

THE EFFECT OF INFLATION ON ECONOMIC GROWTH IN GHANA

BY

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DECLARATION

I hereby declare that this thesis is the result of my own original work towards the Master of Science Degree in Economics and that to the best of my knowledge, it neither contains materials published by another person nor materials which have been accepted for the award of any other degree in the university, except where due acknowledgements have been made in the text.

FREDERICK AMISSAH

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(PG1082517)

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Signature

Date

CERTIFIED BY:

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Signature

Date

DEDICATION

To my lovely daughter, Mena Adwoa Baduwah Amissah.

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I wish to express my appreciation to individuals who provided much support and encouraged me when I was undertaking this study. First, I extend my greatest appreciation to my academic for his guidance and critique of this work. I am also grateful to all friends and relatives who helped me in many ways during my period of graduate study at the KNUST. I really appreciate your precious support.



ABSTRACT

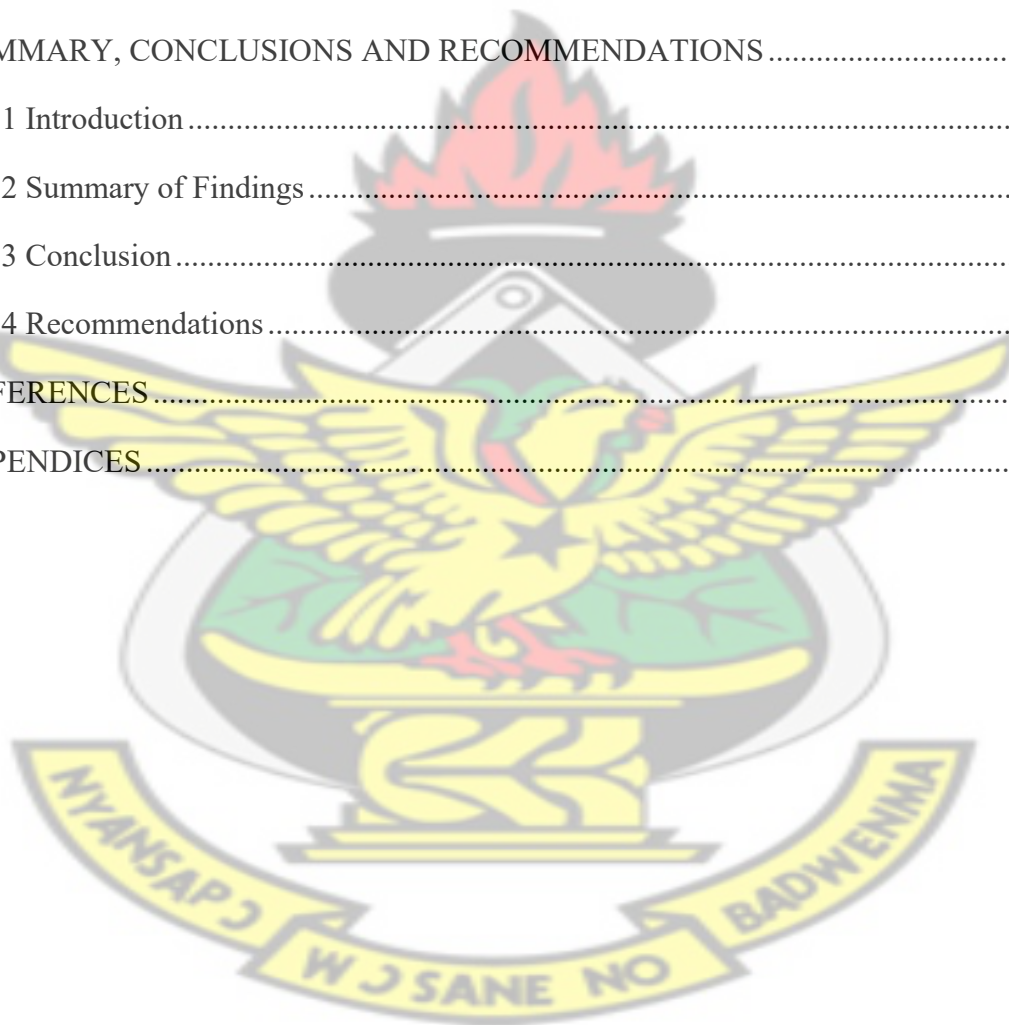
Inflation is a sign that an economy is growing, however excessive rate of inflation is detrimental as it can lead an economy into hyperinflation. Low inflation rates promote economic growth by making prices and wages more flexible (Lucas, 1973). High inflation is bad for the economy and it adversely affects economic performance. It hampers economic growth due to the adverse impact on efficient distribution of resources by changing relative prices (Fisher, 1993). The relationship between inflation and economic growth is one of the most popular macroeconomic issues among central bankers, policy makers and macroeconomists. This study therefore sought to examine the impact of inflation on economic growth in Ghana. Specifically, the study estimated the causal relation between inflation and economic growth and also measure the long run and short run effect of inflation on economic growth. The study estimated a VECM model using annual time series data on economic growth, CPI inflation, capital, foreign direct investment and trade openness from 1980 to 2017. The study found the existence of a unilateral positive causal relationship running from economic growth to inflation. Also, the study found that inflation has a negative impact on economic growth in both the long run and the short run. The study also found that capital and FDI also have a negative effect on economic growth whereas financial development and trade openness have a positive effect. The study recommends that government implement policies that ensures stable prices. This can be in the form of making sure the inflation target set are not missed to ensure the negative effects of inflation are reduced

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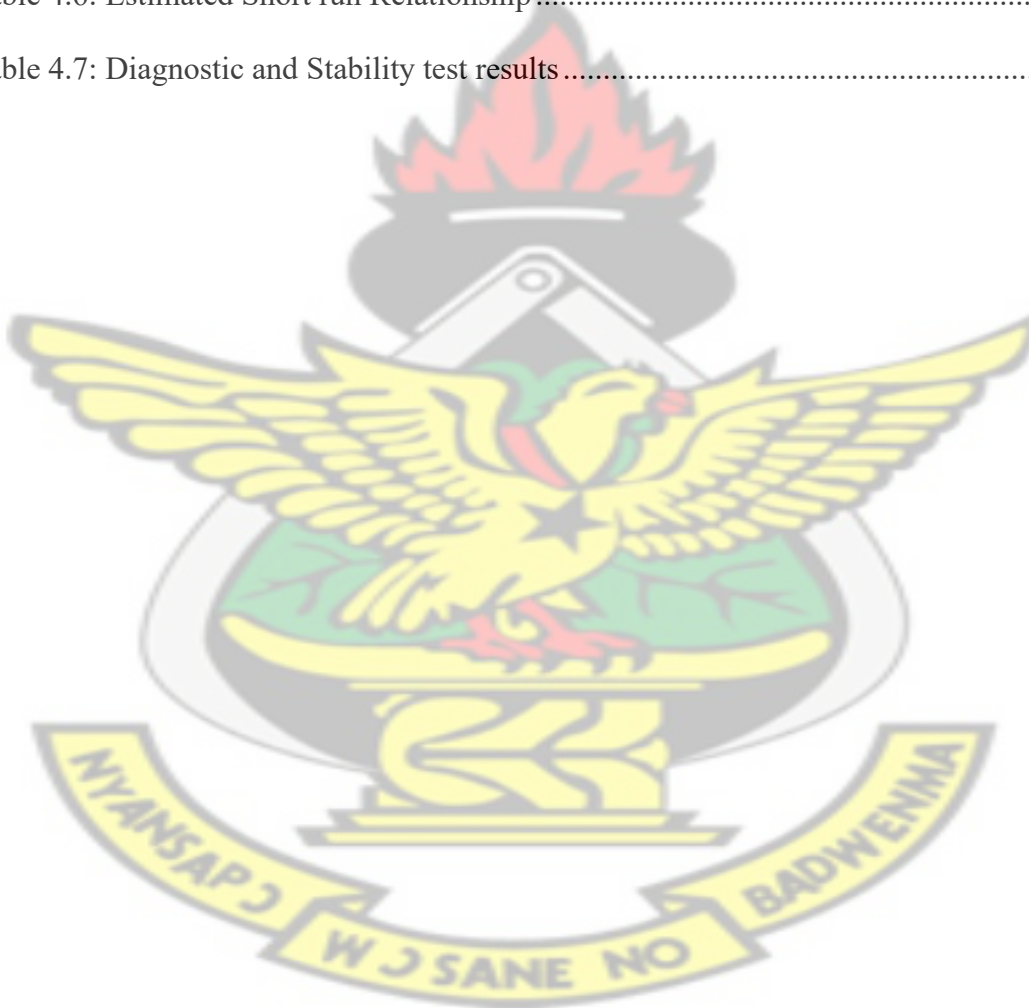
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CHAPTER ONE

INTRODUCTION

1.0 Background to the Study

A major preoccupation of governments in most countries is to achieve sustainable economic growth and low inflation rate. The conventional view in macroeconomics is that lower levels of inflation is a potential driver of economic growth. But Munir and Mansur (2009) contend that the exact nexus between inflation and economic growth remains open and it is subject to considerable interest and debate. One of such debates is the monetarists' view, which argues that inflation leads to poor economic growth (Mallik and Chowdhury, 2001).

According to Gokal and Hanif (2004), inflation creates insecurity about the viability of future investments (mostly high inflation are associated with increased inconsistency in price). An alternative mechanism according to Gokal and Hanif (2004) is that inflation may also reduce a country's competitiveness on the international front; that is, making exports relatively expensive, consequently affecting the balance of payments. Also, inflation has the ability to distort the borrowing and lending decisions by interacting with the tax system to. Firms will therefore have to use majority of their assets to deal with the implications of inflation (for instance, more cautious considering of the prices of other industry players to perceive if any surges are associated to the economy's general inflationary trend or to causes emanating from the industry).

On the contrary, the structuralists posit that inflation can drive economic growth, as higher level of inflation caused by rising interest rates may incentivize people to hold more money in assets and thus making funds available investments and hence increased growth (Mallik and Chowdhury, 2001). In all these, what is of major interest to macroeconomists is the sources of inflationary pressures and their effect on growth. In this regard, the Philips curve has been a useful framework in particular as it provides the starting point for understanding inflationary drivers from the labour market (Alisa, 2015).

