies which assert that there is a strong relationship between them, Bruno and Easterly (1998) has established in their study that this relationship only arise in periods of crises with high inflation. Mallik and Chowdhury (2001), who examined the relationship between inflation and economic growth in the short and long term for four Asian countries using time series analysis, reported positive effect of inflation on growth and emphasized the importance of inflation on economic growth. Generally, studies stating that the effect of inflation on economic growth is a positive one are based on the idea that inflation increases the compulsory savings (Bruno and Easterly, 1995). Nevertheless, this result is based on the empirical analyses conducted using data for periods in which the growth rate is high and the inflation rate is relatively low (Ercel, 1999). When we look at studies on inflation and economic growth. Karaca (2003) has detected a one-way causality from inflation to growth and he has found that every one point increase in inflation between the 1987 and 2002 period has reduced the growth rate by 0.37 points. Berber and Artan (2004) found a similar relationship with the data covering the 1987 to 2003 period and they observed that an increase in inflation by 10% reduces the economic growth by 1.9%.

Li (2005) examines the relationship between inflation and economic performance and the transmission mechanisms by using data for 90 developing countries and 28 developed countries over the period 1961-2004. He used two datasets; the first dataset is based on the growth equation from the expenditure side and includes 117 countries: 90 developing countries and 27 developed countries. The second dataset is based on the growth accounting equation and includes

90 countries: 63 developing countries and 27 developed countries. Based on the data availability, the second dataset generally covers the period from 1961 to 1990 for developing countries and from 1961 to 2004 for developed countries. Because data for a number of developing countries have a shorter span and due to uneven coverage, the study used unbalanced panels. The evidence from his study strongly supports the view that the relationship between inflation and economic growth is nonlinear. The study further suggests that developing countries and developed countries show different forms of nonlinearity in the inflation-growth relationship. For developing countries, the data suggest the presence of two thresholds in the function relating economic growth and inflation. The nonlinear mechanism works as follows: at the rates of inflation lower than those of the first threshold, the effects of inflation on growth are insignificant and even positive; at moderate rates of inflation, which are between the two threshold levels, the effects of inflation are significantly and strongly negative; at extremely high rates of inflation, the marginal impact of additional inflation on economic growth diminishes rapidly but is still significantly negative. However, for developed countries, only one threshold was detected and proved significant. The nonlinear mechanism works as follows: the magnitude of the negative effect of inflation on growth declines as the inflation rate increases.

Additionally, his study reported the mechanism through which inflation affects long-run economic growth in a nonlinear fashion. Two possible channels, the capital accumulation channel and the Total Factor Productivity (TFP) channel are examined by using a linear model and a model with threshold effects. The finding was that, for both developing and developed countries, the TFP growth, but not the level of investment (investment/GDP), which is the channel, hypothesized by existing theoretical models, is the channel through which inflation adversely and nonlinearly affects economic growth. Moreover, at low to moderate inflation, inflation even has a significantly positive effect on the level of investment.

Much of the empirical literature on the relationship between inflation and economic growth reviewed earlier made general analysis based on panel and cross-panel data. However, most studies are now considering individual countries. The most recent studies are Erbaykal and Okuya (2008) and Seleteng (2006). Erbaykal and Okuya examined the relationship between

inflation and economic growth in Turkey in the framework of data covering the period 1987-2006. The study reports the existence of long term relationship between the two variables by using Bound Test developed by Pesaran et al. (2001), and the existence of a cointegration relationship between the two series was detected following the test result. The causality relationship between the two series was examined in the framework of the cauasality test developed by Toda (1995). The study concludes that there is no causality from economic growth to inflation, but a causality relationship was found from inflation to economic growth.

Seleteng (2004) estimates the optimal level of inflation in Lesotho by using quarterly time-series dataset for the period 1981-2004. He converted the data from annual to quarterly time-series by applying cubic interpolation technique embedded in Eviews econometric software. The study adopted the model developed by Khan and Senhadji (2001). The findings report a 10% optimal level of inflation above which inflation is detrimental to economic growth.

23 **Overview of the Literature**

From the above review of both theoretical and empirical literature, it becomes clearer that there is conflicting relationship between inflation and economic growth. It therefore becomes imperative and essential for developing economies to study and establish empirical evidence on the relationship between inflation and economic growth upon which macroeconomic policies should be predicated. This study seeks to do so.

CHAPTER THREE

METHODOLOGY

3.1 Model Specification

The model to be used in this study is adopted from the one developed by Khan and Senhadji (2001) for the analysis of the threshold level of inflation for industrialized and developing countries. This model is based on the production function:

$$Y=f(A,L,K,T) \quad (1)$$

where Y is output, A is productivity, L is labour, K is capital and T is land, so output was related to labour, capital and land inputs. As a consequence, output growth function is expressed as follow;

$$g,=MgA>8k>8»8i) \quad (2)$$

where output growth (g_v) was driven by population growth ($g,$), investment (g_k), land growth ($g,$) and increases in overall productivity (g_A).

To test for the existence of a threshold effect, the following model will be estimated:

$$d\log(gdp,) = u,+/_1 \log(\text{inf},) + y_2 df\,[\log(\text{inf},) - \log(\text{inf}')] + OX, + <r; \quad (3)$$

$$imf\_U/mtJOTf''._,\ j-$$
$$-\ \text{lot/ni(dnr}$$

where $d\log(gdp,)$ is the change in log GDP, u,is a time effect, inf, is inflation, inf' is the threshold level of inflation, $d_t^{m_t}$ is a dummy variable that takes a value of one for inflation levels greater than inf' percent and zero otherwise, $X,$ is a vector of control variables which includes

foreign direct investment ($\log(fdi)$), investment rate (IVT), exchange rate(£A^r), export (log(jc)) and e, is the error term. The index "/" is the time-series index. A regression of GDP growth on the level of inflation would give much weight to the extreme inflation observations, even though the bulk of the observations correspond to low and medium inflation rates. As suggested by Sarel (1996), the log transformation eliminates, at least partially, the strong asymmetry in the inflation distribution. In the class of nonlinear models, Ghosh and Phillips (1998) show that the log transformation provides the best fit. Lastly, the log transformation can be justified by the fact that its implications are more plausible than that of a linear model. In particular, the linear model implies that additive inflation shocks will have identical effects on growth in low- and high-inflation economies, while the log model implies that multiplicative inflation shocks will have identical effects on low- and high- inflation economies. For the above reasons, inflation appears in logs in equation (3). The subtraction of log(inf') from log(inf,) makes the relationship between growth and inflation, described by equation (3), continuous at the threshold level inf*.'[1]

Note that $\boldsymbol{X}_t$ contains only the most important variables among the large set found in the empirical growth literature because very few of these variables pass the robustness tests in Levine and Renelt (1992) and Sala-i-Martin (1997). The model explicitly takes into account the time effect through u_t. The effect of inflation on GDP growth is given by if inflation is less or equal to inf* percent, and $+ y_2$ if inflation rate is higher than inf' percent.

