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INFLATION TARGETING AND ECONOMIC GROWTH IN GHANA

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INFLATION TARGETING MONETARY POLICY AND ECONOMIC GROWTH IN GHANA

BY

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DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the results of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature …… Date……

Name: Emmanuel Nana Yartel

Supervisors' Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised in accordance with the guidelines on supervision of dissertation laid down by the University of Cape Coast.

Supervisor's Signature…….Date…….

Name: Mr. Nkansa Darfor

ABSTRACT

This study investigated the relationship of inflation targeting monetary policy and economic growth in Ghana. Inflation rate was measured by conditional variance generated by fitting an empirical Generalized Autoregressive Conditional Hetroskedasticity (GARCH) model to seasonally adjust annual consumer price inflation for the period 1960-2015. The inflation rate measure, together with macroeconomic control variables, was used to estimate economic growth models for two periods corresponding to two monetary policy regimes and a third period covering the full sample. The first period corresponds to the pre-inflation targeting regime covering 1960-2002. During this period, Ghana had adopted various monetary policy frameworks including exchange-rate targeting, discretionary monetary policy, monetary-aggregate targeting and an eclectic approach. This period was largely characterized by high inflation rate. The inflation rate in turn had significant negative impact on economic growth during this period. Nonetheless, inflation rate did not have any statistically significant impact on real economic growth during the inflation targeting monetary policy period, i.e. 2003-2015. The empirical results for the combined growth model were consistent with the findings for the two periods. The implication of this is that by adopting the inflation targeting monetary policy framework since 2003, Ghana has to some extent succeeded in achieving low and stable general price level thereby creating a conducive environment for economic growth. The government may introduce some structural reforms to unlock the economic growth potentials in the country.

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I say God richly bless you all.

DEDICATION

I dedicate this work to the Yartel Family for their support.

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CHAPTER ONE

INTRODUCTION

Introduction

There is so much knowledge on the Fisher theory in Ghana but with much concentration on Treasury bill as a proxy for interest rate. However, monetary policy and its relationship with inflation is essential in ensuring economic growth across the continent and in Ghana. It is therefore important to study how these two variables behave in the Ghanaian economy to aid policy decisions and also to know the implications of some policies in the country. This research seeks to examine empirically the existence of Fisher hypothesis in Ghana. This theory postulates a one-for-one relationship between nominal interest rate and inflation. The chapter covers the background of the study, statement of the research problem, purpose of the study, research objectives, hypotheses, significance of the study, scope of the study, organization of the study and the limitation of the study.

Background to the Study

This study examines the impact of inflation targeting monetary policy on economic growth in Ghana. The threshold inflation rate is found to be 1% for industrial countries and 11% for developing countries; below these rates the inflation growth effect is positive. Until at least the early 1970s, monetary policy was regarded as ineffective in controlling inflation. Governments relied on fiscal policy to stabilize the economy and to keep inflation low. However, beginning in mid-1970s monetary establishments in advanced

economies attempted to control inflation using monetary aggregates (M3, M2 or M1) with some success. Nonetheless, the instability between monetary targeting and goal variables (inflation and income) made this approach problematic. With such problems with monetary targeting in 1970s and 1980s, advanced economies shifted to inflation targeting in early 1990s.

New Zealand was the first country to adopt inflation targeting monetary policy approach in 1990. Following New Zealand, a growing number of countries have adopted inflation rate as a primary goal of monetary policy. In 2010, 26 countries used inflation targeting monetary policy framework with half of them consisting of emerging market and low income countries (Roger, 2010). According to Hammond (2012), the start of 2012 ushered 27 central banks into fully fledged inflation targeters' status, and several others were in the process of establishing a full inflation-targeting regime. With Albania joining the inflation targeting group in 2009, there were already 28 inflation targeting monetary authorities by 2012 (Jahan, 2012).

Inflation targeting monetary policy is different from other monetary policies by its explicit public commitment to controlling inflation as the primary policy objective and the emphasis on policy transparency and accountability. Inflation targeting monetary policy framework has four main elements (Mishkin, 2004; Roger, 2010): (i) an explicit central bank mandate to pursue price stability as the primary objective of monetary policy and a high degree of operational autonomy; (ii) explicit quantitative targets for inflation; (iii) central bank accountability for performance in achieving the inflation objective, mainly through high-transparency requirements for policy strategy and implementation; and (iv) a policy approach based on a forward-looking

assessment of inflation pressures, taking into account a wide array of information.

Statement of the Problem

High rates of inflation have the potential to harm economic performance since economic contracts are nominal, uncertainty about future prices is likely to involve higher risk premium and unexpected changes in the distribution of wealth (Fielding, 2008). This in turn results in higher economic costs. Economic literature finds therefore that for a given rate of inflation, higher inflation volatility can depress economic growth (Elder, 2004; Fielding, 2008).

The high inflation rates and slow economic growth in Ghana has led to the adoption of various monetary policy frameworks including exchange-rate targeting, discretionary monetary policy, monetary-aggregate targeting and an eclectic approach and finally the inflation targeting monetary policy. Hence this scientific study of inflation targeting monetary policy and economic growth in Ghana.

Research Objectives

General Objective

The general objective of this study is to examine the impact of inflation targeting monetary policy on economic growth in Ghana.

Specific Objectives

This study has two major specific objectives namely;

1. To examine the effect of the pre-inflation targeting regime and the inflation targeting regime on economic growth.

Hypotheses Formulation

Null Hypotheses:

$H_{0:}$ There is no statistically significant negative impact on real economic growth in Ghana in the pre-inflation targeting regime.

$H_{0:}$ There is no statistically significant impact on real economic growth in Ghana during the inflation targeting regime.

Alternative Hypotheses:

$H_{1:}$ There is a statistically significant negative impact on real economic growth in Ghana in the pre-inflation targeting regime.

$H_{1:}$ There is a statistically significant impact on real economic growth in Ghana during the inflation targeting regime.

Significance of the Study

This study is useful in determining whether Ghana by adopting inflation targeting monetary policy in 2002, has succeeded in achieving low and stable general price level thereby creating a conducive environment for economic growth. The study again seeks to suggest policy measures to maintain the inflation rate within the target range as well as reducing its volatility.

Moreover, findings from this study are helpful for Government's consideration on implementation of structural reforms to unlock the economic

growth potential. It will also add to the literature on the effectiveness of inflation targeting monetary policy.

Organization of the Study

The organization of the rest of the paper is as follows; a survey of the literature review which consists of theoretical and empirical reviews. Section three focuses on the methodology of the research covering issues relating to the research design, sample, sources of data, model specification and techniques of analysis. In section four, the empirical analyses are undertaken and results are discussed. While policy implications and concluding remarks are contained in section five.

Chapter Summary

The background of the impact of inflation targeting on economic growth in Ghana is provided and the threshold at which high inflation rates impact negatively on the Ghanaian economy. The findings of the study are also noted to be helpful for Government's consideration on implementation on structural reforms on the economic potentials of Ghana.