Inflation is a sign that an economy is growing, however excessive rate of inflation is detrimental as it can lead an economy into hyperinflation. Low inflation rates promote economic growth by making prices and wages more flexible (Lucas, 1973). Low and stable inflation gives enterprises more confident to invest their resources which may lead to high economic growth in the long run. Inflation redistributes real income and creates seignorage revenue for the government until the optimal inflation tax is reach. It oils the wheels of the labour market as employees are always resistant to nominal wage cut, hence a positive rate of inflation creates the flexibility needed to achieve changes in real wages (Carlin and Soskice 2005).

High inflation is bad for the economy and it adversely affects economic performance. It hampers economic growth due to the adverse impact on efficient distribution of resources by changing relative prices (Fisher, 1993). Among the adverse effects of high inflation are; excessively hit the poor, hard hit the fixed income group since the purchasing power of their income is eroded overtime, decrease the confidence of creditors, leads to social

tension as frustration mounts, turns past decisions into mistakes, creates uncertainty which make people avoid long- term contracts and makes a country exports relatively more expensive (Arnold, 1989).

Reducing inflation has its associated costs like output lost, high unemployment rate and a decrease in the motivation of manufacturers as prices fall. Deflation squeezes enterprises profit and lower households disposable income as it slows down economic recovery. It can lead an economy into a deflation trap where weak aggregate demand leads inflation off gear into negative (Carlin and Soskice, 2005).

The relationship between inflation and economic growth is one of the most popular macroeconomic issues among central bankers, policy makers and macroeconomists (Barro, 1995). Theoretically or empirically, there exist a controversy on the association between inflation and economic growth. Studies have shown that the association between these two variable is negative (Fisher, 1993) or positive relationship (Locus, 1973) or does not exist (Sidrauski, 1967). The structuralists assert that inflation has a positive effect on economic growth while the monetarists claim inflation is detrimental to economic growth. Keynesians also said that inflation may increase growth by raising the rate of profit, hence increasing private investment. The effect of inflation and economic growth and the controversy of their relationship, thus warrant a study of the impact of inflation on economic growth in Ghana.

1.1 Statement of Problem

From both theoretical and empirical perspectives, the relationship between inflation and economic growth is contentious. Theoretically, the Neoclassical Growth Theory for instance posits that higher inflation makes capital more captivating to hold relative to money. This causes higher capital intensity, and in the transition period to higher economic growth (Fisher, 1993). But on the contrary, the monetarist view holds that inflation is harmful to economic growth (Mallik and Chowdhury, 2001).

With regards to empirical studies, Khan and Senhadji (2001) explored the effect of economic growth on inflation and found that the impact of growth on inflation is felt below and beyond certain thresholds and thus refutes the notion that the effect is linear. In another study with findings that corroborate the results of by Khan and Senhadji, Chan and Tsay (1998), found the existence of a threshold beyond which inflation exerts a negative effect on growth. Chan and Tsay (1998) specifically found 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 results of Chan and Tsay (1998) specifically demonstrates that the threshold is lower for industrialized countries than it is for developing countries (the estimates are 1-3 percent and 11-12 percent for industrialized and developing countries respectively).

On the contrary, Fischer (1993) and De Gregorio (1993) found evidence for a negative link between inflation and growth. Yet, studies by Levine and Zervos (1993) and Sala-i-Martin (1997) suggested that inflation was not a robust determinant of economic growth.

Therefore, whilst research studies on the inflation-growth hypothesis abound, it is clear that the relationship is even not determinate and therefore it would be misleading to assume universal application of a particular research findings.

More so, the direction of causality between inflation and growth is also conflicting. Wai (1995) even opines that there is no meaningful relationship between inflation and economic growth. Singh and Singh (2015) in their study of the relationship between inflation and economic growth in Japan, using the Granger causality found evidence of bi-causality suggesting that inflation affects growth and growth affects inflation as well. But the study by Paul et al. (1997) drawing on 70 countries including both developed and developing countries found no causal relationship between inflation and economic growth in 40 percent of the countries, bi-directional causality in about 20 percent, and a unidirectional (either inflation to growth or vice versa) relationship in the rest.

The study by Enu et al. (2013) only determined the relationship between GDP (Gross Domestic Product) growth rate and inflationary rate in Ghana from the period 1980 to 2012 but did not examine the direction of causality. In a related study, Ahiakpor and Akapare (2014) only explored the long run and short run effects of inflation on GDP Growth in Ghana using quarterly time series data spanning 1986-2012. The findings of the study of Ahiakpor and Akapare may not necessarily hold over time. This study therefore fulfills this lacuna in scholarly literature by assessing any possible link between inflation and economic growth in Ghana using different sampling period; 1980 to 2017.

1.2 Research Objectives

The general objective of the study was to examine the relationship between inflation and economic growth in Ghana. The specific objectives were to:

1. To examine the direction of causality between inflation and economic growth in Ghana.
2. To assess the effect of inflation on economic growth in Ghana.

1.3 Research Questions

Based on the specified research objectives, the research questions were formulated as:

1. What is the direction of causality between inflation and economic growth in Ghana?
2. What is the effect of inflation on economic growth in Ghana?

1.4 Rationale/Significance of Study

This study will be significant from both practical and theoretical perspectives. From a practical standpoint, the recommendations that will be proffered in this study can serve as guide to macro-economic policy makers to implement policies to achieve desired goals. As the study seeks to gain insights into the nexus between inflation and economic growth, knowledge gained will be particularly relevant for policy targeting.

In addition, the study will contribute to current literature on the inflation-growth hypotheses. As a result, researchers who intend to conduct related studies later may find the

outcome of the study very useful as it can serve as a reference material. Further, the study potentially serves as a foundation upon which further research may take-off.

Research is generally iterative in character, meaning examining and re-examining a research problem from different perspectives. Granted this, some interesting findings of the study may incentivize other researchers to explore the research problem from different perspectives. In this way, a search for comprehensive understanding of the research problem will be achievable.

1.5 Scope of Study

The focus of this research work is on Ghana. Annual time series data on economic growth and inflation, as well as other macroeconomic variables such as capital government expenditure, financial development, trade openness and governance indicator, spanning from 1980 to 2017 will be employed for the analysis. Time series data on all the variables were source form World Bank's World Development Indicators (2018).

1.6 Limitations of Study

The study has some limitations and must be acknowledged. These limitations do not however question the validity of the results that subsequently emanated from the study. Rather, acknowledging these limitations would be of practical utility from the perspective of determining the direction of future research in particular variables to incorporate and omit and theoretical frameworks to employ. First, the study is limited to a specific sampling period and for that matter results may not entirely be applicable to other

economic periods. In addition the study is limited to the economic environment of Ghana and therefore the extent to which results can be generalized to other countries may be limited in scope. Finally, the findings of the study may not be applicable over time and thus may have a longitudinal limitation.

1.7 Organization of Study

The thesis was structured into five chapters. The first chapter provides a general introduction to the study. It specifically covers the background, problem statement, objectives and research questions, significance, scope, and limitations of the study. The second chapter reviews related literature by synthesizing both theoretical and empirical literature. Chapter three outlines the research methods utilized to conduct the study. Chapter five deals with the summary of findings, conclusions, and recommendations emanating from the study. Finally, the chapter provides suggestions on research avenues that future research can explore.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter provides a review of related literature on the current research problem. The chapter therefore dwells on both theoretical and empirical literature. The literature review is organized into specific themes namely the theories of the study, economic growth models and empirical review of related studies.

2.2 Theoretical review

2.2.1 Monetarism

Milton Friedman propounded this theory and the theory is also termed as Quantity Theory of Money abbreviated as QTM. From the perspective of the monetarists, the price level in an economy is driven mainly by the amount of money supply. Any change in the money supply according to the monetarist has a direct relationship with general price level termed inflation. The argument of the monetarists is that money supply largely accounts for inflationary pressures in an economy but it has no significant impact on growth of output in an economy.

2.2.2 Keynesian Theory

John Maynard Keynes is credited with the development of this theory. In his book in 1936 titled, “The General Theory of Employment, Interest and Money”, Keynes developed this theory. The Keynesians strongly advocate the involvement of the government in the affairs of an economy through expansionary and contractionary economic policies, which

according to them potentially boost investment and push demand to full production in the economy. The Keynesians developed a model that consists of Aggregate Demand and Supply curves. Dornbusch et al (1996) suggest that in the context of the Keynesian theory, there should be a positive relationship between inflation and economic growth but as a result of the adjustment path of the AS and AD curves, this relationship turns negative.

A potential factor that may also account for a positive relationship of inflation and growth has been espoused by Gokal and Hanif (2004). According to them, firms show greater propensity to produce and supply more goods as prices increase in general. When prices increase, firms produce more leading to increase in output. But buyers are more likely to buy less due to a decline in purchasing power occasioned by inflation and due to this, the expected positive relationship between inflation and growth may not hold.

2.2.3 Classical Theory of Inflation

Adam Smith is regarded as the greatest proponent of the classical theory of inflation. Smith presented a growth model based on supply side perspective where he cited three factors in the production process namely land, capital, and labour. According to Smith, economic growth is dependent on these three factors of production, to reiterate, land, capital, and labour. Smith further introduced savings into the growth equation arguing that savings improve output levels. Gokal and Hanif (2004) observe that from the classical theory because higher inflation makes production inputs like land, capital, and labour very expensive and this reduces investment and hence lower growth. Barro (1995) sheds more light on this theory with arguments that stressed the fact that high inflation reduces the

level of investment and such reduction adversely affects economic growth. Therefore, the study anticipates a negative relationship between inflation and growth in the context of the classical theory.

2.3 Economic Growth Models

Economists for a very long time have fundamentally preoccupied themselves with the factors that lead to economic growth. Adam Smith, who is regarded as the father of economics argue that savings as a form of capital accumulation is an important variable for economic growth due to its potential to generate high level of productivity and, thus, to more output per worker. David Ricardo drew on the work of Adam Smith and reinforced the fact that savings plays a vital role in stimulating economic growth but Ricardo point of departure from Adam Smith is his introduction of technology as a significant driver of economic growth. Largely, two models of economic growth have been suggested. In the succeeding subsections of the study, these models are clarified. It is important to examine these models as they eventually helped in the selection of variables in the model of the study.