In order to smooth out business cycle fluctuations and focus on short- and long-term relationship between inflation and growth, equation (3) would be estimated based on annual data from Liberia for the period 1960 -2007. Hence, there are 48 annual observations. Stacking the observation in vectors yields the following compact notation for equation (3):

Continuity of the relationship given by equation (1) is desirable, otherwise small changes in the inflation rate around the threshold level will yield different impacts on growth depending on whether inflation is increasing or decreasing.

$$d \log (gdp) = Xp_{mf} + e., \text{ inf} = \text{inf},..., \text{inf} \quad (4)$$

Where $P, =(ujj_2 6)$ is the vector of parameters and A' is the corresponding matrix of observations on the explanatory variables. Note that the coefficient vector p is indexed by inf to show its dependence on the threshold level of inflation, the range of which is given by inf and inf . The optimal threshold level inf* is chosen so as to minimize 5, (inf), where 5, is the residual sum of square under //, : y_2 * 0 , that is:

$$\text{inf}'=\text{argmin}_{\text{mf}}\{s,(\text{inf}),\text{inf} = \text{inf},...,\text{inf}\} \quad (5)$$

It is important to determine whether the threshold effect is statistically significant. In equation (3), to test for no threshold effect amounts simply to testing the null hypothesis $H_0 : /_2 = 0$. Under the null hypothesis, the threshold inf* is not identified, so classical tests, such as the *I-test,* have nonstandard distributions. Hansen (1996, 1999) suggests a bootstrap method to simulate the asymptotic distribution of the following likelihood ratio *test* of H_0 :

$$JL/?_o=(S_0-S,)/<7^2 \quad (6)$$

Where S_0, and S, are the residual sum of squares under $H_0: y_2 = 0$. and $H_j: y_2$* 0, respectively; and a' is the residual variance under //,. In other words, S_0 and S, are the residual sum of squares for equation (3) with and without threshold effects, respectively. The asymptotic distribution of $LR_{,}$ is nonstandard and strictly dominates the ^distribution. The distribution of LR_n depends in general on the moments of the sample; thus critical values cannot be tabulated. Hansen (1999) shows how to bootstrap the distribution of LR_a.

An interesting question is whether an inflation threshold, for example, of 10% is significantly different from a threshold of 8% or 15%. In other words, can the concept of confidence intervals be generalized to threshold estimates? Hansen (2000) shows that the best way to form a

confidence region for inf* is to form the "no-rejection region"" using the likelihood ratio statistic for tests on inf . To test the hypothesis H_0 : inf" = inf,, the following likelihood ratio test would be computed:

$$LR_t(inf) = (S,(inf') - S,(inf,)) / d^2 \quad (7)$$

Where 5,(inf')and S,(inf,)are the residual sum of squares from equation (3) with threshold inf* and inf,, respectively; and <r^{2}is the residual variance from equation (3) with thresholds,. Note that LR_o tests the existence of a threshold effect while L/f, tests the equality of two potential thresholds. Hansen (2000) shows that, LR} (inf,) converges in distribution to £as oo, where £is a random variable with the following simple distribution function < x) = (1 - exp(-x/2))^2 which can be inverted to yield $c(a) = -2\log(1 - y\backslash - a)$, where c(a)is the a percent critical value. A test H_0: inf' = inf, rejects at the asymptotic level a if LR_j(inf,)exceeds$c(a)$. Under//,, the standard hypothesis tests on all parameters other than the threshold inflation parameter can be carried out as usual.

To determine the extent to which economic growth is related to inflation and vice versa, the theory of cointegration and Error Correction Models (ECM) is considered. With the help of this procedure it is possible to examine the short-run and long-run relationships between two variables. The Engle-Granger (1987) two-step cointegration procedure is used to test the presence of cointegration between inflation and growth. If both time series are integrated of the same order then it is possible to proceed with the estimation of the following cointegration regression:

$$dloggdp, = a,, + b_u \inf, + n, \quad (8a)$$

$$\inf, = a_2, + b_{2J} d\backslash oggdp_l + 7, \quad (8b)$$

where d log is change in log GDP, inf, is inflation rate at time /, and //,and 77, are random error terms (residuals). Residuals and 77, measure the extent to which *d* log *gdp,* and inf, are out of equilibrium. If p, and 77, are integrated of order zero, 1(0), then it can be said that both *d* log *gdp,* and inf, are cointegrated and not expected to remain apart in the long run. If cointegration exists, then information on one variable can be used to predict the other.

There are few other techniques for testing for and estimating cointegrating relationship in the literature. Of these techniques, the Johansen (1988) and Johansen and Juselius (1990) maximum-likelihood test procedure is the most efficient as it tests for the existence of a third cointegrating vector. This procedure gives two likelihood ratio tests for the number of cointegrating vectors: (a) the maximal Eigen value test, which tests the null hupothesis that there are at least *r* cointegration vectors, as against the alternative that there are r + 1, and (b) the *trace - lest,* where the alternative hypothesis is that the number of cointegrating vectors is equal to or less than r +1.

In principle, there can be a long-run or equilibrium relationship between two series in a bivariate relationship only if they are stationary or if each series is at least integrated of the same order (Campbell and Perron, 1991). That is, if two series are integrated of the same order, /(d) for *d* = 0,1**,2...** then the two series are said to be cointegrated and the regression on the same levels of the two variables is meaningful (not spurious and no long-run information is lost). Therefore, the first task is to check for the existence of stationarity property in the series for GDP growth *d* log *(gdp)* and inflation rate (>"0.

To determine the non-stationary property of each variable, each of the series would be tested at its levels (l°g of GDP growth and log of inflation rate) and in the difference (growth and inflation rate). First, the DFtest is used (Dickey and Fuller, 1979) and then the ^^ test (Dickey and Fuller, 1981) with and without a time trend. The latter allows for higher autocorrelation in residuals. That is. equation of the following form is considered:

$$A^*, = A + y\backslash X_{,A} + £ \inf 1 \quad + \qquad (9)$$

However, as pointed out earlier, the *ADF* tests are unable to discriminate well between non-stationary and stationary series with a high degree of autoregression. It is therefore possible that inflation, which is likely to be highly autocorrelated, is in fact stationary although the *ADF* tests show that it is non-stationary. The *ADF* tests may also incorrectly indicate that the inflation series contain a unit root when there is a structural break in the series (Culver and Papell, 1997).

Consequently, the Phillips-Perron *{PP)* test (Phillips and Perron, 1988) would be applied. The *PP* test has an advantage over the ADF test as it gives robust estimates when the series has serial correlation and time-dependent heteroscedasticity, and there is a structural break. For the *PP* test, the equation of the form below would be considered for estimation:

$$AX,=a+ y2X,_{\_x} + fl/ -1 + £ gxAX,^{\wedge} + e_{2l} \qquad (10)$$

In both equations (9) and (10), A j_s the first difference operator and ^i, and $^{£}$2i are covariance stationary random error terms. The lag length ^{n} is determined by Akaike's information Criteria (A1C) (Akaike, 1973) to ensure serially uncorrected residuals and ^{m} (for PP test) is decided according to Newley-West's (Newley and West, 1987) suggestions which state that the PP test has an advantage over the *ADF* test as it gives robust estimates when the series has serial correlation and time-dependent heteroscedasticity, and there is a structural break.