CHAPTER TWO

LITERATURE REVIEW

Introduction

Inflation targeting monetary policy was first adopted about two decades ago. Theories and practices have developed together over this period, resulting in a large body of academic literature on inflation targeting. Many central banks adopted inflation targeting as a pragmatic response to the failure of other monetary policy regimes, rather than in response to new economic thinking (Hammond, 2012; Jahan, 2012).

Theoretical Literature Review

Since 1990, inflation targeting has been adopted by many industrialized countries (New Zealand, Canada, the United Kingdom, Sweden, Israel, Australia and Switzerland), by several emerging market countries (Chile, Brazil, Korea, Thailand, and South Africa) and by several transition countries (Czech Republic, Poland and Hungary) (Mishkin, 2001). During the past decade, popularity of inflation targeting has grown among central bankers and economists. In an inflation targeting regime, there are five important components (Eipstein & Yeldan, 2007). These are absence of any other nominal anchors; such as exchange rates or nominal GDP, an institutional commitment to price stability, absence of fiscal dominance, policy independence and policy transparency and accountability.

Implementation of inflation targeting regime can be classified under different categories. If the central bank announces official targets, it will be explicit inflation targeting regime. Otherwise it is called implicit targeting

regime. If the bank takes forecasts about inflation, it is called as inflation forecast targeting, otherwise actual inflation targeting regime.

The bank may use consumer price index, inflation deflator, producer price index and etc. Frankel (2011) states that although there a number of interpretations of price index, all orthodox interpretations focus on CPI as the choice of price index.

The Classical View

The publication of "Wealth of Nations" in 1776 is considered as the birth of Classical economic thinking. This economic thinking was popular until it was questioned by John Maynard Keynes in 1936 with his publication of "The General Theory of Employment, Interest and Money".

Early classical economists, in particular Adam Smith and David Ricardo, adopted Richard. Quesnay's social class analysis and revised these classes as landlords, capitalists and workers.

Based on the self-interest assumption of classical economists, capitalists compete with each other even in the labour market. Such competition increases labour wage. The rising cost of production through an increase in labour wage reduces the profit of the capitalist benefiting workers and landlords. The fall in the profit level discourages the capitalist who is the source of wealth creation. Thus, the price increase will have a negative impact on productivity of the capitalist leading to decline in the level of the economic growth (Pentecost 2000: 7 - 11).

In later Classical economics output and employment is not determined by the creation of money but rather it is explained by the short-run production function where output Y is explained as a function of labour L and capital K, given by Y= A f (K, L), where Y is output, A is the level of technology, K is capital accumulated, and L is the labour force.

According to this explanation in order to achieve economic growth either the labour force or capital accumulation must rise. The rise in the level of technology also helps to postpone the diminishing returns of growth caused by the rise in capital or labour force (Snowdon and Vane, 2005).

One of the known Classical economic thinkers Jean Baptiste Say states that money has no other function than serving as medium of exchange. According to him, the major determinant of the economic growth, i.e., investment is determined by the level of saving. When saving falls interest rate rises and investment spending will be discouraged. On the other hand, if saving increases interest rate falls and investment expenditure rises to offset the fall in consumption expenditure caused by higher saving. Saving is, therefore, the creator of investment and hence economic growth. This popular classical thinking is well known as Say's law (Baumol, 1999).

The other feature of Classical thinking, the quantity theory of money (QTM), states that in the long-run money does not have an effect on real variables but can pressure the price level. To the Cambridge economists, the theory is stated as M = kPY

Where, M is money supply, k is the fraction of the national income, P is the price and Y is the total national income (Snowdon and Vane, 2005).

To the income version the quantity theory of money is given as

MV = PY

Where, V is the velocity of money in the economy. V is the reciprocal of k and it remains constant as Y. Again in the Fishers' equation of the QTM an increase in money supply leads to an increase in the amount of money at hand among producers and consumers having no effect on the level of output. The rise in the level of money at the hand of agents increases the demand for goods and services produced at full employment. This rise in demand leads to a rise in inflation (Dimand, 2005).

Though the relationship between inflation and economic growth is not stated clearly in the classical economic thinking as indicated by many Classical economists, it is implicitly stated that there is a negative relationship between the two variables.

The Monetarist View

Based on the Quantity Theory of Money (QTM), the Monetarists view argues that monetary changes are seen as a cause rather than consequences of major economic recessions and booms.

Regarding the relationship between inflation and economic growth, monetarists interpreted the Phillips curve differently from how it was interpreted by Keynesians. Milton Friedman, known as the father of the Monetarist school, argues that wage inflation should not only be explained by unemployment but it is also explained by inflation expectations (Leeson, 1994).

For monetarists, there is a positive relationship between inflation and economic growth in the short-run but in the long run an

expansionary monetary policy (effective policy measure for Monetarists) will have no real impact except the general price increase (Friedman, 1968).

For an economy at the natural rate of unemployment (zero inflation, zero growth), if authorities want to reduce unemployment by raising aggregate demand through an increase in the money supply, then workers consider the associated wage increase as a real one. Such belief of workers motivates them to increase their labour supply and hence productivity rises. However, this situation stays only for the short-run. Once workers take into consideration that the wage increase is not in real terms but in nominal terms and when they realize that their real wage did not change they reduce their labour supply. Thus, productivity and economic growth can be raised in the short-run through expansionary monetary policy. In the long-run, after expectations are adjusted, economic growth will not be affected and only the price level will change (Friedman, 1976).

Unlike the Keynesian exogenous expectation, the Monetarists analysis is based on adaptive expectation (error learning expectations). Inflation expectations in this case are made using past information. Due to this reason there are numerous curves related to different expected rate of inflation (Ramalho, 2011).

This is explained well in figure 2.1, where initially the economy is at point A in which unemployment is at its natural rate and wage rate is zero. If policy makers want to reduce unemployment below the natural rate, say to U1 using expansionary monetary policy, then wage rises to W1. Assuming that the policy measure is not anticipated, this increase in wage will be perceived by workers as an increase in their real wages. In this case, the economy will be

at point B where unemployment is reduced and money wage has risen while real wage is declining.

After adjusting their expectations, workers start to seek for additional money wages to compensate the decline in their real wages. Since firms cannot pay the high wage rate that workers seek, unemployment returns back to its natural rate and the economy settles at point C. Hence, in the long-run unemployment is at its natural rate but wage is inflated to W1 (Friedman, 1976).

After expectations are adjusted the short-run Phillips curve shifts from SRPC1 to SRPC2. If inflation is expected to be higher, the short-run Phillips Curve is also expected to shift to the right. If higher inflation is anticipated then there will be no short-run effect for expansionary monetary policy. However, if the policy measure is not anticipated then there will be a short-run effect (Friedman, 1976).

According to Monetarists, there is a positive short-run relationship between inflation and economic growth, provided that the growth is accompanied by the decline of unemployment and rise in the cost of production leading to price inflation. This short-run relationship exists if and only if the policy measure to raise the aggregate demand is not anticipated. In such cases, when workers adjust their expectations output adjusts to its natural rate at the vertical long-run Phillips Curve leaving the price higher. As a result, an increase in money supply will increase the price level without having any effect on output and hence there will be no long-run trade-off between inflation and economic growth (Friedman, 1976).