2.3.1 Endogenous Growth Models

Endogenous growth model basically proposes that growth is primarily the result of endogenous and not external forces. The endogenous growth theory is based on the assumption that investment in human capital, knowledge and innovation are key drivers of economic growth. Greiner (2012) contends that a shortcoming of the exogenous growth model is that it cannot endogenously explain sustained per-capita growth, which is an

empirically observed fact in market economies, but has to resort to exogenously given technical change. The reason for this problem according to him lies in the fact that the production function is characterized by a declining marginal product of physical capital which reduces the incentive to invest as capital rises. As a consequence, the economy converges to a steady state in the long-run where investment is just sufficiently high to keep the per-capita capital stock constant.

The endogenous growth theory could overcome this shortcoming by postulating that there exist endogenous factors that have positive effects on the marginal product of capital. This contribution depicts fundamental endogenous growth models starting with the model where investment is associated with positive externalities on the macroeconomic level. These externalities raise the marginal product of capital and prevents the fact that the incentive to invest vanishes as capital grows, leading to sustained growth in the long-run.

Another class of endogenous growth models assumes that research and development is undertaken by profit maximizing firms thus raising the stock of knowledge that generates sustained per-capita growth. Other variants of endogenous growth models according to Greiner are human capital formation as the source of ongoing growth and the one where the government continually invests in public infrastructure which has a stimulating effect on the private investment share.

In sum, endogenous growth theories highlights one notion: growth is driven by factors within the production process, for example; economies of scale, increasing returns or

induced technological change; as opposed to outside (exogenous) factors such as the increases in population. In endogenous growth theory, the growth rate has depended on one variable: the rate of return on capital. Variables, like inflation, decreases that rate of return, which in turn reduces capital accumulation and decreases the growth rate. These theoretical considerations would subsequently inform the inclusion of human capital as an explanatory variable in the model of the study.

2.3.2 Exogenous Growth Models

Generally, exogenous growth theories argue that economic growth results from factors outside the economy or company of interest. Exogenous growth assumes that economic prosperity is primarily determined by external rather than internal factors. According to this belief, given a fixed amount of labor and static technology, economic growth will cease at some point, as ongoing production reaches a state of equilibrium based on internal demand factors. One popular exogenous growth model is the Solow Growth model.

Solow's growth model was published in 1956 as a seminar paper on economic growth and development under the title "A contribution to the theory of economic Growth". Solow won Noble prize in Economics in 1987 for his valuable contribution for the understanding of economic growth. The Solow growth model tried to give an answer for one of the great mysteries of growth economics i.e. why rich countries are so rich and why the poor ones are so poor?

Like that of many economics models, Solow growth model is built on assumptions:

1. Countries will produce and consume only a single homogenous good (output)
2. Technology is exogenous in the short run.

According to this model, a country that uses more capital per worker will produce more output per worker, subjected to the law of diminishing returns to capital per worker. (Charles, 2002). The other important equation from the Solow growth model is the capital accumulation equation. This indicates that, the change in capital per worker is a function of investment per worker, depreciation per worker and population growth. Of these three variables only investment per worker positively related with change in capital per worker (Charles, 2002)

2.4 Empirical Review

A study by Stanner (1993) sought to determine the relationship between inflation and economic growth. The sample of the study comprised 12 developed and developing countries. Two sampling periods were examined in this study; employing time series data over the periods 1948 to 1986 and 1980 to 1988. Data was collected from the German Statistisches Bundesamt (1990). The study employed simple correlation to find out the relationship among the variables. The empirical findings of the study revealed a negative relationship between inflation and economic growth in both developed and developing counties.

Barro (1995) conducted a study to explore the relationship between inflation and economic growth between 1960 and 1990, a period of 30 years. The author employed a panel data of

100 countries within this sampling period. Consumer Price Index (CPI) was used as the proxy measure of inflation in this study. The major finding of the empirical analysis is that the estimated effect of inflation on growth and investment are significantly negative when some plausible instruments are used in the statistical procedures. Therefore, the author concludes that there are some effects of causation from higher long term inflation to reduce growth and investment.

Sorel (1995) attempted to examine the possibility of nonlinear effects of inflation on economic growth. The data set contains annual information for 87 countries, during the period 1970-90. The data set contains population, GDP, terms of trade and real exchange rates. The CPI and the terms of trade data are used in order to reduce the problems of negative correlation between the inflation and growth. The terms of trade are used in order to eliminate the negative correlation between growth and inflation that is caused by external supply shocks. The study used the OLS regression estimation. The empirical estimation of the study found that when the level of inflation is low, the negative effect of inflation is not significant on economic growth. But when inflation is high it has a negative effect on growth. This negative effect is statistically significant. The study estimated that the structural inflation is 8 percent. This study demonstrated that when the structural break is taken into account the estimated effect of inflation on economic growth increases by a factor of three.

Andres, et al (1999) sought to find out the correlation between growth and inflation of the OECD countries and to discuss whether this correlation withstands. This paper tries to

assess the long running costs of inflation, within an explicit theoretical framework stemming from growth literature. This approach is well suited to test the robustness of the correlation between growth and inflation with reasonably well working markets, such as OECD countries during the period from 1960-1992. The estimation method uses causality between inflation and growth along with VAR approach. The result suggests that there are two channels by which inflation influences growth. These are firstly, through a reduction in propensity to invest. Secondly, a reduction in the efficiency of the input costs. The main empirical findings is that current inflation has never been found to be positively correlated to income per capita over the long run. Overall this result indicates that the long run costs of inflation are non-negligible and that efforts to keep inflation under control will sooner or later payoff in terms of better long run performance and highest per capital income.

Mallik, et al (2001) attempted to determine the relationship between inflation and GDP growth for four South Asian countries (Bangladesh, India, Pakistan and Sri Lanka). This study employed co-integration and Error correction model to examine the extent to which economic growth is related to inflation and vice versa. Data was adapted from IMF international financial statistics. The empirical evidence defines that there is a long run relationship between economic growth rates and inflation rates in all four countries. Finally, the study evaluates that inflation and economic growth are positively related, the sensitivity of inflation to changes in growth rates is longer than that of growth to changes in inflation rates. It also suggests that the economies are in a knife edge position.

Gylfason, et al (2001) investigated the cross country link between inflation and growth. This study has dealt with cross country analysis for 170 developing and developed countries. The study used annual data series covering the frequency from 1960-1992. The study has employed simple regression techniques in order to determine the link between inflation and growth. The empirical findings suggest that the cross country links between inflation and growth are economically and statistically significant and robust.

Valdovinos, et. al. (2003) sought to examine the growth rate of the economy and the level of inflation from a non-structural, low frequency point of view. The study has used annual data for the eight Latin American countries covering the period from 1970-2000. The study employed spectral analysis to examine the growth inflation levels. The empirical findings of the study emphasized that the average long run rate of inflation in a country is negatively associated with the countries long run rate of growth.

Gokal, et al (2004) attempted to investigate the meaningful relationship between inflation and growth in Fiji. The study used the annual data from the period 1970-2003. The study employed the econometric techniques like Unit Root Test (ADF, PP) and Granger Causality. The study found that there exists a weak negative correlation between inflation and growth.

Bakare, Kareem and Oyelekan (2015) assessed the effects of inflation rate on economic growth in Nigeria using annualized time series data for the period 1986 – 2014. The secondary data were sourced from CBN Statistical Bulletin. The ADF econometric

technique was used to determine the stationarity of the series, while Granger causality test was employed to ascertain the causal direction of dependent and independent variables. The study found out that inflation rate related negatively and significantly with economic growth. Also, the finding test indicated that GDP granger caused inflation, and inflation did not granger cause GDP. Regarding policy implication of the result, it was recommended that productive activity should be intensified in the economy so as to reduce and stabilize prices of goods and services for the purpose of promoting economic growth.

Another empirical study draw from Pakistan where Chughtai, Malik and Aftab (2015) explored the effect of major macroeconomic variables namely inflation, interest rate, and exchange rate on economic growth. The authors adopted secondary time series between the period 1981 and 2013. The study adopted multiple regression technique. Results of this study revealed that inflation and interest rate exhibit negative relationship with economic growth but the effect of exchange rate on economic growth was positive.

In a related study, Samuel and Nurina (2015) analyzed the effect of inflation, interest rates and exchange rates on economic growth rate in Indonesia. Results of the study show that interest rate has a significant impact on growth whereas exchange rate was found positively correlated with economic growth. Further, findings of this study indicate that inflation has no significant impact on economic growth.

In Ghana, Enu et al. (2013) examined the relationship between inflation and economic growth between the period 1980 and 2012 using time series data. The study utilized three

statistical techniques namely scatter plot, correlation and linear regression techniques. Results from the study indicated that there is a negative relationship between inflation and economic growth in Ghana over the years examined. Specifically, the results of the study revealed that a unit increase in inflation leads to a fall in GDP by 0.0864724 percentage points.

Marbuah, (2010) studied the association between inflation and economic growth to find out if a threshold effect existed essentially in Ghana over the time span 1955-2009. The study attests of a significantly threshold level of inflation on economic growth with and without structural break. The outcome gave a least inflation threshold level of 6% and the highest inflation threshold level of 10%. Furthermore, he discovered that adjusting for structural break in the model increases the effect of inflation on growth at a robust threshold level of 10% by a factor of 1.8 or approximately 81%. The recommended that it is good for the Ghanaian economy to targets inflation not to exceed 10% and any inflation target beyond 10% threshold, could be detrimental to the economy.

Quartey, (2010) used Johansen co-integration approach and studied whether the tax income maximization rate of inflation is growth maximizing in Ghana. The discovered that there was a negative impact of inflation on economic growth. Moreover, the study used the Laffer curve to establish the tax income maximization rate of inflation as 9.14 % over the time span of 1970-2006. The also found that the rate of inflation that results in growth maximization in Ghana is not a single figure

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology employed in achieving the stated objectives. This section is in three sections, the first section presents the specification of the model to be estimated. The second section deals with the data type and sources of data employed. The final section also presents the empirical strategy adopted for the estimation.