The null hypothesis of non-stationarity is tested using the ***t-statistic y^*** critical values calculated by Mackinnon (1991). The null hypothesis that ***gdp,*** and inf,are non-stationary time series is rejected if /land /2are less than zero and statistically significant for each. Given the inherent weakness of the unit root test to distinguish between the null and the alternative hypotheses, both *DF-ADF* tests would be applied following Engle and Granger (1987) and Granger (1986), and subsequently supplemented by the PPtest following West (1988) and

Culver and Papell (1997). These tests would be carried out for both variables by replacing *X,* with *y,* and in equations (9) (for the *DF-ADF*tests) and (10) (for the ^test).

*DF- ADF- PP*unit root tests would also be applied for residuals [u], and 7, (from equations (8a) and (8b) by re-specifying equations (9) and (10) in terms of and H, instead of X,. When [u], and are found to be integrated of order zero then it can be concluded that these two series are cointegrated. If the hypothesis of no integration is rejected, a stable long-run relationship exists between economic growth and inflation.

According to Engle and Granger (1987), when gdp, and inf,are found to be cointegrated then there must exist an associated error correction mechanism (ECM) that may take the following form:

$$A gdp_t = \#10 + O' A inf + \hat{}<t>\backslash Hbgdp_{,\_,} + p\backslash ti_{,,x} \quad (11a)$$

$$A inf_t = \#20 + £\#21/Ag4>,-y + \&22iMnf_{t\_l} + p2Tj_{l\_l} + e_{Al} \quad (11b)$$

Where A denotes the first difference operator, M-i and -i are error correction terms. •>'and ^are the number of lag lengths (determined by AIC) and and ^are random disturbance terms. Here ' begins at one and *j* begins at zero in order for the series to be related within a structural ECM (Engle and Yoo, 1991). The error correction terms /Viand -i(which are the residual series of the cointegrating vector normalized for gdp, and [inf(]) measure deviations of the series from the long-run equilibrium relations. For the series to converge to the long-run equilibrium relation. $0 < p\backslash,p2 < 1$ should hold. Nevertheless, cointegration implies that not all *P*^, should be zero.

3.2 **Model Estimation**

The first step is to test for the existence of a threshold effect in the relationship between GDP growth and inflation using the likelihood ratio, LR^ discussed in equation (6). This implies estimating equation (3) and computing the residual sum of squares (RSS) for threshold levels of inflation ranging from infto>nf. The optimal threshold level is the one that minimizes the sequence of RSS. The generalized least squares (GLS) will be used in consistence with all the necessary econometric tests.

After establishing the existence of a threshold for the sample, the next important question is to determine how precise these estimates are. This requires the computation of the confidence region around the threshold estimate. While the existence of threshold effects in the relationship between inflation and growth is well accepted, the precise level of the inflation threshold is still subject to debate especially in developing countries, like Liberia. Indeed, as discussed earlier, based on existing studies, the range could be between 2.5% and 40%. If the confidence region shows that the threshold estimate is not significantly different from a large number of other potential threshold levels, that would imply that there is substantial uncertainty about the threshold level. The confidence region would be constructed using the likelihood ratio

defined by equation (7).

lastly, the study examines the cointegrating relationship between economic growth and inflation. First, cointegrating equations (8a) and (8b) would be estimated after all the tests discussed earlier. Similarly, equations (11a) and (1 lb) would be estimated to present the long-run effects and the lagged values of the two series (short-run effects).

33 Data Collection Techniques

In this study we use secondary annual-time-series data for the period 1960 to 2008, on GDP growth(*d \og(gdp,)*), inflation (inf,), the vector of control variables (A',) which includes foreign direct investment *(\og(Jdi)),* investment rate (*IVT*), exchange rate(£X), and

exports(log(x)). The data for use in this study are acquired from the Central Bank of Liberia. Ministry of Finance, Liberia Institute of Statistics and Geo-Information Services (LISGIS), World Bank's Global Development Network Growth Database and the IMF International Financial Statistics. The study makes use of Eviews, Pcgive and STATA softwares in the analysis of the data.

3.4 Description of Variables

Table 3.4: Variable Definition

Variable	**Definition**
d log gdp	Annual change in gross domestic product
Inf	Annual inflation
i Fdi	Annual gross foreign direct investment (millions of LD)
| Ivt	Annual investment rate
X	Annual gross exports (millions of L $)
Ex	Exchange rate per US $

CHAPTER FOUR

EMPIRICAL FINDINGS AND DISCUSSION OF RESULTS

4.1 Descriptive Statistics

Before embarking on the details of empirical finding, it is important to examine whether the data exhibits normality. Most economic data is skewed (non-normal), possibly due to the fact that economic data has a clear floor but no definite ceiling. Also it could be the presence of outliers. The Jarque-Bera test statistics is used to test normality of the series. It utilizes the mean based coefficients of skewness and kurtosis to check normality of variables used. Skewness is the tilt in the distribution and should be within the -2 and +2 range for normally distributed series. Kurtosis is the peakedness of a distribution and should be within -3 and +3 range when data is normally distributed. Normality test uses the null hypothesis of normality against the alternative hypothesis of non-normality. If the probability value is less than Jarque-Bera chi-square at the 5% level of significance, the null hypothesis is not rejected. Table 4.1 gives the summary of the descriptive statistics of the data used in the study. The normality test shows that foreign direct investment (FDI), investment rate (IVT), exchange rate (EX), inflation (INF) and export (X) are not normally distributed. This is likely to impair the normality of the residuals forming the long-run relationship.

The descriptive statistics among others do give guidance on which of the equations is able to yield better results and to highlight the possible problems one may encounter. However, there is need to supplement the statistics by more incisive quantitative analysis such as the correlation matrix.

Table 4.1 Summary of Descriptive Statistics

	Change in gdp	Foreign Direct Investmet	Investment Rate	Inflation	Export	Exchange Rate
Mean	5.130	20.424	6.307	1.178	0.999	43.946
Median	4.310	20.404	5.837	1.145	1.060	50.016
Maximum	1.040	20.993	15.961	8.240	2.149	82.910
Minimum	1.320	20.077	2.973	-1.997	-2.370	2.444
Standard Deviation	2.840	0.151	3.481	1.621	0.711	23.867
Skewness	1.415	1.252	1.122	1.580	-2.000	-0.294
Kurtosis	1.803	2.239	-3.478	2.803	2.793	1.903
Jarque-Bera	4.244	33.509	10.526	85.499	244.790	3.099
Probability	0.119744	0.05201	0.005181	0.060	0.070	0.212
Observation	48	48	48	47	41	48

The correlation matrix is an important indicator that tests the linear relationship, between the explanatory variables. The matrix also helps to determine the strength of the variables in the model, that is, which variable best explains the relationship between GDP and its determinants. This is important and helps in deciding which variable(s) to drop from the equation. Table 4.2 presents the correlation matrix of the variables in levels.