Neo Classical View

Based on the rational expectations and continuous market clearing approach, the relationship between inflation and economic growth is explained by the inter-temporal substitution approach and the surprise model in the New Classical economics (Lucas, 1996).

According to the inter-temporal substitution approach rational workers supply more labour when real wage increases and they take more leisure when real wage falls. When workers supply more labour, productivity is expected to move up leading to economic growth. An increase in nominal wage however, will not have an impact on real economic variables such as employment and growth (Lucas & Rapping, 1969).

The surprise model explains more about the goods market in the economy than the labour market. A rational firm decides to increase its productivity only when price of its product increases. However, the price increase should be in relative terms. If the price increase is in absolute terms, then rational firms do not change their production and will have no real impact in the economy (Lucas, 1973).

For Neo Classicals, if there is any unexpected increase in wage or price, the increase surprises suppliers of labour and goods. Such surprises will have a real impact on the economy in the short-run until economic agents adjust their expectations. Such surprises are usually related to an unannounced increase in money supply that causes the general price increase. If the money supply increase is announced and was expected by economic agents, then it will not have any real effect on the economy (Lucas, 1973).

Even if there is an unannounced increase in money supply, output might deviate from its natural rate only for the short-run and in the long-run it will be back to its natural rate when workers realize that the price increase is in absolute terms.

Unlike Keynesians, wages and prices are assumed to be fully flexible and if future inflation is anticipated there will be zero sacrifice ratios for reducing inflation. This means if tight monetary policy is announced inflation can be reduced in the short-run with no trade-off. In such a case there will be no short-run effect since the level of inflation is anticipated.

Unlike Monetarists, monetary policy is used not to increase aggregate demand but to control inflation. To achieve higher economic growth supply side policies play a more major role than the monetary policy.

The Romer-Lucas (Endogenous) Growth Model

In the Romer-Lucas model of growth, unlike the Solow-Swan growth model, technological change is not exogenously determined but it is derived from the capital accumulation process.

Accumulations of capital goods that are used to produce consumer goods enable workers to learn how to operate high technology machinery and modify them (Lucas, 1988). Such a learning process allows technological advancement. According to this theory there will be no diminishing returns of output because of the associated technical advancement of the capital accumulation as there occurs

capital deepening. Thus capital accumulation is still the important factor in achieving economic growth (Romer, 1994).

Theories such as proximate growth theories, do not openly discuss inflation and its relationship with growth. Other theories especially theories after the Great Depression have analyzed the relationship between inflation and growth. For instance, Keynesians say that there exists a long run positive relationship between inflation and growth where there is no visible short-run relationship. Monetarists, on the other side, state that there is no long-run relationship between the two variables. In the short run, until expectations are adjusted, there is a positive relationship between them.

New Classicals affirm that anticipated inflation has neither long-run nor short-run effect on growth. However, if inflation is unanticipated it has a negative impact on the growth of the economy. Based on the wage and price rigidities assumption, to the New Keynesians, inflation anticipated or unanticipated has a negative impact on the economic growth of a country.

From these theories one can clearly understand that there are conflicting results among theories regarding the relationship between inflation and economic growth. Keeping in mind these conflicting theories, the next section will examine in detail global empirical studies regarding the two macro-economic variables.

Empirical Review

Though empirical evidence on the impact of inflation targeting monetary policy on inflation volatility is mixed, a growing body of empirical economic literature suggests that inflation targeting monetary policy has largely succeeded in reducing both the inflation rate and inflation volatility.

Mishkin and Posen (1998) among such studies analyzed the experience of inflation targeting monetary policy regime in the first three countries that have adopted the policy - New Zealand, Canada, and the United Kingdom, as well as in Germany which adopted many elements of inflation targeting. They conclude that inflation targeting appears to have been successful in increasing the transparency of monetary policy making and in lowering significantly the rate of inflation in these countries, without any negative consequences for output.

They found in particular that New Zealand, which was prone to high and volatile inflation before the inflation-targeting regime was adopted, has emerged from this experience as a low-inflation country with high rates of economic growth.

They also found that inflation targeting has worked to keep inflation low and stable in Canada even though accountability was to the general public rather than specifically to the government through specified contracts.

As in New Zealand, a key component of Canada's success with inflation targeting has been a strong and increasing commitment to transparency and the communication of monetary policy strategy to the public. Likewise, the British inflation targeting helped produce lower and more stable inflation rates due mainly to the Bank of England's focus on transparency.

Mishkin and Posen (1998) conclude further that the design choices of the inflation targeting countries have tended to converge over time, suggesting that a consensus is emerging on best practice in

the operation of an inflation-targeting regime. Transparency and flexibility, properly balanced in operational design, appear to create a sound foundation for a monetary strategy in pursuit of price stability. Apart from this, the study finds that inflation targeting has not required the central banks to abandon their concerns about other economic goals such as the level of the exchange rate or the rate of economic growth.

In addition to this, a study by IMF (2005) found adoption of inflation targeting to be associated with a 4.8 percentage point reduction in average inflation relative to other monetary policy regimes between 1990 and 2004. Inflation targeting was also associated with a 3.6 percentage point reduction in the variability of inflation relative to other strategies.

Moreover, Mishkin and Schmidt-Hebbel (2007), based on empirical evidence from a panel of inflation targeting and a control group of high income non-inflation targeting countries, conclude that inflation targeting helps countries to achieve lower inflation rate and inflation variability compared to non-inflation targeting countries.

Lin and Ye (2008) evaluated the average treatment effect of inflation targeting in thirteen developing countries that have adopted this policy by the end of 2004. Using a variety of propensity score matching methods, they find strong and robust evidence that inflation targeting has quantitatively large and statistically significant effects on lowering inflation and inflation variability in the thirteen countries considered. They conclude further that on average, the adoption of inflation targeting has led 8 to a fall in the level of inflation by nearly 3 percentage points and significantly lowered inflation variability.

Empirical evidences also suggest that inflation volatility is closely associated with the inflation rate due to the information asymmetry in the financial market generated by the latter. So the higher is the inflation rate, the more information asymmetry, the more inflation volatility, and the lower is the real growth rate (Emara, 2012). Today there are 28 countries that have adopted full inflation targeting as their monetary policy framework.

Overall, inflation-targeting countries appear to have done better than others in minimizing the impact of external shocks compared to non-inflation targeting countries. Roger (2010) argues that following the commodity price shock between 2006 and 2008, among low-income economies, non-inflation-targeting countries experienced bigger increases in inflation than inflation-targeting countries, although their gross domestic product growth rates fell by similar amounts.

On the other hand, among high-income economies, inflation-targeting countries had a smaller growth decline than non-inflation-targeting countries and slightly less of an increase in inflation.

There is a considerable body of economic literature that deals with the relationship between inflation, as well as its volatility and economic growth. For the earliest of these studies, see for instance, Kaldor (1959), Black (1959), Dornbusch and Frenkel (1973), and Sidrauski (1976) among others, who contributed significantly to our understanding of the growth inflation nexus. In recent years, in addition to Elder (2004) and Fielding (2008), a number of studies indicate statistically significant negative relationship between

economic growth and both the inflation levels and its volatility. For instance, using time series - cross sectional data.