3.2 Model Specification

To estimate the effect of inflation on economic growth, following the neoclassical growth function, to specify economic growth as a function of capital and inflation. This may be given as;

$$Y_t = f(P_t, K_t) \quad 3.1$$

Where Y is economic growth P is inflation and K is capital. The economic growth of Ghana is determined by both conventional and non-conventional factors. Following Samuel and Nurina (2015) and Enu et al. (2013), the study included other control variables such as Foreign Direct Investment, Trade Openness and financial development. Equation 3.1 can be modified as;

$$Y_t = f(P_t, K_t, FDI_t, TO_t, FD_t) \quad 3.2$$

Where Y, P and K are as previously defined in Equation 3.1., FDI represents Foreign Direct Investment, TO represents Trade Openness and FD is Financial Development. The estimable form of equation (3.3) is specified;

$$\ln Y_t = \beta_0 + \beta_1 \ln P_t + \beta_2 \ln K_t + \beta_3 \ln FDI_t + \beta_4 \ln TO_t + \beta_5 \ln FD_t + \varepsilon_t \quad 3.4$$

From equation 3.4, $\beta_1, \beta_2, \beta_3, \beta_4$, and β_5 are the coefficients of inflation, capital, FDI, trade openness and financial development respectively. ε is the white noise error term.

3.3 Data types and source

The study used secondary data source. Annual time series data spanning from 1980 to 2017 for all the macroeconomic variables were sourced from the World Development Indicators (WDI, 2018). Descriptions of each variable used in the study are briefly provided as follows:

3.3.1 Economic growth

Economic growth measured by Gross Domestic Product (GDP) can be expressed as the market value of all aggregate goods produced in an economy in a given time interval of a year. Accounting for a nation's annual growth or output, GDP is a common known procedure. GDP is of two categories: Nominal GDP and Real GDP. The study uses Real Gross Domestic Product since it is adjusted by price level which experiences sensational variances amid time and thus, it reflects a true movement of output. It's used as a proxy for

economic growth since it gives a better performance for output change of an economy (Antwi et al., 2013; Sackey et al., 2012). It is dependent variable.

3.3.2 Inflation

Inflation may be described as the persistent increase in the general price level in the economy for a period of time. The study measures inflation using the Consumer Price Index (CPI). The CPI is also able to capture nominal price changes in the economy. The CPI is used with reference to price levels in 2010 as the base year (CPI 2010 =100). Prior studies like Andinuor, 2013, Alfaro, 2003 and Carkovic and Levine, 2002 have all utilized CPI as a proxy measure of inflation. From a theoretical sense, an increase in prices level of goods and services has the potential to cause a decline in purchasing power. This in turn could have an adverse impact on domestic level of production hence constrain growth in output (GDP). Hence, the a priori expectation in the study is that inflation should be negatively related to growth.

3.3.3 Capital

Capital is considered as a factor of production refers to already produced goods or assets that are used in the production of goods and services. Gross Fixed Capital Formation as a percentage of GDP was used as the proxy for capital. Gross Fixed Capital Formation represents that fraction of expenditure spent on GDP. It thus presents the value added in the economy that is reinvested rather than consumed in the economy. The study used K to represent Gross Fixed Capital Formation following Awokuse (2007) and Bhaale and Mutenyo (2011). The study expects that capital should have a positive effect on economic

growth following the basic growth models which specifies that the increased accumulation of capital should promote growth.

3.3.4 Foreign direct investment (FDI)

FDI is the transfer of capital, technology, and expertise from a foreign country to a host country on a long term bases. Put differently, FDI describes a situation whereby individual of a particular country, (source country) obtained ownership of investment in another country (host country) for production control and distribution purposes and other related activities of a firm(s) found in the host country. In this study, FDI is operationally measured as the net FDI inflows as a percentage of GDP. Previous empirical studies by authors like Brenner, (2014), Alfaro (2003) and Carkovic and Levine (2002) all employed ratio of FDI to GDP as a proxy measure of FDI. In Ghana, FDI in recent years has witnessed mammoth trends. This coupled with the theoretical assumptions of the economic growth models where growth is partly a function of capital should lead to a positive relationship between FDI and economic growth in Ghana.

3.3.5 Trade Openness

Trade openness captures the ability of an economy to trade effectively as well as maximises trade opportunities with other countries. It also identifies the influence of globalisation on inequality. This study measures trade openness as the ratio of the sum of exports and imports to GDP (WDI, 2016) following Hassan, Sanchez and Yu (2011), Adu, Marbuah and Mensah (2013)

3.3.6 Financial Development

Financial development comprises of the regulations, institutions, policies and conducive environment that allow efficient allocation of credit and resources in the financial sector. A developed financial sector allows for efficient mobilization of resources directed into productive capital investments. The study measure financial development using the ratio of total credit to the private sector to GDP (WDI, 2016). The ratio of total credit to the private sector to GDP shows the fraction of credit to the total credit that is given to the private sector relative to the public sector.

3.4 Estimation Strategy

To ensure that the estimates are reliable and consistent because of the time series data been used for the analysis, there is the need to perform preliminary test on the variables use to ascertain their properties. The study first test the stationarity properties of the variables and then test for the existence of any long run equilibrium relationship among the variables. The study finally provides a brief description of the economic technique employed to estimate the short run and long run coefficients.

3.4.1 Stationarity Test

In using times series data for estimations, it is very important to test the stationarity properties of the variables of interest to ensure analysis made are consistent and robust. Knowing the stationarity properties helps determine the order of integration of the various variables and inform correct specification of the model and also the appropriate economic technique in order to ensure the established relationship are not spurious.

A number of tests are available for testing the stationarity properties of variables. However, the study uses the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests. These two test are usually preferred to ensure consistency and accuracy of the test results. Though the PP unit root test is a modified version of the ADF test, the difference is how these tests manage serial correlation. Whereas the PP test ignores any serial correlation, the ADF uses a parametric auto-regression to approximate the structure of errors. That is, the PP test corrects for both serial autocorrelation and heteroscedasticity following Newey-West (1987).

A generalized ADF test may be specified as;

$$\Delta Z = \gamma_1 + \gamma_2 t + \gamma_3 Z_{t-1} + \sum_{n=1}^n \beta_i \Delta Z_{t-1} + \varepsilon_t \quad (3.7)$$

Where Z_t is the time series variable, Δ is the first difference operator, t is a time/trend variable, γ_i are the estimated parameters, β_i is the various estimated parameters of the differenced values of the lagged variables and ε_t is the white noise error term. From the specified equation, the study tests for the hypothesis of the presence of unit root (the time series is non-stationary); $\gamma_3 = 0$. If the null hypothesis is rejected, then the series is stationary [I(0)]. If, however, we are unable to reject the null hypothesis then, the series is non-stationary and as such possess unit root.

A generalized PP test may also be specified as;

$$\Delta Z_{t-1} = \alpha_0 + \beta Z_{t-1} + \varepsilon_t \quad (3.8)$$

The study tests the null hypothesis of the existence of unit root ($H_0 : \beta = 0$) against the null hypothesis of non-existence of unit root. Failure to reject the null hypothesis implies the series is non-stationary. If the null hypothesis is rejected, then the variable is stationary at the levels.

3.4.2 Co-integration Test and Vector Error Correction Model

When a non-stationary variable is regressed on another non-stationary variable, a spurious regression may occur, resulting to wrong estimation of results. Nevertheless, an exception exist, thus, when two or additional variables are non-stationary, a linear combination makes them stationary, then the datasets are cointegrated. Cointegration is an econometric technique within the regression theory framework, for testing the relationship amidst non-stationary datasets. Thus the datasets involved in the regression equation move together, hence they do not drift apart during the period. When non-stationary time series variables have been transformed to become stationary and there exists a linear combination amidst datasets such that it generates non trending residuals, then the series are said to be cointegrated.

The study applied the Johansen co-integration test to test for cointegration of the times series used in the analysis. Should there be the presence of co-integrating vectors by using both trace test and maximum eigenvalue test as proposed by Mackinon et al (1999) amidst

the variables, thus the variables' having a long run equilibrium, then there is the need to estimate for Error Correction (EC).

The error correction (EC) term provides information on the speed of adjustment of the long run equation to equilibrium. Although this is popular, it has shortcomings. For instance, if there are more than two variables in a model, there may be more than one cointegrating vector. With the single-equation approach these different cointegrating vectors cannot be identified. But even if there is only a single cointegrating vector the univariate approach is inefficient if not, all variables on the right-hand side of the cointegrating vector are weakly exogenous. The multivariate or vector error correction (VEC) approach, which has been developed by Johansen (1988, 1991) and Johansen & Juselius (1990, 1992), overcomes most of the problems of the two-step approach. The study therefore adopts the VEC model.

Having tested for cointegration, the study uses vector error correction model (VECM) that looks at the long run relationship between the variables as well as the dynamics and error correction in the short run. The Vector Error Correction Model (VECM) is designed with an error correction term fused into it, to be used on cointegrated variables which are non-stationary with one of its importance being able to measure any long run equilibrium deviations. If a long-run equilibrium relationship exist among the series, then the study expects coefficient of the error-correction term to be significantly different from zero. A simplified VECM may be specified as

$$A_t = v + Z_1 A_{t-1} + \mu_t \quad 3.9$$

Where A_t is an $n \times 1$ vector of variables, v is an $n \times 1$ vector of parameters, Z_1 is $n \times n$ matrices of parameters, and μ is an $n \times 1$ vector of disturbances which has zero mean and covariance matrix which is unbiased. The model in equation (3.9) can be rewritten in as;

$$\Delta A_t = V + \Gamma_1 \Delta A_{t-1} + \Pi A_{t-1} + \mu_t \quad 3.10$$

Where, $\Gamma_1 = I - A_1$, and $\Pi = -(I - A_1)$. Π is a matrix which shows the long-run equilibrium linkages among the variables. The matrix Π has a reduced rank of $0 < r < n$, so that it can be expressed as $\Pi = \alpha \beta^1$. Where α and β are both $n \times r$ matrices of rank r . α measures the speed of adjustment of the model to equilibrium after external shock, and β^1 explains the long run matrix of coefficient. Also, $\beta^1 A_{t-1}$ represents the error-correction term.