Table 4.2: Correlation Matrix at Levels

	Log of Gross Domestic Product	Log of Foreign Direct Investment	Inflation	Investment Rate	Log of Export	Exchange Rate
Log of Gross Domestic Product	1	0.4452	0.628	0.2153	0.1222	-0.0360
Log of Foreign Direct Investment	0.4452	1	0.404	0.0778	-0.1058	0.0161
Inflation	0.6278	0.4044	1.000	-0.0474	0.1074	-0.2501
Investment Rate	0.2153	0.0778	-0.047	1	0.0813	0.6924
Export	0.1222	-0.1058	0.107	0.0813	1	-0.1885
Exchange Rate	-0.0360	0.0161	-0.2501	0.6924	-0.1885	1

Table 4.2 shows that correlation between independent variables is not strong hence no serious problem of multicollinearity.

4.2 Time Series Properties

Non-stationarity of time series data has often been regarded as a problem in empirical analysis. An important step is therefore to test for stationarity of the variables. The Augmented Dickey-Fuller (ADF) tests are used to test for stationarity of the series. The results of the test for the variables at levels are presented in Table 4.3

Table 43: Unit Root Tests at Levels

Variable	ADF Statistics	1% Critical Value	5% Critical Value	Comments
Log of Gross Domestic Product	-2.628	-3.581	-2.927	Non stationary
Inflation	-3.514	-3.581	-2.927	Non stationary
Log of Foreign Direct Investment	-2.762	-3.581	-2.927	Non stationary
Investment Rate	-2.257	-4.173	-3.511	Non stationary
Log of Export	-2.657	-3.581	-2.927	Non stationary
Exchange Rate	-1.430	-3.581	-2.927	Non stationary

The tests show that all the variables are non stationary at levels. The percentage change in growth rate of gross domestic product, foreign direct investment, investment rate , inflation and exports are stationary after first differencing I (1), while exchange rates are stationary after second differencing I (2). This is shown in Table 4.4.

Table 4.4: Unit Root Tests at First and Second Difference

Variable	ADF Statistics	1% Critical Value	5% Critical Value	Order of Integration
D Log of Gross Domestic Product	-4.001	-3.588	-2.930	I(D
D Inflation	-7.531	-3.585	-2.928	1(1)
D Log of Foreign Direct Investment	-5.838	-4.178	-3.514	K D
D Investment Rate	-3.622	-3.585	-2.928	I d)
D Export	-4.082	-3.585	-2.928	1(1)
DExchange Rate	**-3.558**	**-3.585**	**-2.929**	Id)
DD Exchange Rate	-6.307	-3.588	-2.930	1(2)

43 **Cointegration Analysis**

After finding out the order of integration we next attempted to establish whether the non-stationary variables at levels are cointegrtated. Differencing of variables to achieve stationarity leads to loss of long-run properties. The concept of cointegration implies that if there is a long-run relationship between two or more non-stationary variables, deviations from this long-run path are stationary. To establish this, the Engel-Granger two step procedure is used. The gist of this method is that there is some adjustment process that prevents the errors in the long-run relationship from becoming larger indefinitely (Error Correction Mechanism- ECM). In this case, we therefore first estimate a static (long run) model using the least squares method. The generated residuals from the long-run equation of the non-stationary variables are then tested using the ADF. The results of cointegrating regression are reported in Table 4.5.

Table 4.5: Cointegrating Regression, Reporting the Long-Run Relationship

Dependent Variable: Log of Gross Domestic Product				
Included observations: 41				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	10.424	5.593	1.864	0.072
Log of Foreign Direct Investment	0.527	0.274	1.922**	0.064
Investment Rate	0.112	0.025	4.433***	0.001
Dummy Variable	-0.187	0.121	1.539*	0.134
Dummy Variable for War	-0.243	0.091	2.655***	0.012
Exchange Rate	0.006	0.003	2.062***	0.047
Inflation	0.107	0.021	5.054***	0.001
(Log of Export	0.079	0.049	1.611*	0.117
jR-squared	0.669	Akaike info criterion		0.259
Adjusted R-squared	0.586	Schwarz criterion		0.118
jS.E. of regression	0.193	F-statistic		8.084
Durbin-Watson stat	2.007	Prob(F-statistic)		0.001*

***, **, * indicate significant levels at 10%, 5% and 1% respectively.

The long-run relationship for gross domestic product (GDP) growth is thus expressed as:

LNGDP = **10.424** + **0.526*LNFDI** + **0.112*IVT** - **0.186*DM** - **0.242*SER01** + **0.005*EX** + 0.106*INF + **0.079*LNX**

4.5 Unit Root Test of the Error Correction Term

The error term (residual) derived from the cointegration regression is tested for stationarity. Table 4.6 reports the stationarity test for the residual of the co-integrating regression.

Table 4.7: Unit Root Test of the Error Correction Term (ECM-1)

ADF Test Statistic	-4.0471	1% Critical Value	-3.6752	
		5% Critical Value	-2.9665	
		10% Critical Value	-2.6220	

The residuals are found to be stationary at 1%, 5%, and 10% levels of significance for both tests, which support the existence of cointegrating relationship in the estimation equation. Hence, the residuals become the error correction term and consequently, an error correction formulation is adopted.

4.6 Error Correction Modeling and Interpretations

After accepting cointegration, the next step was to re-specify the equation to include the error correction term (ECM). This term captures the long-run relationship. It reflects attempts to correct deviations from the long-run equilibrium and its coefficient which can be interpreted as the speed of adjustment or the amount of disequilibrium transmitted each period to economic growth. The results of the error correction model are presented in Table 4.8. Before embarking on the discussion of the regression results, the error correction model was subjected to number of diagnostic tests in order to evaluate its validity. The diagnostic test outcomes were statisfactory. See section 4.10 for details of the diagnostic results and analysis.

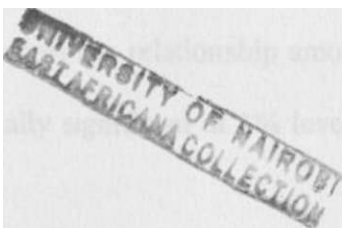


Table 4.8: Error Correction Model Reporting the Short-Run Relationship

Dependent Variable: DLog Gross Domestic Product				
Included observations: 40				
Excluded observations: 6 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	10.4959	2.4626	-4.262	0.0002
DLog Foreign Direct Investment	0.5249	0.1207	4.347	0.0001
Din vestment Rate	0.0736	0.0086	8.473	0.0021
Dummy for War	-0.1098	0.0336	-3.261	0.0028
DInflation	0.0989	0.0091	10.821	0.0002
Dlog Export	0.0519	0.0220	2.353	0.0254
DExchange Rate	0.0038	0.0012	3.156	0.0036
Dummy Variable	0.0181	0.0511	1.355	0.0250
Lag Error Correction Mechanism	-1.0090	0.0822	12.265	0.0025
R-squared	0.940324	Mean dependent var		0.100000
Adjusted R-squared	0.922421	S.D. dependent var		0.303822
S.E. of regression	0.084623	Akaike info criterion		1.888897
1 Sum of squared L	0.214833	Schwarz criterion		1.466677
Log likelihood 1	47.77795	F-statistic		52.52404
Durbin-Watson stat	1.972413	Prob(F-statistic)		0.000005

Table 4.8 reports the regression results for the existence of a short-run relationship among the variables. Notice that **F**-statistic in both regressions is statistically significant at **1%** level, thus

implying that all the coefficients of explanatory variables are statistically significant, i.e, foreign direct investment (FDI), investment rate (IVT), dummy variable for war (SER01), inflation rate (INF), exports (X), exchange rate (EX), all influence growth of gross domestic product. The regression performed indicates goodness of fit with an adjusted *R of 92%* implying that all explanatory variables explain the deviations of regression from the actual fit, while the residuals explains only 8%.