Further, using intra-year inflation data to construct an annual measure of inflation volatility, they find that inflation volatility is robustly negatively correlated with growth even after the effect of the level of inflation is controlled for.

In addition, Rother (2004) argues that among the harmful effects of inflation, the negative consequences of inflation volatility are of particular concern. He states that high variability of inflation over time makes expectations over the future price level more uncertain and given that contracts are nominal, this induces risk premium for long-term arrangements, raising costs for hedging against inflation risks and leading to unanticipated redistribution of wealth. He concludes therefore that inflation volatility can impede growth even if inflation on average remains restrained.

The Development of Monetary Policy Framework in Ghana

The history of monetary management in Ghana can be categorized into two main distinct phases i.e. the period associated with monetary controls and the period under which monetary policy has been allowed to develop in a setting of a liberalized environment. Prior to 1983, when major reforms in the financial structure of the economy began, the Bank of Ghana operated largely a direct controlled system of monetary management. This entailed the reliance on predominantly direct intervention instruments, prominent among which was direct credit control. This involved the imposition of ceilings, both global and sectorial, on individual commercial banks' lending and had to be consistent with national macroeconomic targets like growth, inflation and

external balance. With time, these arrangements proved to be ineffective and introduced inefficiencies in various sectors of the economy.

These weaknesses inherent in the economy at the time necessitated reforms in the conduct of monetary policy. The direct control system of monetary management had to be abandoned with the advent of liberalization of the economy in 1983.

The liberalization process entailed progressive de-regulatory measures, culminating in the institutionalization of a market-based system of monetary management in early 1992 and focused largely on the use of indirect and market based instruments in the conduct of its monetary policy. This brought into focus a new dimension to the way monetary management was designed and implemented, the Bank of Ghana Act 612 (2002) was passed by Parliament. The Act gave the Bank of Ghana the independence in the discharge of its monetary policy. The independence aspect of the law implied that the Bank could use whatever tools available at its disposal in achieving its primary objective of price stability.

The Act gave birth to the Monetary Policy Committee (MPC). Conduct of Monetary Policy is vested in the MPC. The law paved the way for the Bank of Ghana to be an inflation-targeting central bank. The Monetary Policy Committee since 2002 has been putting in place various institutional, operational as well as accountability and transparency structures to facilitate the effective discharge of its functions (www.bog.gov.gh/20-07-2016).

The introduction of the inflation targeting monetary policy was expected not only to maintain the inflation rate within the target range but also reduce its volatility. A highly volatile rate of inflation has the potential to harm economic performance. Since economic contracts are nominal, uncertainty about future prices is likely to entail higher risk premium and unanticipated changes in the distribution of wealth (Fielding, 2008). This in turn results in higher economic costs. According to Elder (2004) and Fielding (2008) economic literature finds that for a given rate of inflation, higher inflation volatility can depress economic growth.

Many studies address the role of economic policy on economic growth but few of these studies focus on the impact of the second moments of policy on growth. This studies attempts to investigate the impact of inflation on economic growth in Ghana during the two monetary policy regimes, i.e. (i) the pre-inflation targeting monetary policy regime of 1960-2002, (ii) the inflation targeting monetary policy regime of 2003-2015 and (iii) the combined period of1960-2015.

Causes of Inflation in Ghana

Since the introduction of inflation targeting monetary policy, the Ghana has largely contained inflation within the range of 8% to 31% for the period between 2003 and 2015 fiscal years. Inflation declined in 2010 to 8.58 % reaching its lowest level since the inception of Act 612 (2002) following.

Ghana's gradual recovery from the impacts of the global economic crisis. The main causes of inflation in Ghana are mainly attributed to the following factors; increases in monetary aggregates (money supply), petroleum price increases, exchange rate depreciation, and poor agricultural

production. Data available from Institute of Statistical, Social and Economic Research ISSER, Bank of Ghana & the Statistical Service of Ghana demonstrate the extent to which these variables determine inflation in Ghana. Since 1992, the highest rate of inflation recorded was 70.8% in 1995 when money supply grew at 65.3% in 1994 (www.bog.gov.gh). Petroleum prices had increased by 59.91% in 1993, 18.87% in 1994, and 23.7% in 1995 (www.npa.gov.gh). The Cedi had depreciated by 25% in 1994, and 28% in 1995. Having had the rate of money growth slowed down, coupled with relatively stable exchange rates and improved agricultural productivity between 1996 and 1999, inflation had declined to 12.6%.

In 2000, increased money supply and fuel prices as well as depreciation of the Cedi, triggered inflation to 40. 5%. The rates were better between 2002 and 2007 as inflation dropped to 17% in 2002, shot up to 23.6 in 2003, down to 11. 8% in 2004, up to 14.8% in 2005, down to 10. 5% in 2006 and a little up to 12.7% in 2007 and 17.4% as at October, 2015 (www.bog.gov.gh).

Global Empirical Findings on Inflation and Growth

Economists to see the relationship between inflation and growth using panel data from 100 countries over the period of 1960-1990. His methodology is based on the Neo-classical growth model and incorporates inflation as one of the explanatory variables in the model. He kept other determinants of growth constant and has tried to see the impact of inflation on growth in countries he studied. His

finding reveals that inflation has a statistically significant negative impact on growth and investment.

Bruno and Easterly (1996) have analyzed the effects of inflation on long-term growth. To study this, panel data of 26 countries over a period of thirty one years from 1961 – 1992 was used.

They identified countries that exhibited more than 40% inflation rate and the growth performance of these countries is assessed before, during and after the occurrence of the high inflation crisis. The finding of their analysis indicates that a higher level of inflation harms the growth and lower inflation has less cost on the economy. Their analysis also concludes that the high inflation in the 70's and 80's had affected temporarily the economic growth of the countries under study.

The study of Abbott and De Vita (2011) revisits the relationship between inflation and growth in different exchange rate regimes. A panel data for 125 countries, both from developing and developed countries is used over the period 1980 – 2004. A growth model is employed explained by the rate of inflation, fixed exchange rate and intermediate exchange rate (measured as a dummy variable), investment, civil unrest and hyperinflation (both measured as dummy variable). The results of the study suggest that the cost of inflation on the economic growth becomes higher and significant for the case of developing countries that adopt flexible exchange rate regimes compared to the ones that use fixed or intermediate exchange rates. Based on these findings the authors recommend macro-economic policy makers in developing countries to adopt fixed or intermediate exchange rate regimes.

Malla (1997) has studied how inflation affects the rate of economic growth using a small data sample for OECD and Asian countries. The study is undertaken independently for Asian countries and OECD countries using a growth equation explained by capital accumulation and labour force. The finding for 11 OECD countries reveals that there exists no relationship between inflation and growth which is contrary to the theories. However, for the Asian countries there exists strong negative relationship between the two variables.