3.4.3 Granger Causality Test

Granger-causality Wald test was carried out to determine the causal relationship between inflation and economic growth. The Granger-causality test was conducted on null hypothesis that the dependent variable does not Granger-cause the independent variable and vice versa. The test involves the estimation of the following pair of regressions.

$$\Delta P_t = \alpha_1 + \sum_{i=1}^p \beta_{1i} \Delta P_{t-i} + \sum_{i=1}^q \beta_{2i} \Delta Y_{t-i} + \lambda_1 ECT_{t-1} + \varepsilon_{1t} \quad 3.11$$

$$\Delta Y_t = \alpha_2 + \sum_{i=1}^p \beta_{2i} \Delta Y_{t-i} + \sum_{i=1}^p \beta_{2i} \Delta P_{t-i} + \lambda_2 ECT_{t-1} + \varepsilon_{2t} \quad 3.12$$

Where ECT is the error correction term from the long run cointegrating relationship, this shows the correction of the disequilibrium and λ is the speed of adjustment. The error correction term should be negative and significant. The negative state spells out the fact that with any deviation from the long run, the variables would turn back to equilibrium. The VECM models in equation (3.11) and (3.12) is able to correct the disequilibrium in the cointegration relationship and also tests the short run and long run causal relationship between inflation and economic growth. The granger causality test can results in a unidirectional, bidirectional or a no causality relation between the variables under study.



CHAPTER FOUR

RESULTS AND DISCUSSION

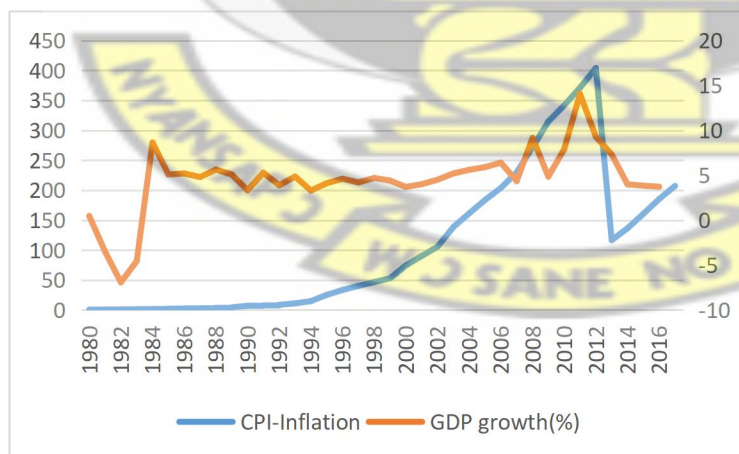
4.1 Introduction

This chapter presents the data analysis and the outcomes to meet our prior objectives and stated hypothesis in chapter one. The chapter presents the trends in the inflation and economic growth. The results from the stationarity tests, cointegration tests and finally the results from the VECM estimations are presented in this chapter.

4.2 Trends in inflation and economic growth in Ghana

In order to have a visual presentation of inflation and the growth rate of the economy, the graphical analysis of the trends of these variables are conducted. The trend analysis enable the study identify the behaviour of the series over time. Figure 4.1 presents the trends in inflation and economic growth rate over the study period.

Figure 4.1: Trends in inflation and economic growth



Source: Author's construction using data from World Bank's WDI (2018)

From Figure 4.1, inflation exhibits an increasing trend over the study period. Periods immediately after the Structural Adjustment Program and the Economic Recovery Program saw inflation stabilized with relatively lower price levels. Thereafter, inflation has been increasing persistently even though measures were put in place to control it. The inflation targeting framework which was introduced in 2002 although actual implementation started in 2007 to help stabilize the rising prices. It is worth noting that single digit inflation were only achieved in 2006 and 2007, 8.7% and 8.85% respectively.

The recovery of Ghana from recession on the back of the economic recovery and structural adjustment programs, which saw economic growth rate bouncing back from -5.56% in 1983 to 8.64% in 1984. The stagnant economic growth rates below 5% for almost two decades, can be attributed to factors such as weak state institutions that resulted in neglect and failure of the SAP reforms, low levels of investments due to low levels of savings and high interest rates, high levels of budget deficit and unfavorable terms of trade and foreign exchange depreciation (Alhassan 2014). The economy has been witnessing consistent but relatively lower growth rates between 1984 and 2010 with an average of about 5.2% annually. Ghana however, became a middle income economy after rebasing the national account in 2010 with a change in the base year from 1993 to 2006. The rebasing shifted the annual growth rate to 8.3% between 2007 and 2012. According to Aryeetey et al., (2000), some policies that were adopted to revamp the economy included exchange rate liberalization, fiscal discipline, monetary policy tightening, foreign trade reforms, financial sector reforms, the privatization of state-owned enterprises, investment expansion, price deregulation and labour market reforms.

4.3 Results of the stationarity test

The stationarity test is an important preliminary test conducted on the variables to avoid analysis of spurious relationship. Knowing the stationarity properties aids in correct specification of the model and also inform the appropriate economic technique to use. The results of the stationarity properties of the variables based on the ADF and Philip-Perron tests are presented in Table 4.1.

Table 4.1: ADF and PP stationarity test results

Variable	ADF test		PHILIP-PERRON Test		ORDER OF INTEGRATION
	CONST	CONST + T	CONST	CONST + T	
PANEL A: LEVELS					
lnY	0.8157	-2.6185	2.5275	-2.9493	-
lnP	-1.6336	-1.6928	-1.6336	-1.7578	-
lnK	-2.2016	-1.9422	-1.8969	-1.4346	-
lnFDI	-1.7614	-2.9959	-1.997	-2.1264	-
lnFD	-1.2046	-2.4743	-2.7227	-0.7161	-
lnTO	-2.9209*	-2.8083	-1.3975	-1.6795	-
PANEL B: FIRST DIFFERENCE					
Δ lnY	-4.673***	-4.580***	-3.283**	-3.135**	I(1)
Δ lnP	-5.043***	-4.943***	-5.043***	-4.943***	I(1)
Δ lnK	-5.426***	-6.207***	-6.033***	-14.23***	I(1)
Δ lnFDI	-5.459***	-5.503***	-5.526***	-8.054***	I(1)
Δ lnFD	-5.890***	-5.959***	-7.980***	-11.38***	I(1)
Δ lnTO	-6.097***	-7.634***	-4.814***	-5.036***	I(1)

Note: **and *** denotes significant at 5% and 1% level respectively

Source: Author's Estimation (2019)

From Table 4.2, it was evident that all the variables in the specified model; economic growth, inflation, capital, foreign direct investment, financial development and trade openness were not stationary at levels based on the ADF test and Philip Perron test in both with a constant term and a trend at 5% significance level. Specifically, the study found evidence of the presence of unit root for all the variables. However, when the variables were differenced for the first time, the study failed to reject the null hypothesis of the presence of unit root for both tests, thus the variables are all integrated of the first order, I (1).

4.4 Results and analysis of the cointegration test

Because all the variables are integrated of order one; I(1), the study further tests for the presence of a long run equilibrium relationship among the variables using the Johansen Multivariate cointegration tests. The results from the cointegration test are presented in Table 4.3.

Table 4.3: Johansen Cointegration test results

Hypothesized No. of CE(s)	Trace Statistic	5% critical value	Decision
None	124.881	95.7536***	COINTEGRATION
At most 1	59.6898	69.81889	PRSENT
	Max-Eigenvalue	5% critical value	
None	65.1912	40.0775***	COINTEGRATION
At most 1	27.2416	33.8768	PRSENT

Note: * implies rejection of the null hypothesis at 1% level of significance**

Source: Author's Estimation (2019)

The result from Table 4.3 indicates that there exist a long run equilibrium relationship among the variables. Specifically, the study rejected the null hypothesis of the existence of no cointegration among the variables at 5% level of significance. This is because the estimates for the trace statistics and the maximum eigenvalue for none are greater than their respective critical values at 5%. This outcome provides evidence that economic growth, inflation, capital, foreign direct investment, financial development and trade openness share a long run relationship. Because the study has established the existence of a long run equilibrium relationship among the variables in the model, the study further estimates the long run and short run coefficients using the VECM estimation technique.

4.5 Results from the Long Run Estimates

The study estimated the VECM model after a long run equilibrium relationship has been established among the variables. Table 4.5 presents the results from the long run and short run estimations respectively.

From Table 4.3, the long run empirical results found a negative and statistically significant relationship between inflation and economic growth. Specifically, a 1% increase in domestic inflation will cause economic growth to decline significantly by 0.207% in the long run. The result suggest that as prices increases, holding all other factors constant, demand also falls. This increases the tendency for demand consumption to fall. And because consumption is a function of economic growth, declining consumption will subsequently lead to decrease in economic growth. Higher price levels adversely affect the domestic economy as it reduces the real value of assets in the economy and thus inhibits

the overall performance of the economy. The negative relationship confirms the findings of Kilimani (2009) in Uganda and Agbola (2013) in Ghana.

Table 4.5: Estimated long-run results

Dependent Variable Economic growth			
Variables	Coefficient	Std. Error	t-statistics
lnP	-0.2073	0.0386	-5.3694***
lnK	-0.3572	0.0405	-8.8105***
lnFDI	-0.2372	0.0225	-10.5351***
lnFD	0.7758	0.0999	7.7617***
lnTO	0.5137	0.0577	8.8909***
C	-24.035		

Note: * indicates significance at 5%**

Source: Author's Estimation (2019)

Surprisingly, capital was found to have a negative impact on economic growth in the Ghanaian economy in the long run. The result contradicts the basic growth theories that increasing capital will enhance production and then increase output and growth. The coefficient indicates that increasing capital by 1% will cause output to decline by 0.357%. This relationship may suggest that in the Ghanaian economy just like other developing economies which are characterized by low levels of capital and increase in capital are not usually invested in productive ventures likely to increase output. The result contradicts the findings of Aryeetey and Fosu (2005) and Christopoulos and Tsionas (2004).

The long run estimates further indicate that FDI has a negative and statistically significant effect on economic growth. Specifically, 1% increase in FDI will cause economic growth to decline significantly by 0.237% in the long run. The negative and statistically significant relationship between FDI and economic growth indicates that an increase in the inflow of foreign investments and capital will reduce economic growth in the long run. This outcome firms the dependency theory which suggested that FDI may have adverse effect on growth in the long run. This is because most organizations financed with foreign investments are likely to make projects and activities that benefits the country providing the foreign direct investment. Also, the negative relationship may also indicate that in the long run, the amount of revenue that Ghana could lose in the form of subsidies and corporate tax incentives to multinational companies rather outweighs the benefits the economy derives from the establishment of these multinational companies. The negative outcome confirms the findings of Eller et al. (2005) in eleven Central and Eastern European nation and Commodore (2013) but contradicts the findings of Leitao and Rasekhi (2013) in Portugal and Sakyi et al. (2015) in Ghana.