The lagged error correction mechanism (ECM) included in the growth model to capture the long-run dynamics between the cointegrating series bears the correct sign (negative) and statistically significant. It indicates a rapid response of output to deviations from long-run relationship with each of the variables. In particular, negative deviations from the stationary relationship are "corrected" by increases in output. The ECM coefficient which is **(-1.0090)** implies that about 100% of the discrepancy between actual and equilibrium value of gross domestic product (GDP) is corrected each period. Thus, there are economic forces in the economy, which operate to restore the long-run equilibrium path of the gross domestic product (GDP) following short-run disturbances.

4.4 Granger Causality

Table 4.6 shows the results of the Granger- Causality test between inflation and economic growth.

Table 4.6: Granger Causality Test Results

Table 4.6 reports the results of the Granger-Causality between inflation and economic growth.

Table 4.6: Granger Causality Test

Sample: 1960 2007 Lags: 2 Null Hypothesis:	Obs	F-Statistic	Probability
Dlog Inflation does not Granger Cause Log gdp	45	2.30128	0.00154
Log gdp does not Granger Cause Dlog Inflation		1.74668	0.00913

The test statistics in Table 4.6 show that the null hypothesis is rejected: which means that inflation rate Granger-Causes GDP growth. The causality between the two variables is two-directional. The second null hypothesis of economic growth Granger-Causes inflation is also rejected, which implies that there is a two-way causality between economic growth and inflation. This finding is consistent with the empirical finding of **Seleteng** (2004). Seleteng estimates the optimal level of inflation in Lesotho by using quarterly time-series data for the period 1981-2004. The study reports that the causality between inflation and economic growth is two-directional.

4.7 Tests for Existence of Threshold Effects

In order to test for the existence of a threshold effect in the relationship between GDP growth and inflation we use the likelihood ratio, $\boldsymbol{LR_0}$ discussed in equation (6). This implies estimating equation (3) and computing the residual sum of squares (RSS) for threshold levels of inflation ranging from $\inf$ to $\inf$. The optimal threshold level is the one that minimizes the sequence of RSS. The results are reported in Table 4.9.

Table 4.9: Estimation of Log-Linear Model (at u=l to 30%)

Dependent variable: d log gdp						
U	Variable	Coefficient	Std. Error	t-stats.	Prob.	RSS
1%	Inflation ^>g(inf,)-Iog(inr)] I.og of Foreign Direct lnv Investment Rate Log of Export Exchange Rate Constant	**0.0429** -0.1735 0.1482 0.0853 0.0791 1.3906 5.9429	**0.0223** **.01429** **0.0821** **0.0543** **0.0572** **0.9877** **1.8498**	**1.92** **-1.21** **-0.81** **-1.81** **0.176** **14.08** **-3.21**	**0.062** **0.233** **0.08** **0.10** **0.176** 0.000 **0.003**	**1.9159**
14%	Inflation d,**' [log(inf,) - log(inf')] Log of Foreign Direct lnv Investment Rate Log of Export Exchange Rate Constant	**0.1010** -0.0883 0.1312 -0.1317 0.0878 1.4053 -6.1023	0.0554 0.7723 0.4320 0.0832 0.0597 0.0997 1.8651	1.82 **-1.14** 1.50 -1.58 1.47 14.09 -3.27	0.077 0.260 0.023 0.122 0.150 0.001 0.002	1.8468
7%	Inflation d,M' [log(inf,) - log(inf*)] Log of Foreign Direct lnv Investment Rate Log of Export	-0.0821 -0.0594 0.08778 -0.1297	0.0500 0.0679 0.0676 0.0849	1.64 -0.88 1.08 -1.53	0.110 0.387 0.005 0.136	

	Exchange Rate	0.0821	0.0599	1.37	0.180	1.8748
	Constant	1.4006	0.1003	13.96	0.000	
		-6.0171	1.8756	-3.21	0.003	
10%	Inflation	-0.6976	0.0443	1.57	0.125	
	[log(inf,) - log(inf')]	-0.0420	0.0599	-0.70	0.487	
	Log of Foreign Direct Inv	0.3421	2.6543	1.34	0.005	
	Investment Rate	-0.1328	0.0853	-1.56	0.128	
	Log of Export	0.0811	0.1043	-6.53	0.196	1.8893
	Exchange Rate	1.3976	0.1005	13.90	0.000	
	Constant	-5.9762	1.8816	-3.18	0.000	
					0.003	
13%	Inflation	-0.7013	0.0360	1.95	0.060	
	[log(inf,) - log(inf*)]	-0.0480	0.0498	-0.96	0.342	
	Log of Foreign Direct Inv	0.2310	0.3254	1.06	0.210	
	Investment Rate	-0.1291	0.0845	-1.53	0.136	
	Log of Export	0.0828	0.0595	1.39	0.173	1.8665
	Exchange Rate	1.3941	0.0995	14.00	0.000	
	Constant	-5.8903	1.8628	-3.16	0.003	
15%	Inflation	0.0763	.03389	2.25	0.031	
	<nf'[log(inf,)-log(inf)]	-0.0615	0.0472	-1.30	0.201	
	Log of Foreign Direct Inv	0.2136	0.2310	1.03	0.012	
	Investment Rate	-0.1303	0.0827	-1.58	0.124	1.8273
	Log of Export	0.0868	0.0583	1.49	0.146	
	Exchange Rate	1.3973	0.0985	14.17	0.000	
	Constant	-5.9627	1.8446	-3.23	0.003	

16%	Inflation	-0.0839	0.0323	2.60	0.014	
	^mf'[log(inf,)-log(inf)]	-0.776	0.0451	-1.72	0.094	
	Log of Foreign Direct Inv	0.2186	0.2143	1.50	0.123	
	Investment Rate	-0.1218	0.0816	-1.49	0.145	1.7668
	Log of Export	0.0909	0.0569	1.60	0.119	
	Exchange Rate	1.3925	0.0968	14.38	0.000	
	Constant	-5.8780	1.8121	-3.24	0.003	
17%	Inflation	-0.0839	0.0323	2.60	0.014	
	[log(inf,)-log(inf*)]	-0.776	0.0451	-1.72	0.094	
	Log of Foreign Direct Inv	0.2186	0.2143	1.50	0.123	
	Investment Rate	-0.1218	0.0816	-1.49	0.145	
	Log of Export	0.0909	0.0569	1.60	0.119	1.7668
	Exchange Rate	1.3925	0.0968	14.38	0.000	
	Constant	-5.8780	1.8121	-3.24	0.003	
18%	Inflation	-0.0839	0.0323	2.60	0.014	
	['og(inf,) - log(inf*)]	-0.776	0.0451	-1.72	0.094	
	Log of Foreign Direct Inv	0.2186	0.2143	1.50	0.123	
	Investment Rate	-0.1218	0.0816	-1.49	0.145	
	Log of Export	0.0909	0.0569	1.60	0.119	1.7668
	Exchange Rate	1.3925	0.0968	14.38	0.000	
	Constant	-5.8780	1.8121	-3.24	0.003	
19%	Inflation	-0.0839	0.0323	2.60	0.014	
	t/,mr' [log(inf,) - log(inf*>]					