Dotsey and Sarte (2000) studied the effects of inflation variability on economic growth for the US economy. They used the neo-classical endogenous growth model with money included as an explanatory variable. The finding of the authors shows that higher average inflation has a negative impact on the steady state growth. This is because of the higher cost of transaction that inflation causes to the money market. On the other hand, the authors argue that inflation has a positive impact on growth in the short-run through precautionary savings. During inflation volatility, precautionary savings rise and that is positively related to growth and negatively related to welfare. In the overall finding, the negative effect of inflation outweighs the positive impact of inflation, thereby supporting the view that higher inflation has a negative impact on growth.

The study of Ozdemir (2010) aims to assess the dynamic linkages between inflation uncertainty, inflation and output growth for UK. The vector auto-regressive fractionally integrated moving average (VARFIMA) model is employed for quarterly data of GDP and CPI

from 1957 Q2 – 2006 Q4. The author has selected this method since it enables one to see the causal effect between inflation and growth. To get robust results the author has split the sample data into three sub-periods: from 1957Q2 – 1973Q2, 1973Q3 – 1988Q1 and 1988Q2 – 2006Q4. He also analyzed the full period to compare the results. For all types of samples, Toda – Yamamoto (1995) non-causality test is used to determine the direction of the causality between the two variables. The result of the study for the full period indicates that inflation uncertainty has a positive impact on the rate of inflation and economic growth. However, for the study of the sub periods, it is found that there exists no relationship between inflation and output growth.

Thus according to this study, inflation uncertainty is one of the important determinants of growth. This finding is similar to the study undertaken for the US economy by Dotsey & Sarte (2000). Gillman and Harris (2010) investigate the effect of inflation on economic growth for countries under transition. The study is undertaken by using a panel data evidence for 13 transition countries over the period 1990 – 2003. The data is obtained from World Bank Development Indicator (WDI). The estimation process has three equation systems namely the growth, inflation and money demand equations.

The maximum likelihood estimation technique using full information is applied. The results obtained from the study are similar to the findings for the OECD countries that there exists strong negative relationship between growth and inflation. This confirms that the growth in the region is similar to that of developed countries implying the convergence of growth. The authors thus suggest monetary policies to be inflation targeting and fiscal policies to keep budget deficits within acceptable range.

Boyd and Champ (2006) also explained how high inflation affects economic growth through financial intermediaries. Their analysis starts with the theoretical insight that states inflation reduces the real return on assets. This is through discouraging saving and encouraging borrowing which raises nominal interest rate. A rise in the nominal interest rate in turn discourages investment and hence growth. Based on this the authors tested two testable hypotheses from the theoretical literature. These are (a) whether higher inflation reduces bank lending or does not and (b) whether inflation reduces the return on real assets or does not. To test these hypotheses averaged data of relevant economic variables for 100 countries across various time periods in the 80's and 90's is used. To Boyd and Champ averaging data for long time horizon allows them to see the long-run effects of inflation on growth.

According to the finding of the analysis, keeping other factors that affect bank lending constant, high inflation reduces the amount of money that banks lend. Inflation has also a negative effect on the return of real assets through the real bank interest rates. The authors have then concluded that inflation has a negative effect on economic growth. Boyd and Champ have also noted the necessity of finding the critical point where inflation becomes harmful.

Erbaykal and Okuyan (2008) have tried to explain the relationship between inflation and economic growth in Turkey using quarterly time series data from 1987Q1 – 2006Q2. To see the relationship between the two variables, co-integration and causality

tests between the series is undertaken. The Bound test is used to examine the co-integration relationship and the WALD test developed by Toda & Yamamoto (1995) to see the causal relationship between the two time series variables.

Unlike other studies, Erbaykal and Okuyan have used the Bounds test approach, developed by Pesaran, Shin and Smith (2001), because even if variables are not found to be stationary in the same order it is still possible to have a co-integration test. In this approach regardless of the series whether they are I(0) or I(1) the existence of the co-integration relationship can still be examined. Autoregressive Distributed Lag (ARDL) models are used to see the long-term and short-term relationship between the two variables under study.

Unlike the Vector Error Correction (VEC) model developed by Engle and Granger (1987), the WALD method developed by Toda and Yamamoto does not require co-integration relationship between the series. According to this approach co-integration relationship is not a necessary condition to examine causal relationship. Using these methods Erbaykal and Okuyan have found no statistically significant long-term relationship between the two macro-economic variables under study. They found a negative and statistically significant short-term relationship. In the causality analysis, a unidirectional causal relationship running from inflation to economic growth is obtained. The authors suggest that macro-economic policies must offer a stable environment so that steady and sustainable growth can be achieved.

The study of Xiaojing (2008) examined the trade-off between inflation and economic growth in China using annual time series data from 1978 – 2007. He used the Phillips curve equation to see what the relationship would

look like between the two variables. The finding of his study reveals that growth can be affected differently at different steady state levels. At the socially accepted steady state of inflation, 5%, GDP growth will be 9.39%. However a rising inflation above its steady state will have a negative effect on growth and tight monetary and fiscal policies are recommended in these cases. Nevertheless, tight policies can harm the economic growth of the country if they are still adopted when the rate of inflation is below the steady state.

Gokal and Hanif (2004) have analyzed the relationship between inflation and economic growth in Fiji. Their study focuses mainly on whether there is any meaningful and causal relationship between the two variables in the country. To achieve their objectives they used annual observation of 34 years (1970 – 2003) for variables of Real GDP, annual average CPI, and year on year CPI inflation rate. To test the causal relationship Granger causality test is applied but before that the authors have examined the time series properties of the data using Augmented Dickey Fuller (ADF) and Phillips Perron (PP) tests and the variables are found to be integrated of order I(1). The findings of the analysis reveal that both inflation measures (annual average CPI and year on year CPI) have negative weak relationship with the GDP growth. The finding of the Granger causality test indicates that causality runs one way from economic growth to inflation.

The authors conclude that inflation in Fiji is highly influenced by international factors and there is a weak and negative relationship between inflation and economic growth. They further recommend that

Fiji's monetary policy must aim to reduce inflation and inflation expectations to promote economic growth.

The study of Hodge (2005) aims to check the findings of the numerous empirical findings that inflation has negative long-run impact on the economic growth in South Africa. The study also examines the level of growth sacrificed in the short-run to achieve lower inflation. To attain the results of the study annual time series data for the period of 1950 – 2002 is used. A growth equation is used with explanatory variables of CPI, labour productivity, investment, tax on income and wealth, and terms of trade to see the long-run relationship between the two variables. OLS regression results have shown that there is a strong and statistically significant negative long-run relationship between inflation and economic growth in South Africa. To see the short run relationship between the two variables, an inflation equation explained by lagged inflation, lagged GDP growth rate, lagged change in labour cost and change in import prices is used. The finding shows that there has to be accelerating inflation in order to achieve growth in the short run.

Hence, inflation targeting has to be ignored to achieve short-term growth. But in the long run the two variables have a negative relationship and thus an increase in inflation to achieve short-term growth will have higher cost in the long-run.

Baharumshah, Hamzah and Sarbi (2011) analyzed the effects of inflation and inflation uncertainty on the economy for five ASEAN (Association of South East Asian Nations) countries namely; Malaysia, Singapore, Thailand, Indonesia and Philippines.