The study also found financial development has a positive and statistically significant effect on economic growth. Precisely, a 1% increase in the financial development of the economy will increase economic growth significantly by 0.775%. The significant and positive impact of financial development on economic growth indicates that promoting financial development, will boost economic growth in the long run. This confirms the McKinnon and Shaw hypothesis, as well as the prior expectations and the findings of

Goldsmith (1969), Kilimani (2009) in Uganda and Eso (2010) in 15 ECOWAS countries but contradicts Adusei (2013) in Ghana.

The study also found a positive and statistically significant relationship between trade openness and economic growth. Specifically, a 1% increase in openness to trade will boost output significantly by 0.513%. The significant positive relationship between trade and economic growth proves that globalization and trade liberalization have positive spillover on output growth in the domestic economy. Trade openness enhance cross border transfer of goods, knowledge and technology, broadening the market base for trade as well as allowing for greater pool of resources for production. This shows that government policies to remove trade barriers in Ghana will increase economic growth and the ability of such trade policies to increase the productive capacity as well as promote growth is highly feasible. The positive relationship confirms the findings of Calderon (2010) and Loayza & Odawara (2010).

4.7 Result from the Short Run Estimates

The short run coefficients from the VECM estimations are presented in Table 4.6. The error correction term (ECM_{-1}) coefficient shows that, the value is negative as expected and significant. Thus, from economic perspective, the ECM_{-1} measures the speed at which the endogenous variable responds to changes in the independent variables before converging to its long-run equilibrium level. The implication of the negative and significant sign is that, the adjustment process of the system to restore equilibrium is effective. It further shows that; 81.8% of any disequilibrium in the short run will be restored in the long run.

Table 4.6: Estimated Short run Relationship

Dependent Variable Economic growth			
Variables	Coefficient	Std. Error	t-statistics
ECM	-0.8181	0.3343	-2.4472**
lnP₋₁	-0.2925	0.3225	-0.9069
lnP₋₂	-1.1884	0.3808	-3.1202***
lnK₋₁	0.2502	0.0762	3.2833***
lnK₋₂	0.0227	0.0266	0.8550
lnFDI₋₁	-0.0090	0.0940	-0.0957
lnFDI₋₂	0.0259	0.0746	0.3480
lnFD₋₁	-0.4819	0.3295	-1.4622
lnFD₋₂	-0.1813	0.2192	-0.8270
lnTO₋₁	-0.2021	0.2553	-0.7919
lnTO₋₂	-0.0352	0.2427	-0.1453
C	0.2550	0.1124	2.2677***
R-Squared	0.6625		
Adj. R-squared	0.4536		
F-statistics	3.1712		

Note: **and * denotes significant at 5% and 1% level respectively**

Source: Author's Estimation (2019)

From Table 4.6, the study found that inflation has a negative influence on economic growth in the short run. This is consistent with the long run relationship. However, the negative effect was statistically significant only for the second lag of inflation. Thus, inflation can adversely influence economic growth after a one-year lag. Specifically, a 1% increase in inflation will cause economic growth to decline significantly by 1.188% in the second lag.

This suggest that increasing prices is detrimental to ensuring output growth and subsequently economic growth.

The short run estimates further shows that capital has a positive influence on economic growth. The result supported the basic growth theories that increasing capital will enhance production and then increase output and thus growth. However, the positive relationship is statistically significant for the first lag but statistically insignificant for the second lag. This suggest that the positive effect of capital on economic growth is instantaneous. Specifically, increasing capital by 1% will increase economic growth by 0.250% in the first lag.

The result further shows that foreign direct investment has both negative and positive effect on economic growth in the first lag and second lag respectively. Contrary to the long run estimate, the effects in both the first lag and the second lag are both statistically insignificant. The insignificant relationship in the short run is probable since FDI involves physical investments into infrastructure and capital equipment and machineries which takes time before the effect are felt in the domestic economy. Thus the effect of FDI on economic growth are not instantaneous but the long run impact is likely to be negative.

Again, the study found that financial development has both negative and positive effect on economic growth in the first lag and second lag respectively. However, the mixed effect in the short run were statistically insignificant. This indicates that financial development can only influence economic growth in the long run but not in the short run.

Finally, trade openness was found to have a negative effect on economic growth in both the first lag and the second lag. It is not surprising that the negative impact is not statistically significant. This suggest that policies that opens the economy to trade and globalization may not have the tendency of promoting growth in the Ghanaian economy in the short run.

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4.6 Causal Relationship between Inflation and Economic growth

In order to find out the causal relationship between inflation and economic growth in Ghana, the study further employs the Pairwise Granger causality test. The results from the causality test is presented in Table 4.4

Table 4.4 Granger causality test result

Null hypothesis	F-statistic	Prob.
Economic growth does not granger cause inflation	0.6740	0.0122
Inflation does not granger cause economic growth	1.7515	0.1902

From Table 4.4 the results from the Granger causality test show that there is a unidirectional causality between inflation and economic growth. This means that inflation does not granger cause economic growth but economic growth granger causes inflation. This indicates that lagged values of economic growth possess important information that may be a good predictor or very crucial in predicting inflation. However, the study found evidence that inflation does not grange cause economic growth. This also indicates that lagged values of inflation may not be a good predictor of economic growth. This further

shows a unilateral positive causal relationship running from economic growth to inflation. Thus an increase in economic growth may literally mean increased economic activities which increase the demand for goods and activities in the domestic economy. This gives more money to the citizens to spend and as such increases their demand for goods and services. Assuming supply remain the same the increased demand will cause prices to increase. This confirms the findings of Mallik and Chowdhury (2001).

4.7 Model Diagnostics and Goodness of Fit

In order to ensure the estimated model is consistent and devoid of any econometric problems, the study conducts various diagnostics and stability tests. Table 4.7 presents the results of the stability and diagnostic test generated from the estimated VECM model.

Table 4.7: Diagnostic and Stability test results

Test	F- statistic	Prob. Values
Serial Correlation		
Lag 1	46.127	0.1202
Lag 2	45.417	0.1351
Heteroscedasticity	550.0344	0.4436
Normality	32.516	0.1012

Source: Author's Estimation (2019)

From Table 4.7 the diagnostic and stability tests conducted to indicate that the estimates are free from any econometric problems.

Specifically, the VEC Residual Serial Correlation LM test indicates the absence of serial correlation among the variables as the F-statistic of 46.127 for lag one and 45.417 for lag two were not statistically significant. The VEC residual heteroscedasticity test based also reported a statistically insignificant F-statistics of 550.034, thus indicating the absence of heteroscedasticity among the error terms. From the VEC Residual normality test, the Jarque- Bera showed that the series in the model are normally distributed.

Also the graph of the stationarity of the cointegration equation predicts that the cointegrating equations maintained a fairly stable pattern. Thus, notwithstanding the spikes along the cointegrating equation graph, the figure depict that, they lie within the 95% confidence interval hence the nature of the cointegrating equation is stationary (Appendix 6). The test for correctly specified number of cointegration equations using the inverse roots of AR Characteristic Polynomial graph (Appendix 7) shows that none of the remaining eigenvalues appears close to the unit circle. Thus, the VECM for the model is correctly specified and stable.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapter provides the summary of major findings in relation to the specific objectives and conclusion on the study as well as the recommendations.

5.2 Summary of Findings

This study sought to examine the impact of inflation on economic growth in Ghana. Specifically, the study estimated the causal relation between inflation and economic growth, and also measure the long run and short run effect of inflation on economic growth in Ghana. Annual time series data on economic growth and inflation, as well as other macroeconomic variables such as capital, foreign direct investment, financial development and trade openness spanning from 1980 to 2017 was employed for the analysis. The study estimated the data using the VECM estimation technique.

The results from the preliminary test indicated all the variables included in the model are integrated of order one. Since all the variables in the model were integrated of order one, it justified the use of the Johansen Multivariate cointegration tests to examine the presence of a long run equilibrium relationship among the variables. The study found the existence of a long run equilibrium relationship among the variables.

In order to estimate the causal relationship between inflation and economic growth, the pairwise granger causality test was used. The results from the granger causality tests showed the existence of a unilateral positive causal relationship running from economic growth to inflation. This indicates that lagged values of economic growth possess important information that may be a good predictor or very crucial in predicting inflation.

After a long run equilibrium relationship was established based on the Johansen multivariate cointegration test, the study estimated the long run and short run impact of inflation as well as other macroeconomic variables on economic growth using the VECM Model. The results from the estimated model showed that inflation has a negative and statistically significant impact on economic growth in the long run. A negative impact was also realized in the short run, however the effect in the short run was statistically significant only for the second lag.

The study also found capital had a negative and statistically significant effect on economic growth in the long run. This contradicts the basic growth theories but rather suggest the unproductive use of domestic capital accumulation. However in the short run capital had a positive but statistically insignificant effect on economic growth. Also, foreign direct investment was found to have a negative and statistically significant effect on economic growth in the long run. The effect of FDI in the short run were statistically insignificant for both the first and second lag.

Also, financial development was found to have positive impact on economic growth in the long run. This indicates that promoting financial development especially through increasing the total credit available to the private sector has the ability to increase domestic investments which is likely to boost economic growth in the long run. The effect was statistically insignificant in the short run. Also openness to trade was found to have a positive and statically significant influence on economic growth in the long run, however the effect of trade openness was statistically insignificant in the short run.

5.3 Conclusion

Inflation is a sign that an economy is growing, however excessive rate of inflation is detrimental as it can lead an economy into hyperinflation. Low inflation rates promote economic growth by making prices and wages more flexible (Lucas, 1973). High inflation is bad for the economy and it adversely affects economic performance. It hampers economic growth due to the adverse impact on efficient distribution of resources by changing relative prices (Fisher, 1993). The relationship between inflation and economic growth is one of the most popular macroeconomic issues among central bankers, policy makers and macroeconomists. This study therefore sought to examine the impact of inflation on economic growth in Ghana. Specifically, the study estimated the causal relation between inflation and economic growth and also measure the long run and short run effect of inflation on economic growth. The study estimated a VECM model using annual time series data on economic growth, CPI inflation, capital, foreign direct investment and trade openness from 1980 to 2017. The study found the existence of a unilateral positive causal relationship running from economic growth to inflation. Also, the

study found that inflation has a negative impact on economic growth in both the long run and the short run. The study also found that capital and FDI also have a negative effect on economic growth whereas financial development and trade openness have a positive effect.