	Log of Foreign Direct Inv	-0.776	0.0451	-1.72	0.094	
	Investment Rate	0.2186	0.2143	1.50	0.123	
	Log of Export	-0.1218	0.0816	-1.49	0.145	1.7668
	Exchange Rate	0.0909	0.0569	1.60	0.119	
	Constant	1.3925	0.0968	14.38	0.000	
		-5.8780	1.8121	-3.24	0.003	
20%	Inflation	0.07545	0.0311	2.42	0.021	
	<//[nf]'[log(inf,)-log(inf')]	-0.06597	0.0447	-1.48	0.149	
	Log of Foreign Direct Inv	0.1386	0.2043	1.30	0.103	
	Investment Rate	-0.1294	0.0820	-1.58	0.124	
	Log of Export	0.0861	0.0573	1.50	0.141	**1.8038**
	Exchange Rate	1.3920	0.0978	14.23	0.000	
	Constant	-5.8653	1.8309	-3.20	0.003	
1 21%	Inflation	**0.0429**	**0.0223**	**1.92**	**0.062**	
	£/™[f] [log(inf,) - log(inf')]	-0.1735	**.01429**	**-1.21**	**0.233**	
	Log of Foreign Direct Inv	0.1482	**0.0821**	**-0.81**	**0.08**	
	Investment Rate	0.0853	**0.0543**	**-1.81**	**0.10**	**1.9159**
	Log of Export	0.0791	**0.0572**	**0.176**	**0.176**	
	Exchange Rate	1.3906	**0.9877**	**14.08**	0.000	
	Constant	5.9429	**1.8498**	**-3.21**	**0.003**	
L						
' 25%	Inflation	**0.0429**	**0.0223**	**1.92**	**0.062**	
	d,[mf]' [log(mf]) - log(inf')]	-0.1735	**.01429**	**-1.21**	**0.233**	
	Log of Foreign Direct Inv	0.1482	**0.0821**	**-0.81**	**0.08**	
	Investment Rate	0.0853	**0.0543**	**-1.81**	**0.10**	**1.9159**
		0.0791	**0.0572**	**0.176**	**0.176**	

	Log of Export					
	Exchange Rate	1.3906	**0.9877**	**14.08**	0.000	
	Constant	5.9429	**1.8498**	-3.21	**0.003**	
28%	Inflation	**0.0429**	**0.0223**	**1.92**	0.062	
	d;[f]'[log(inf,)-log(inf)]	-0.1735	**.01429**	**-1.21**	**0.233**	
	Log of Foreign Direct Inv	0.1482	0.0821	-0.81	**0.08**	
	Investment Rate	0.0853	0.0543	-1.81	**0.10**	
	Log of Export	0.0791	0.0572	**0.176**	**0.176**	**1.9159**
	Exchange Rate	1.3906	**0.9877**	**14.08**	0.000	
	Constant	5.9429	**1.8498**	**-3.21**	**0.003**	
30%	Inflation	**0 .0429**	**0.0223**	**1.92**	0.062	
	d™ [log(inf,)-log(inf")]	-0.1735	**.01429**	**-1.21**	**0.233**	
	Log of Foreign Direct Inv	0.1482	**0.0821**	**-0.81**	**0.08**	
	Investment Rate	0.0853	**0.0543**	**-1.81**	**0.10**	**1 9159**
	Log of Export	0.0791	**0.0572**	**0.176**	**0.176**	
	Exchange Rate	1.3906	**0.9877**	**14.08**	0.000	
	Constant	5.9429	**1.8498**	**-3.21**	**0.003**	

- d,[mf] [log(inf,) - logtfnf')] denotes the dummy variable

The estimation of equation 3 gives a precise value of the optimal level and quantifies the impact of that level on economic growth (Table 4.9). Therefore, equation 3 is estimated and the RSS for *i*>

optimal level of inflation ranging from 1% to 30% is computed. In the Granger-Causality test reported in Table 4.6, inflation rate is found to be Granger-Causing economic growth and vice versa, at a lag of two (lag-2) over the period 1960 to 2007. Inflation is therefore kept at lag two

in the estimate. The optimal level is identified as the one that minimizes the sequence of RSS as depicted in Table 4.9 and Figure 2.

Figure 2: The Value of u Versus the Residual Sum of Squares

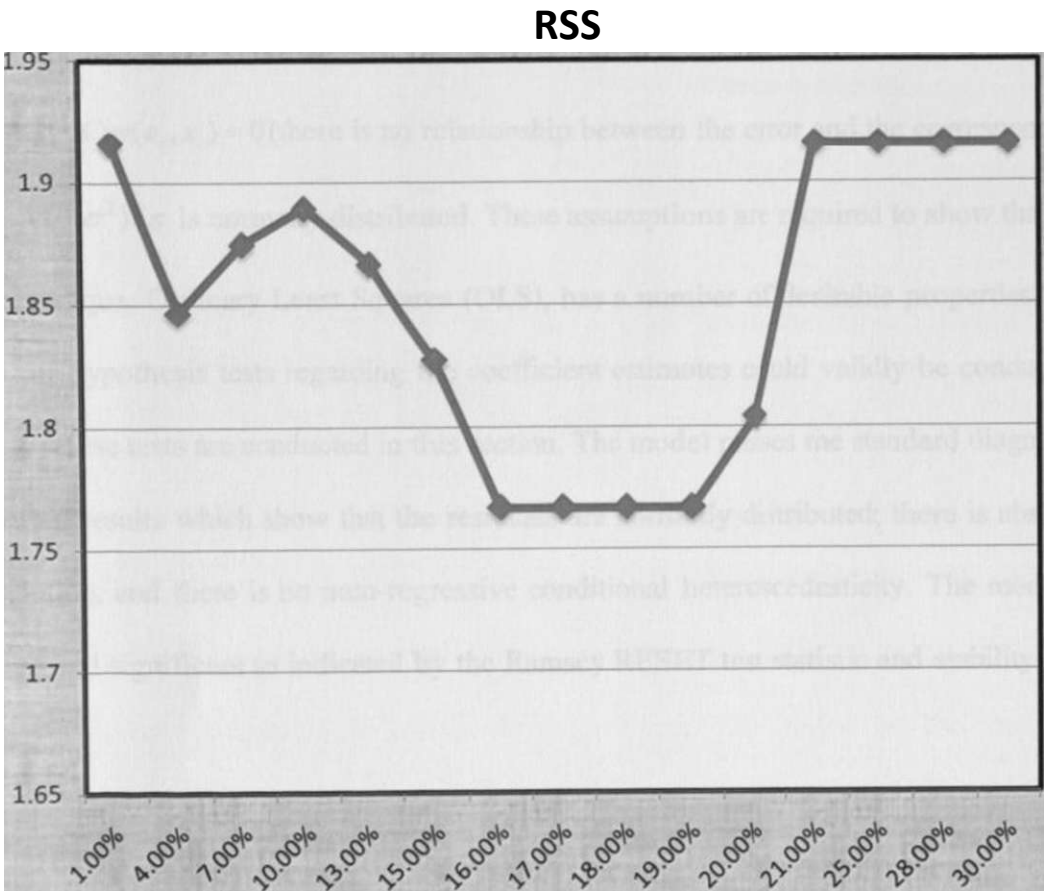


Table 4.9 and Figure2 illustrate the level of inflation, which is conducive for economic growth, and this is found to be 19% and this is in line with the findings (Li, 2005; Valdovinoz, 2003) which reported that for developing countries, inflation rate of up to 40% is conducive for economic growth. It is instructive however, that these studies did not consider the optimal level.