The L1-ARCH (Autoregressive conditional heteroscedastic) model is adapted to measure inflation uncertainty which is helpful to measure extreme observations. Based on the model employed the finding of the study shows that there exists a negative relationship between inflation uncertainty and economic growth. The authors indicated that measures that are undertaken to reduce inflation uncertainty have a positive impact on the overall growth of the economy. But the authors mentioned that their study is not a full analysis. It only focuses on inflation uncertainty and it ignores other growth determinants.

The study of Mallik and Chowdhury (2001) examines the relationship between inflation and economic growth in four South Asian countries namely Bangladesh, India, Pakistan and Sri Lanka. The long-run and short-run relationship between the two variables is examined using.

Johansen and Juselius (1990) co-integration test and the Engle and Granger (1987) Error Correction Model (ECM). Accordingly, the empirical finding reveals that the two variables are co-integrated showing a positive long-run relationship between them for all four countries.

However, Mallik and Chowdhury did not prescribe an increase in the rate of inflation to secure sustainable growth rather they suggested that the four economies under study are at a knife edge i.e. any level of inflation above the current level may lead them to higher economic recession.

Dholakia and Sapre (2011) studied the trade-off between inflation and economic growth in India for the period 1950 – 2009. Specifically the study aims to estimate the short-run aggregate supply curve, analyze the inflation unemployment trade-off and address inflationary expectations. To estimate the short-run trade-off between inflation and growth, the regular

Phillips Curve based on adaptive expectations is used. For the period under study, a trade-off between the two variables exists in India enabling them to capture the speed of the recovery. The finding of the analysis also reveals that there exists a positively sloped short-run aggregate supply curve responsive to market prices showing that the economy is being more exposed to the international market.

Salian and Gopakumar (2012) too have studied the relationship between inflation and growth in the short-run and in the long-run for the Indian economy. Annual data for the period 1972-2007 obtained from Reserve Bank of India is used to execute the research. To see the long-run relationship, the two step co-integration procedure is used and an error correction model is employed to see the short-run dynamics between the two variables under study. The finding of the study is similar to Dholakia et al (2011). In this study inflation and growth are negatively related. The study also found that inflation is more sensitive to changes in the economic growth while growth is less sensitive to the changes in inflation. These authors then concluded that higher inflation from the previous year is harmful to the economic growth. Thus, no matter what the threshold level is, policy makers must pressure inflation downwards.

Mallick (2008) is the other study that analyzes the impact of inflation on growth for the case of India. Annual time series data from 1960/61 to 2004/05 obtained from Reserve Bank of India (RBI) and Handbook of Statistics on Indian Economy is used. The study applies co-integration techniques, the error correction model (ECM) approach and auto-regression distributive lag model (ARDL) to see the long-run and short-run relationships between the two variables. In this setup the result of the study indicates that inflation has a significant negative impact on the growth level while investment has a positive effect on growth. Other variables such as real interest rate and government budget deficit do not have any significant impact on economic growth. The author recommends a policy that aims for macro-economic stability, i.e. price stability to attain rapid economic growth.

The relationship between inflation, capital accumulation and growth is also studied separately for import dependent developing countries by Ahortor and Adenutsi (2009). In order to see the relationship among the variables under study, a hexa-variate vector autoregressive (VAR) model is used with inflation, investment, growth, import, money supply and exchange rate variables.

Samples of 30 import dependent countries are studied in the paper. Co-integration test and the associated error correction model are used to see the long-run and short-run relationships between the relevant variables. The findings of the study indicate that capital accumulation and economic growth have a long-run negative impact on the level of inflation. But in the short-run, real exchange rate has a

positive impact on the growth rate while it negatively affects the level of inflation. The authors also recommend that inflation should be controlled in the short-run using tight monetary policy. To control inflation in the long-run, according to the authors, both demand management and supply side policies must be carried out.

The study of Bittencourt (2010) has examined how higher inflation affected the growth of four Latin American countries (Bolivia, Peru, Argentina and Brazil). He used panel data for the period 1970 – 2007 obtained from the Bureaux of Census of the four countries, World Bank's World Development Indicators (WDI) and Penn World Table (PWT). To execute the study Bittencourt used a growth equation with explanatory variables: inflation, government expenditure, openness, investment, money supply, political regime and interaction between education and urbanization. Among the explanatory variables only inflation is relevant for the study. Accordingly, inflation was found to have harmful effects on the growth of these countries.
To him measures taken to lower inflation were effective. Some of the measures taken were introduction of the central bank independence, inflation targeting policies and fiscal responsibility laws.

Yap (1996) analyzed the inflation and growth experience in the Philippines. He used descriptive analysis of the data to see the development of the two macro-economic variables. In this analysis, Yap indicated that 10% to 15% inflation is tolerable. He also considered the measures taken during the period of the crisis as suitable but measures taken during the time of recovery (1985-95) as short sighted. He recommends the importance of macro-economic stability that can be gained by strong fiscal performance. He also

indicated that inflation in Philippines is not only caused by lack of strong fiscal performance but also by the oligopolistic nature of the economy.

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

The model developed by Khan and Senhadji (2001) is employed to estimate the threshold level of inflation. The empirical finding of the study shows that there is a statistically significant long-run negative relationship between CPI and real GDP.

The estimated threshold model of inflation also suggests 6% as a threshold point for the Bangladesh economy. Thus, macroeconomic policy makers of Bangladesh are advised to keep inflation below this threshold point.

Ismail, Zaman, Atif, Jadoon and Seemab (2010) studied the long-run and short-run effects of investment, exports and inflation on the economic growth for the Pakistan economy. Time series data over the period 1980 – 2009

obtained from International Financial Statistics (IFS) and World Development Indicators (WDI) is used. Co-integration and Error Correction tests are used to see long-run relationship and short-run dynamics respectively. The empirical finding of the authors affirms that export and investment have a positive impact on economic growth on Pakistan's economy while inflation drags it down both in the long-run and in the short-run. Thus, inflationary conditions do not create a healthy environment for the growth of a nation. Therefore, the authors recommend that the government of Pakistan take measures to reduce inflationary pressures.

Fielding (2008) studied inflation volatility and economic development in Nigeria. The study aims to address: the determinants of inflation volatility, whether economic development brings more or less inflation volatility and what government can do to reduce this volatility further.

Fielding used monthly price data of 96 specific items in the 37 states of the country for the period 2001 – 2006 obtained from Nigeria Bureau of Statistics. He preferred the disaggregated data for two reasons. First, unequal distribution of income and hence heterogeneity of consumption is the major characteristic of developing countries. Thus a more aggregated data tends to give more weight to the consumption of the rich and will not be more informative about the cost of living of the poor. Second, the majority of consumers in poor countries are producers too, thus any price volatility on a specific commodity can easily affect the welfare of society.

The finding of Fielding (2008) states that better transport and communication infrastructure is associated with lower inflation volatility. More access to credit, average inflation and urbanization are associated with

higher inflation volatility. Public spending on infrastructure and development are therefore likely to reduce inflation volatility. Public spending on financial deepening such as extending credit access is likely to increase inflation volatility. According to Fielding, if government policy makers desire to lower inflation volatility the focus should not be on financial development but on communication and transport infrastructural development.