5.4 Recommendations

Based on the findings, the study presents the following recommendations;

- I. Because inflation tend to adversely affect economic growth in the economy, the study recommends that the Government of Ghana implement policies that ensures stable prices. This can be in the form of managing the inflation like setting inflation targeting mechanisms to ensure the negative effects of inflation are reduced.
- II. Also, government must invest capital both domestic and foreign generated funds into productive sectors of the economy. Developmental projects, educations, agriculture development and enterprise development would be very beneficial in this regard. Investing in education and enterprises in particular will help boost human capital which will have positive effect on economic growth.

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APPENDICES

Date: 03/28/19 Time: 11:00
Sample (adjusted): 1982 2017
Included observations: 36 after adjustments
Trend assumption: Linear deterministic trend
Series: LNY LNCPI LNFDI LNFD LNK LNT0
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.836488	124.8812	95.75366	0.0001
At most 1	0.530794	59.68989	69.81889	0.2450
At most 2	0.358523	32.44820	47.85613	0.5874
At most 3	0.241500	16.46486	29.79707	0.6792
At most 4	0.163842	6.514030	15.49471	0.6347
At most 5	0.002005	0.072264	3.841466	0.7881

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.836488	65.19129	40.07757	0.0000
At most 1	0.530794	27.24168	33.87687	0.2506
At most 2	0.358523	15.98334	27.58434	0.6672
At most 3	0.241500	9.950829	21.13162	0.7493
At most 4	0.163842	6.441766	14.26460	0.5572
At most 5	0.002005	0.072264	3.841466	0.7881

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

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

Unrestricted Cointegrating Coefficients (normalized by b*S11*b=I):

LNY	LNCPI	LNFDI	LNFD	LNK	LNT0
3.385477	0.303727	-0.869423	-1.347213	-1.644908	1.999956
-4.501627	-2.376186	1.117692	7.438001	-0.246819	-1.696320
-2.765383	0.585011	0.377232	2.910660	0.967222	-3.286258
1.287827	0.221682	0.203292	-1.082772	-0.235364	-1.978919
-0.223732	0.112978	-1.327225	3.650002	0.131040	-1.932282
7.261964	-0.970102	-0.264071	-1.889745	0.613180	1.413861

Unrestricted Adjustment Coefficients (alpha):

D(LNY)	0.011772	-0.007029	0.006187	-0.001711	0.000752	-0.000318
D(LNCPI)	-0.029188	0.065205	-0.038083	-0.030085	-0.003083	-0.008137

D(LNFDI)	0.043930	-0.168213	-0.224299	-0.057179	0.132655	-0.002217
D(LNFD)	-0.064883	-0.092899	-0.033557	0.021265	-0.022224	-0.002822
D(LNK)	0.433036	0.529429	-0.416049	-0.002793	-0.082705	-0.030766
D(LNTO)	-0.017241	-0.009422	0.032789	0.074137	0.006255	-0.003116

1 Cointegrating Equation(s): Log likelihood 77.82079

Normalized cointegrating coefficients (standard error in parentheses)

LNK	LNCPI	LNFDI	LNFD	LNK	LNTO
1.000000	0.089715 (0.06514)	-0.256810 (0.04183)	-0.397939 (0.16121)	-0.485872 (0.04969)	0.590746 (0.10071)

Adjustment coefficients (standard error in parentheses)

D(LNK)	0.039852 (0.01095)
D(LNCPI)	-0.098817 (0.14169)
D(LNFDI)	0.148723 (0.36045)
D(LNFD)	-0.219659 (0.10910)
D(LNK)	1.466035 (0.79945)
D(LNTO)	-0.058368 (0.11277)

2 Cointegrating Equation(s): Log likelihood 91.44163

Normalized cointegrating coefficients (standard error in parentheses)

LNK	LNCPI	LNFDI	LNFD	LNK	LNTO
1.000000	0.000000	-0.258555 (0.04560)	-0.141092 (0.14246)	-0.596588 (0.06202)	0.634549 (0.12563)
0.000000	1.000000	0.019453 (0.15722)	-2.862931 (0.49125)	1.234094 (0.21387)	-0.488255 (0.43320)

Adjustment coefficients (standard error in parentheses)

D(LNK)	0.071494 (0.01661)	0.020278 (0.00706)
D(LNCPI)	-0.392347 (0.22528)	-0.163805 (0.09581)
D(LNFDI)	0.905954 (0.57235)	0.413047 (0.24342)
D(LNFD)	0.198538 (0.15222)	0.201039 (0.06474)
D(LNK)	-0.917257 (1.20479)	-1.126497 (0.51239)
D(LNTO)	-0.015953 (0.18735)	0.017152 (0.07968)

3 Cointegrating Equation(s): Log likelihood 99.43330

Normalized cointegrating coefficients (standard error in parentheses)

LNK	LNCPI	LNFDI	LNFD	LNK	LNTO
1.000000	0.000000	0.000000	-3.247831	0.443500	1.557130

			(0.68090)	(0.38800)	(0.81848)
0.000000	1.000000	0.000000	-2.629182	1.155839	-0.557669
			(0.34000)	(0.19374)	(0.40870)
0.000000	0.000000	1.000000	-12.01579	4.022697	3.568223
			(2.79242)	(1.59122)	(3.35663)

Adjustment coefficients (standard error in parentheses)

D(LNY)	0.054386	0.023897	-0.015757
	(0.01699)	(0.00668)	(0.00397)
D(LNCPI)	-0.287032	-0.186084	0.083890
	(0.24687)	(0.09702)	(0.05765)
D(LNFDI)	1.526228	0.281829	-0.310816
	(0.57948)	(0.22773)	(0.13533)
D(LNFD)	0.291336	0.181408	-0.060081
	(0.16484)	(0.06478)	(0.03850)
D(LNK)	0.233278	-1.369890	0.058300
	(1.24819)	(0.49052)	(0.29150)
D(LNTO)	-0.106627	0.036334	0.016827
	(0.20505)	(0.08058)	(0.04789)

4 Cointegrating Equation(s): Log likelihood 104.4087

Normalized cointegrating coefficients (standard error in parentheses)

LNY	LNCPI	LNFDI	LNFD	LNK	LNTO
1.000000	0.000000	0.000000	0.000000	-0.553595	-0.874463
				(0.31588)	(0.39061)
0.000000	1.000000	0.000000	0.000000	0.348671	-2.526091
				(0.40625)	(0.50236)
0.000000	0.000000	1.000000	0.000000	0.333813	-5.427781
				(1.15136)	(1.42375)
0.000000	0.000000	0.000000	1.000000	-0.307003	-0.748682
				(0.15569)	(0.19252)

Adjustment coefficients (standard error in parentheses)

D(LNY)	0.052183	0.023518	-0.016105	-0.048281
	(0.01722)	(0.00665)	(0.00398)	(0.02196)
D(LNCPI)	-0.325777	-0.192754	0.077774	0.446048
	(0.24937)	(0.09639)	(0.05759)	(0.31814)
D(LNFDI)	1.452591	0.269154	-0.322441	-1.901296
	(0.58750)	(0.22708)	(0.13569)	(0.74951)
D(LNFD)	0.318722	0.186122	-0.055758	-0.724271
	(0.16630)	(0.06428)	(0.03841)	(0.21216)
D(LNK)	0.229681	-1.370509	0.057732	2.146547
	(1.27420)	(0.49250)	(0.29429)	(1.62559)
D(LNTO)	-0.011151	0.052769	0.031899	-0.031692
	(0.18911)	(0.07310)	(0.04368)	(0.24127)

5 Cointegrating Equation(s): Log likelihood 107.6296

Normalized cointegrating coefficients (standard error in parentheses)

LNY	LNCPI	LNFDI	LNFD	LNK	LNTO
1.000000	0.000000	0.000000	0.000000	0.000000	-3.156853
					(0.94147)
0.000000	1.000000	0.000000	0.000000	0.000000	-1.088571
					(0.51490)

0.000000	0.000000	1.000000	0.000000	0.000000	-4.051518 (1.06477)
0.000000	0.000000	0.000000	1.000000	0.000000	-2.014411 (0.43739)
0.000000	0.000000	0.000000	0.000000	1.000000	-4.122853 (1.13873)

Adjustment coefficients (standard error in parentheses)

D(LNY)	0.052015 (0.01720)	0.023603 (0.00665)	-0.017103 (0.00533)	-0.045537 (0.02402)	-0.011143 (0.00521)
D(LNCPI)	-0.325087 (0.24949)	-0.193102 (0.09647)	0.081866 (0.07737)	0.434796 (0.34839)	0.001760 (0.07563)
D(LNFDI)	1.422912 (0.56547)	0.284141 (0.21866)	-0.498503 (0.17535)	-1.417105 (0.78961)	-0.216849 (0.17141)
D(LNFD)	0.323694 (0.16421)	0.183611 (0.06350)	-0.026262 (0.05092)	-0.805387 (0.22930)	0.089281 (0.04978)
D(LNK)	0.248185 (1.27104)	-1.379853 (0.49149)	0.167500 (0.39414)	1.844675 (1.77486)	-1.255570 (0.38528)
D(LNTO)	-0.012550 (0.18908)	0.053476 (0.07311)	0.023597 (0.05863)	-0.008861 (0.26402)	0.045770 (0.05731)

Pairwise Granger Causality Tests

Date: 03/28/19 Time: 11:45

Sample: 1980 2017

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LNY does not Granger Cause LNCPI	36	0.67409	0.0122
LNCPI does not Granger Cause LNY		1.75157	0.1902

Vector Error Correction Estimates

Date: 03/28/19 Time: 08:23

Sample (adjusted): 1983 2017

Included observations: 35 after adjustments

Standard errors in () & t-statistics in []

Cointegrating Eq:	CointEq1
LNY(-1)	1.000000

LNCPI(-1) -0.207366
 (0.03862)
 [-5.36945]

LNK(-1) -0.357242
 (0.04055)
 [-8.81050]

LNFDI(-1) -0.237217
 (0.02252)
 [-10.5351]

LNFD(-1) 0.775871
 (0.09996)
 [7.76171]