4.8 Diagnostic Tests for Equation 3

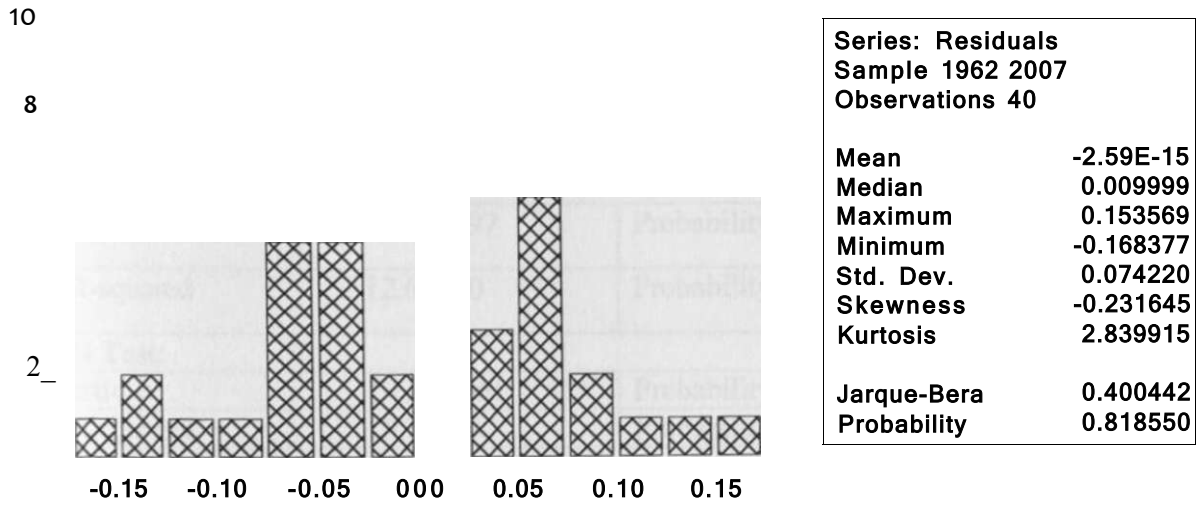
Different tests that are presented here are tests that are frequently used for diagnostic testing. There are five critical assumptions relating to classical linear regression model (CLRM) and they are: £(fr,) = 0(the errors have zero mean), *Var(e$_l$)* = o^2 <00(the variance of the errors is constant and finite over all values of Cov(c$_{(}$,£$_y$) = 0(the errors are statistically independent on one another; *Cov(c$_l$,x,)* = 0(there is no relationship between the error and the corresponding *x.* and *e,~ N(0,o")(e$_l$* is normally distributed. These assumptions are required to show that the estimation technique, Ordinary Least Squares (OLS), has a number of desirable properties, and also so that the hypothesis tests regarding the coefficient estimates could validly be conducted. Consequently, these tests are conducted in this section. The model passes the standard diagnostic test for reported results which show that the residuals are normally distributed; there is absence of autocorrelation, and there is no auto-regressive conditional heteroscedasticity. The model is well specified and significant as indicated by the Ramsey RESET test statistic and stability test-CUSUM test.

4.8.1 The Normality Test

The normality assumption, *e,~ n(o,ct^2*), is required in order to conduct hypothesis testing, particularly if the sample size is small. For sample sizes that are sufficiently large, violation of the normality assumption is virtually inconsequential. Based on the central limit theorem, the test statistic will asymptotically follow the appropriate distribution even in the absence of error normality. In smaller samples it is important to meet this assumption for the *p-test lo* be valid.

Figure 3 reports the normality test result. The result (reported in Figure 3) confirms that the residuals are normally distributed.

Figure 3: Normality Test



4.8.2 The Stability Test

Table 4.10 reports Ramsey's reset test for the correct functional form (stability test). It is implicitly assumed that the appropriate functional form is linear. This means that the regression model is assumed to be linear in parameters. Whether the model should be linear in form can be formally tested using Ramsey's reset test, which is a general test for misspecification of functional form. The results (reported in Table 4.10) reveal that the regression model and the parameters are stable.

Table 4.10: Stability Test

F-statistic	13.18461	Probability	0.003
Log likelihood	25.85976	Probability	0.004

4.8.3 White Heteroskedasticitv and ARCH Tests

Table 4.11 reports the white heteroskedasticity and ARCH test results. From Table 4.11, the results reveal that there is no herteroskedasticity. The test results above imply that the estimates are tautological and therefore, can be relied upon.

Table 4.11: White Heteroskedasticity and ARCH Tests

White **Heteroskedasticity Test:**			
F-statistic	0.609897	Probability	0.551492
Obs*R-squared	12.66330	Probability	0.653190
ARC **H Test:**			
1 F-statistic	1.116661	Probability	0.890317
Obs*R-squared	0.256187	Probability	0.879771

CHAPTER FIVE

SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

5.1 Summary

In this study we examine the relationship between economic growth and inflation using secondary time series data from Liberia for the period 1960 to 2007. The objectives were to estimate the optimal level of inflation which is conducive for economic growth in the Liberian cconomy and to determine and establish the direction of causality between economic growth and inflation. The model adopted from the one developed by Khan and Senhadji (2001) for the analysis of the threshold level of inflation for industrialized and developing countries. The study also utilized the Johanson cointegration technique to unveil the existence of a long-run cointegration between gross domestic product, foreign direct investment, investment rate, inflation rate, investment share of GDP, export and exchange rate.

The estimates of causality test and an application of optimization model suggests the following major findings. The Granger-Causality test identified a feedback or bilateral causality between inflation and economic growth. This helped to some extent, in the model specification. The results of the optimization model recommend a 19% optimal level of inflation for the Liberian economy. The implication is that any inflation rate above this optimal level would impact negatively on economic growth of the Liberian economy. The long-run and short-run results indicate that growth rate of gross domestic product is positively affected by foreign direct investment, inflation rate, export, exchange rate, investment rate and the dummy variable. On the other hand, dummy variable for war is found to negatively influence growth rate of gross domestic product in Liberia. Moreover, a stability test suggests that the estimated parameters do not suffer from structural instability.

52 Conclusion

Given the ambiguous relationship between inflation and economic growth as summarized earlier and the primary objective of the Liberian government as envisaged in its Poverty Reduction Strategy, the findings of the study provides policy makers, especially the monetary authority, in Liberia with the necessary information to formulate monetary policies that would target the reported- optimal level of inflation in the Liberian economy thereby stimulating economic growth. Besides, the findings suggest a bilateral causality between economic growth and inflation. Policy makers can rely on this finding to institute policies that would enhance price stability thereby attractive economic growth.