Another study in the case of Nigeria is the study of Chimobi (2010). He employed GDP and CPI time series data for the period 1970 – 2005 as proxy for growth and inflation, respectively. The Johansen and Juselius (1990) co-integration test and VAR based Granger Causality tests are used to see the co-integrating and causal relationships. The result obtained shows that there is a unidirectional causality that goes from inflation to economic growth. Though the study did not check whether there is a positive or negative relationship between the two variables, it assumed that inflation has a harmful impact on growth, as revealed from recent literature. Hence the one way causality that runs from inflation to growth shows the negative effect of inflation on economic growth, according to the author.

The findings of the global literature on the relationship between inflation and growth are conflicting as seen in the empirical literature review. Barro (1995), Ahmed and Mortaza (2005) and Hodge (2005) have found a negative relationship between inflation and growth. On the other hand, Bruno and Easterly (1996) and Boyd and Champ (2006) have indicated that higher inflation leads to lower economic

growth but lower inflation promotes economic growth. The other group of economists such as Dotsey and Sarte (2000), Ozdemir (2010) and Mallik and Chowdhury (2001) argue that there exists a positive relationship between inflation and growth.

On the other hand economists such as Malla (1997), found out that there is no relationship between inflation and growth. Different studies have different findings in the relationship between inflation and growth. However, most of the economists agree that there is a non-linear relationship between the two macro-economic variables, i.e., lower inflation promotes growth while higher inflation discourages growth. Some economists take this study further by questioning how low inflation should be in order to promote growth. These economists analyzed the possible threshold level of inflation for specific countries and for groups of countries. The findings of these studies will be discussed in the next sub-section.

Inflation and Economic Growth in Ghana

According to Osiakwan & Armah (2013) over the years, research has been conducted on the effects of inflation on: GDP, GDP growth, GDP per capita growth, etc. to identify the relationship between inflation and these variables.

However, there is lack of a common conclusion about the effect, if any, of inflation on these variables. Furthermore, such studies done in relation to specific countries are not common at least not for Ghana. Therefore, it becomes difficult to deduce what the figures (inflation rates) convey as they

are reported from time to time as is done in Ghana (Osiakwan & Armah 2013).

Using real GDP per capita and HDI as indicators of standard of living and inflation as determinant of standard of living, regression and sensitivity analyses have been performed to identify how standard of living behaves with respect to changing levels of inflation. The primary objectives of study were to identify the theoretical relationship between inflation and standard of living; as well as determine the sensitivity of standard of living to inflation.

To some extent, the outcome of this study agrees with the argument of Espinoza et al (2011) that inflation becomes costly at high levels. Furthermore, the results of the study agree with that there is significant relationship between inflation and economic growth (standard of living in the context of this research). On the other hand, Stanners (1996) concluded that there that there was actually no correlation between inflation and an improved growth rate. This results of this study show otherwise. In fact, the inverse relationship between inflation and standard of living, as determined by the analyses, proves that Ghanaians will actually have an improved standard of living and thus, economic growth when inflation reduces. The outcome of the study also agrees with the conclusions by Kremer et al. (2009) and Ayyoub et al (2011) in establishing that there is a significant inverse relationship between inflation and economic welfare. Nevertheless, there are still differences in the sense that both studies (Kremar et al., 2009 & Ayyoub et al, 2011) identified thresholds at and above which

inflation became hurtful and below which inflation becomes insignificant; such thresholds have not been identified for Ghana as far this study is concerned. Hence, the inverse relationship applies irrespective of the level of inflation as far as a change in inflation level takes place.

Chapter Summary

The review of literature in this chapter has examined the conceptual framework for inflation targeting and economic growth in Ghana.

Previous studies on inflation targeting and economic growth produced mixed results and conclusions. However, most of these studies employed a variety of information sources as a basis for their decision making. Nonetheless, these studies have noted the importance of inflation targeting on economic growth globally and even in Ghana.

CHAPTER THREE

RESEARCH METHODOLOGY

Introduction

This chapter discusses the research methodology used in the study. It basically deals with the research design, sources of data, model specification, definition of the variables and the estimation techniques used.

Research Design

This study adopts the quantitative design by employing a systematically collected and presented data to examine the impact of inflation targeting monetary policy on economic growth in Ghana. The research uses quantitative approach because past information on the variables being studied

is available and can be quantified. It is assumed that pattern of the past information will continue into the future.

Sources of Data

The macroeconomic data used in the analysis for the pre-inflation targeting monetary policy regime, 1960Q1 to 2002Q4, for the inflation targeting monetary policy regime, i.e. 2003Q1 to 2010Q3 and the combined model 1960Q1-2010Q3 is obtained from the Bank of Ghana (www.bog.gov.gh/20-07-2016).

These are quarterly real GDP growth rate (gdp); growth in gross real fixed capital formation (rgfkf); growth in real exports of goods and services (exp) and gross savings/GDP ratio expressed as percentage (s_gdp). The inflation rate (inf) used to measure volatility is also obtained from the Bank of Ghana. It is expressed as quarterly inflation rate seasonally adjusted at annual rate. The values are expressed in 2005 constant prices and are seasonally adjusted and annualized rates except for the S-GDP which is a ratio. The volatility of the headline consumer price inflation (Ht INF) for the period 1960Q1-2010Q3 is obtained by fitting the GARCH (1, 1) model, equations (3) –(5), into the seasonally adjusted annual inflation rate measured at quarterly frequency.

Model Specification

Measuring Inflation Volatility: The GARCH Model

Theoretical framework

Various methods are used to measure macroeconomic volatility. The two most common ones are unconditional standard deviation and conditional variance generated by the GARCH model. This paper uses the GARCH based conditional variance to measure the volatility of consumer price inflation in South Africa for the period 1960-2015. The volatility measure obtained in this manner is then used to assess its impact on real economic growth in three distinct periods: (1) the pre-inflation targeting monetary policy period, 1960-2002; (2) inflation targeting monetary policy period, 2003-2015, and (3) the combined, full sample, period from 1960-2015.

The general GARCH (p, q) specification, which incorporates the variance of the error term in the autoregressive process is given by:

$y_t = y'_{t\theta} + \varepsilon_t$ ..... (1)

Where

$\varepsilon t | \Omega t-1 \sim (0, H_t)$

$H_t = \alpha_0 + \alpha_1 \varepsilon_{2t-1} + \ldots\ldots + \alpha p\ \varepsilon_{2t-p} + \Sigma_1 H_{t-1} + \ldots\ldots + \Sigma q H_{t-q}$..... ...(2)

ε_t is the error term, while $\Omega t-1$ is the information set and Ht is the conditional variance of the error term. The AR process y'_t is often used as the conditional mean of the series. A GARCH (p, q) model contains higher order lag terms up to (p, q). Such higher-order models are often useful when a long span of data is used, such as several decades of daily data or a year of hourly data. With additional lags, such models allow both fast and slow decay of information (Engel, 2001).