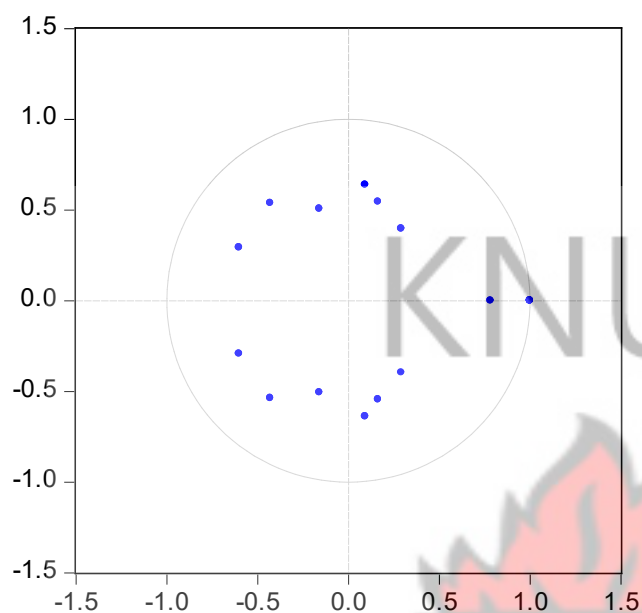
LNT0(-1) 0.513781
 (0.05779)
 [8.89098]

C -24.03566

Error Correction:	D(LNY)	D(LNCPI)	D(LNK)	D(LNFDI)	D(LNFD)	D(LNT0)
CointEq1	-0.818133 (0.33431) [-2.44723]	0.044781 (0.03115) [1.43746]	-0.108217 (1.91950) [-0.05638]	0.212745 (1.13232) [0.18788]	-0.018473 (0.34251) [-0.05393]	-0.373047 (0.30601) [-1.21907]
D(LNY(-1))	6.681350 (3.20145) [2.08698]	0.079434 (0.29833) [0.26626]	6.420726 (18.3817) [0.34930]	5.738922 (10.8434) [0.52925]	0.339634 (3.27993) [0.10355]	1.468952 (2.93043) [0.50127]
D(LNY(-2))	-3.156643 (1.93535) [-1.63105]	0.060656 (0.18035) [0.33633]	-26.74946 (11.1122) [-2.40723]	-2.693589 (6.55510) [-0.41092]	-1.127429 (1.98279) [-0.56861]	-0.258222 (1.77151) [-0.14576]
D(LNCPI(-1))	-0.292539 (0.32256) [-0.90694]	0.076987 (0.03006) [2.56134]	-0.413558 (1.85201) [-0.22330]	0.960219 (1.09251) [0.87891]	-0.269744 (0.33046) [-0.81626]	-0.215685 (0.29525) [-0.73052]
D(LNCPI(-2))	-1.188475 (0.38089) [-3.12022]	-0.008517 (0.03549) [-0.23994]	-5.243063 (2.18698) [-2.39740]	-0.933606 (1.29010) [-0.72367]	0.211101 (0.39023) [0.54096]	-0.266471 (0.34865) [-0.76429]
D(LNK(-1))	0.250209 (0.07621) [3.28331]	0.001717 (0.00710) [0.24175]	-1.132226 (0.43755) [-2.58764]	-0.174229 (0.25811) [-0.67501]	0.032373 (0.07807) [0.41464]	-0.095930 (0.06976) [-1.37524]
D(LNK(-2))	0.022758 (0.02662) [0.85503]	0.002969 (0.00248) [1.19690]	-0.142297 (0.15282) [-0.93113]	-0.030618 (0.09015) [-0.33964]	-0.008048 (0.02727) [-0.29512]	-0.000249 (0.02436) [-0.01023]
D(LNFDI(-1))	-0.009004 (0.09407) [-0.09572]	0.001951 (0.00877) [0.22260]	0.355957 (0.54011) [0.65904]	0.074229 (0.31861) [0.23297]	0.012800 (0.09637) [0.13281]	-0.037607 (0.08611) [-0.43676]

D(LNFDI(-2))	0.025972 (0.07462) [0.34805]	0.001893 (0.00695) [0.27216]	0.357802 (0.42846) [0.83510]	-0.073192 (0.25275) [-0.28959]	-0.028712 (0.07645) [-0.37556]	-0.057333 (0.06831) [-0.83936]
D(LNFD(-1))	-0.481916 (0.32957) [-1.46227]	-0.011575 (0.03071) [-0.37690]	0.364131 (1.89227) [0.19243]	0.000353 (1.11626) [0.00032]	-0.194195 (0.33765) [-0.57514]	-0.186690 (0.30167) [-0.61886]
D(LNFD(-2))	-0.181350 (0.21928) [-0.82704]	-0.010109 (0.02043) [-0.49473]	1.453335 (1.25902) [1.15434]	-0.519282 (0.74270) [-0.69918]	-0.363810 (0.22465) [-1.61943]	-0.063878 (0.20071) [-0.31825]
D(LNTO(-1))	-0.202189 (0.25531) [-0.79195]	0.052783 (0.02379) [2.21864]	0.295041 (1.46588) [0.20127]	0.141409 (0.86473) [0.16353]	0.062081 (0.26156) [0.23734]	0.281996 (0.23369) [1.20670]
D(LNTO(-2))	-0.035298 (0.24279) [-0.14538]	-0.009155 (0.02262) [-0.40464]	0.914257 (1.39402) [0.65584]	0.651427 (0.82234) [0.79216]	0.195224 (0.24874) [0.78485]	-0.273975 (0.22224) [-1.23281]
C	0.255049 (0.11247) [2.26774]	0.031798 (0.01048) [3.03405]	1.618568 (0.64576) [2.50646]	-0.070421 (0.38093) [-0.18486]	0.138072 (0.11523) [1.19828]	0.115882 (0.10295) [1.12564]
R-squared	0.662522	0.695948	0.788449	0.346429	0.341172	0.471111
Adj. R-squared	0.453607	0.507726	0.657489	-0.058162	-0.066673	0.143704
Sum sq. resids	0.801871	0.006963	26.43518	9.199075	0.841667	0.671854
S.E. equation	0.195408	0.018209	1.121971	0.661854	0.200198	0.178866
F-statistic	3.171252	3.697478	6.020522	0.856245	0.836524	1.438915
Log likelihood	16.41988	99.48072	-44.75143	-26.27856	15.57223	19.51575
Akaike AIC	-0.138279	-4.884612	3.357225	2.301632	-0.089842	-0.315186
Schwarz SC	0.483860	-4.262473	3.979364	2.923771	0.532298	0.306953
Mean dependent	0.153642	0.050900	0.011939	0.080997	0.068628	0.074686
S.D. dependent	0.264356	0.025953	1.917097	0.643408	0.193841	0.193293
Determinant resid covariance (dof adj.)	6.30E-10					
Determinant resid covariance	2.94E-11					
Log likelihood	126.4051					
Akaike information criterion	-2.080293					
Schwarz criterion	1.919173					

Inverse Roots of AR Characteristic Polynomial



VEC Residual Serial Correlation LM Tests

Null Hypothesis: no serial correlation at lag order h

Date: 03/28/19 Time: 08:24

Sample: 1980 2017

Included observations: 35

Lags	LM-Stat	Prob
1	46.12754	0.1202
2	45.41721	0.1351
3	35.44078	0.4950

Probs from chi-square with 36 df.

VEC Residual Normality Tests

Orthogonalization: Cholesky (Lutkepohl)

Null Hypothesis: residuals are multivariate normal

Date: 03/28/19 Time: 08:24

Sample: 1980 2017

Included observations: 35

Component	Skewness	Chi-sq	df	Prob.
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1	1.110294	7.191061	1	0.0073
2	-1.080107	6.805348	1	0.0091
3	-0.209483	0.255984	1	0.6129
4	0.018731	0.002047	1	0.9639
5	0.016354	0.001560	1	0.9685
6	-0.082245	0.039458	1	0.8425

Joint	14.29546	6	0.0265
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Component	Kurtosis	Chi-sq	df	Prob.
1	5.135105	6.648065	1	0.0099
2	5.304620	7.745608	1	0.0054
3	2.752885	0.089055	1	0.7654
4	2.596143	0.237855	1	0.6258
5	4.483965	3.211473	1	0.0731
6	2.554610	0.289293	1	0.5907

Joint	18.22135	6	0.0057
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Component	Jarque-Bera	df	Prob.
1	13.83913	2	0.0010
2	14.55096	2	0.0007
3	0.345038	2	0.8415
4	0.239901	2	0.8870
5	3.213033	2	0.2006
6	0.328751	2	0.8484
Joint	32.51681	12	0.1012

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Date: 03/28/19 Time: 08:25

Sample: 1980 2017

Included observations: 35

Joint test:

Chi-sq	df	Prob.
550.0344	546	0.4436

Individual components:

Dependent	R-squared	F(26,8)	Prob.	Chi-sq(26)	Prob.
res1*res1	0.812318	1.331741	0.3527	28.43113	0.3376
res2*res2	0.927162	3.916634	0.0252	32.45066	0.1786
res3*res3	0.920931	3.583760	0.0329	32.23259	0.1855
res4*res4	0.893746	2.588126	0.0819	31.28111	0.2180

res5*res5	0.559260	0.390434	0.9668	19.57410	0.8113
res6*res6	0.396038	0.201764	0.9992	13.86134	0.9748
res2*res1	0.936075	4.505670	0.0163	32.76264	0.1691
res3*res1	0.858190	1.862059	0.1822	30.03665	0.2661
res3*res2	0.893370	2.577928	0.0828	31.26797	0.2184
res4*res1	0.685692	0.671259	0.7911	23.99922	0.5760
res4*res2	0.655328	0.585017	0.8564	22.93646	0.6365
res4*res3	0.562124	0.395000	0.9651	19.67433	0.8067
res5*res1	0.719785	0.790365	0.6966	25.19247	0.5081
res5*res2	0.776672	1.070066	0.4945	27.18352	0.3998
res5*res3	0.597153	0.456102	0.9377	20.90035	0.7471
res5*res4	0.549860	0.375856	0.9719	19.24511	0.8259
res6*res1	0.727811	0.822745	0.6711	25.47339	0.4923
res6*res2	0.899204	2.744921	0.0701	31.47213	0.2112
res6*res3	0.875974	2.173176	0.1274	30.65909	0.2412
res6*res4	0.781078	1.097794	0.4772	27.33772	0.3918
res6*res5	0.342098	0.159995	0.9998	11.97343	0.9913