5J Policy Implications

Inflation targeting (IT) has recently become the dominant monetary policy prescription for developing and developed countries alike. Emerging market governments in many countries, like Liberia, are increasingly pressured to follow IT as part of an IMF-led stabilization package and the routine rating procedures of the international financial institutions. Nevertheless, the common expectation of IT is that price stability would ultimately lead to higher employment and sustained economic growth. This has however, failed to materialize.

From this background, several policies can be drawn from the findings of the study. The feedback or bilateral causality between inflation and economic growth identified by the findings of the study implies that policy makers should implement monetary and fiscal policies in such a way as to target the optimal level of inflation reported by the study. This would ensure stability of the economy thereby ensuring economic growth.

Given the estimated optimal level of inflation which is conducive for economic growth in Liberia, the Liberian monetary authorities need to formulate policies that would ensure that inflation is below or is kept at this optimal level. Keeping inflation below or at the optimal level would speed up the process of economic growth in the Liberian economy.

The study reported long-run and short-run results which indicate that growth rate of gross domestic product is positively affected by foreign direct investment, inflation rate, exports, exchange rate, investment rate and the dummy variable (war). This requires the Liberian government to ensure stability in the country and to formulate policies which would attract foreign investment in the country. This also obligates the authority to encourage both the agricultural and industrial sector productivity thereby increasing export. Encouraging the agricultural and industrial sectors requires that the Liberian authority invest in infrastructure such as roads and electricity since these were devastated by the civil war. Also a policy to enhance domestic savings should be considered. This would encourage both sectors to obtain loans from ihe banks for investment. Additionally, policies to enhance investment and ensure an optimal level of inflation and a stable exchange rate should be put in place.

In the same vein, the authorities should adopt sound microeconomic and macroeconomic policies that would ensure equitable distribution of the natural resources in the country. This, holding other things constant, would enhance investment and employment thereby helping to attain sustainable peace in the Liberian society since war was found to affect gross domestic product negatively.

5.4 Limitations of the Study

A major limitation of the study is the problem of the availability, relevance and reliability of data on the Liberian economy. Different data sources give different data for the same variable. Since the study utilized secondary data from several sources each of which may have been contaminated, there is a likelihood that this could affect the findings of the purely econometric methodology utilized. A useful extension of the present study would be to empirically determine the mechanism through which inflation affects economic growth and vice versa.

55 Areas for Further Research

The study established the optimal level of inflation and confirmed a bilateral causality between economic growth and inflation in Liberia. Further studies could consider the determinants of inflation and economic growth in Liberia. Further research could also utilize more disaggregated data and explore sectional inflation behavior.

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Appendix 1: Data used in the Study (1960-2007)

Year	For Dir Invt (Millions LD)	Inflation	Exchange	Exports (Millions LP)	gdp (Millions LP)	Investment
1960	20.38499	-3.5643	0.968397	45.82782	1.90E+08	5.68923
1961	20.39892	-2.1643	0.968397	34.58007	I.84E+08	5.98431
1962	20.40992	1.0643	0.971032	36.58883	1.92E+08	6.85213
1963	20.40992	1.076196	0.974492	38.70556	2.00E+08	7.21481
1964	20.41945	0.7132	0.981587	57.43533	2.36E+08	7.57421
1965	20.42486	2.495962	0.993441	57.9748	2.49E+08	7.743523
1966	20.42889	0.628742	1.008116	63.19676	2.63E+08	7.912342
1967	20.43024	0.008765	1.022974	73.0417	2.8IE+08	8.342131
1968	20.43958	1.514564	1.035691	77.83248	3.00E+08	9.534912
1969	20.38499	0.550523	1.045679	82.91011	3.30E+08	10.11003
1970	20.38499	0.986287	1.052441	68.8527	3.49E+08	7.66624
1971	20.24845	1.097652	1.057148	68.59663	3.67E+08	7.33527
1972	20.33318	1.070593	1.060486	68.98898	3.98E+08	8.01415
1973	20.40992	1.434906	1.064621	78.43361	4.21E+08	6.08699
1974	20.38639	2.083437	1.071133	77.19238	5.28E+08	8.60074
1975	20.54414	2.981907	1.080837	65.13231	6.20E+08	15.96124
1976	20.42081	3.07821	1.091871	71.80978	6.50E+08	13.79348
1977	20.53211	1.987644	1.081787	61.58328	7.45E+08	14.82489
1978	20.50137	2.548882	1.06624	62.05125	8.06E+08	11.96342
1979	20.3623	1.14527	1.080816	60.72983	9.12E+08	13.59429
1980	20.40581	2.256801	1.131387	64.33594	9.54E+08	11.18592
1981	20.66564	2.205955	1.189262	62.88943	9.35E+08	7.00198
1982	20.35365	1.667146	1.261644	56.2614	9.58E+08	7.60109
1983	20.37371	1.613597	1.292999	53.45387	9.11E+08	6.46056
1984	20.3551	2.654749	1.221005	50.42178	9.34E+08	6.11277
1985	20.27698	1.555533	0.993599	49.94791	9.35E+08	4.13877
1986	20.27698	0.059017	0.563756	50.08443	9.26E+08	3.94659
1987	20.35798	0.250502	0.181515	52.20559	9.73E+08	4.09722
1988	20.66775	1.802859	2.370261	54.42197	1.04E+09	3.64275
1989	20.99329	2.192541	1.181515	37.33567	7.86E+08	2.97302
1990	20.59657	1.184821	1.14407	29.56034	3.84E+08	3.57874
1991	20.31379	2.065439	2.373021	5.52811	3.48E+08	2.98351
1992	20.28476	1.712834	19.87432	3.580009	2.24E+08	3.57402
1993	20.21577	3.46543	20.002345	2.44371	1.60E+08	3.50902
1994	20.32726	1.956723	20.12342	3.23564	I.32E+08	3.48003

1995	20.30926	1.676042	30.093277	6.8902	1.35E+08	3.46579
19%	20.077	1.873446	1.244060	7.2942	1.59E+08	3.39425
1997	20.584	1.698465	1.833702	8.786753	2.96E+08	3.36377
1998	20.55603	0.543272	2.102386	10.78977	3.60E+08	3.28778
1999	20.63115	8.239913	43.259169	14.5541	4.42E+08	3.24203
2000	20.33318	0.085844	39.50404	21.4655	5.61E+08	3.26119
2001	20.31379	0.124674	42.758779	23.18487	5.43E+08	3.26941
2002	20.30623	2.451927	49.50796	19.85891	5.59E+08	3.26421
2003	20.75282	3.267818	65.008838	32.35004	4.10E+08	3.24609
2004	20.40168	0.974609	50.508939	37.27844	4.60E+08	3.13409
2005	20.41129	0.063163	54.509752	37.88606	5.30E+08	3.21452
2006	20.45408	2.626515	59.501092	28.62745	6.I2E+08	3.57201
2007	20.48501	2.171543	62.502745	33.26981	7.35E+08	3.94821

Source: World Bank's Global Development Network Growth Database, the IMF International Financial Statistics, and Central Bank of Liberia.