The most popular model of volatility measure is the GARCH (1, 1) process due to Engel (1982) and Bollerslev (1986). In line with Kumo (2006)

and using Bollerslev's specification, the GARCH (1, 1) model can be stated as:

$y_t=\alpha_0,+\alpha_1,ty_{t-1}+\varepsilon_t$ (3)

$\varepsilon_t = H_{1/2t}\, u_t$, $u_t \sim N(0,1)$, ….(4)

and

$H_t = \alpha\, 0 + \alpha_1\varepsilon_{2t-1} + \beta_1 H_{t-1}$ (5)

Where, $\varepsilon_t \sim N(0, H_t)$

In this model conditional variance is measured as a sum of lagged squared residual and the lagged conditional variance itself. Some empirical specifications of the GARCH (1, 1) models add a trend variable in equation (3). However, preliminary estimation for the present study has shown no major differences in the values of the variances obtained by adding or omitting the trend variable.

Equations (3) – (5) are used to estimate conditional variance measures of volatility of the quarterly headline consumer price inflation seasonally adjusted at annual rates in Ghana for the period 1960-2015.

Empirical econometric analyses of the impact of inflation targeting monetary policy on inflation volatility and of the latter on growth focus mostly on panel data regression across groups of countries that have adopted the inflation targeting policy and those which have not. The current study pursues a different approach in that it focuses on the impact of the inflation volatility on growth in a single country framework for different monetary policy regimes.

Accordingly, to assess the impact of inflation volatility on economic growth in Ghana during the pre-inflation targeting monetary policy regime and the inflation targeting monetary police regime, we specify the following linear economic growth function:

$GDPg_t=\alpha+\Sigma\beta ini=0X_t+\gamma H_t INF+\varepsilon_t$..... (6)

where, GDP_t is real GDP growth at time period t; X_t is vector of conventional determinants of economic growth; the vector Xt consists of three key determinants of economic growth; i.e. real gross fixed capital formation (RGFKF), real export of goods and services (REXP) and gross savings / GDP ratio (S-GDP). Fixed investment and export are often regarded as two engines of growth while savings is also a key driver of economic growth. These serve as the key control variables in the linear model linking inflation volatility to growth while εt is normally distributed and serially uncorrelated error term.

The expanded form of equation (6) can be expressed as:

$GDPg_t=\alpha+\beta_1 RFKFg_t+\beta_2 REXPg_t+\beta_3 (S-GDP)$ +

$\gamma H_t INF_t+\varepsilon_t$..... (7)

Equation (7) is estimated using the OLS technique

Definition and measurement of the variables

Inflation (inf)

Inflation is an independent variable in this model and is used as a proxy for macroeconomic instability because it measures the constant increase in prices of goods and service at a given time period.

If a country's inflation is stable, investors can have stable investment planning horizon especially for long term. The purpose of inflation is for

business direction. There is an inverse relationship economic growth and inflation.

Real Gross Domestic Product (real gdp)

Real Gross Domestic Product (rgdp) is a macroeconomic measure of the value of economic output adjusted for price changes (i.e., inflation or deflation).[1] This adjustment transforms the money-value measure, nominal GDP, into an index for quantity of total output. Although GDP is total output, it is primarily useful because it closely approximates the total spending: the sum of consumer spending, investment made by industry, excess of exports over imports, and government spending. Due to inflation, GDP increases and does not actually reflect the true growth in an economy. That is why the inflation rate must be subtracted from the GDP to get the real growth percentage, called the real GDP.

Real GDP is an example of the distinction between real vs. nominal values in economics. Nominal gross domestic product is defined as the market value of all final goods produced in a geographical region, usually a country. That market value depends on the quantities of goods and services produced, and their respective prices (referred in lower case below). Real gross domestic product accounts for price changes that may occur due to inflation. If prices change from one period to the next but actual output does not, nominal GDP would also change even though output remained constant. To adjust for price changes, real GDP is calculated using prices from a

specific year, the base year. This allows real GDP to accurately measure changes in output separate from changes in prices.

If a set of real GDPs from various years are calculated, each using the quantities from its own year, but all using the prices from the same base year, the differences in those real GDPs will reflect only differences in volume.

An index called the GDP deflator can be obtained by dividing, for each year, the nominal GDP by the real GDP, so that the GDP deflator for the base year will be 1. It gives an indication of the overall level of price change (inflation or deflation) in the economy.

GDP deflator for year t = nominal GDP_t / Real GDP_t

Real GDP growth on an annual basis is the nominal GDP growth rate adjusted for inflation. It is usually expressed as a percentage.

Gross fixed capital formation (rgfkf)

Gross fixed capital formation (rgfkf) is a macroeconomic concept used in official national accounts such as the United Nations System of National Accounts (UNSNA), National Income and Product Accounts (NIPA) and the European System of Accounts (ESA). The concept dates back to the National Bureau of Economic Research (NBER) studies of Simon Kuznets of capital formation in the 1930s, and standard measures for it were adopted in the 1950s. Statistically it measures the value of acquisitions of new or existing fixed assets by the business sector, governments and "pure" households (excluding their unincorporated enterprises) *less* disposals of fixed assets. rgfkf is a component of the expenditure on gross domestic

product (GDP), and thus shows something about how much of the new value added in the economy is invested rather than consumed.

rgfkf is called "gross" because the measure does not make any adjustments to deduct the consumption of fixed capital(depreciation of fixed assets) from the investment figures. For the analysis of the development of the productive capital stock, it is important to measure the value of the acquisitions less disposals of fixed assets beyond replacement for obsolescence of existing assets due to normal wear and tear. *"Net fixed investment"* includes the depreciation of existing assets from the figures for new fixed investment, and is called *net fixed capital formation*.

rgfkf is *not* a measure of *total* investment, because only the value of net additions to fixed assets is measured, and all kinds of *financial* assets are excluded, as well as stocks of inventories and other operating costs (the latter included in intermediate consumption). If, for example, one examines a company balance sheet, it is easy to see that fixed assets are only one component of the total annual capital outlay.

The most important exclusion from rgfkf is *land sales and purchases*. The original reason, leaving aside complex valuation problems involved in estimating the value of land in a standard way, was that if a piece of land is sold, the total amount of land already in existence, is not regarded as being increased thereby; all that happens is that the *ownership* of the same land changes. Therefore, only the value of land improvement is included in the GFCF measure as a net

addition to wealth. In special cases, such as reclamation from the sea, a river or a lake (e.g. a polder), new land can indeed be created and sold where it did not exist before, adding to fixed assets. The rgfkf measure always applies to the resident enterprises of a national territory, and thus if e.g. oil exploration occurs in the open seas, the associated new fixed investment is allocated to the national territory in which the relevant enterprises are resident.

Data is usually provided by statistical agencies annually and quarterly, but only within a certain time-lag. Fluctuations in this indicator are often considered to show something about future business activity, business confidence and the pattern of economic growth. In times of economic uncertainty or recession, typically business investment in fixed assets will be reduced, since it ties up additional capital for a longer interval of time, with a risk that it will not pay itself off (and fixed assets may therefore also be scrapped faster). Conversely, in times of robust economic growth, fixed investment will increase across the board, because the observed market expansion makes it likely that such investment will be profitable in the future.

Gross Domestic Saving (s_gdp)

Gross Domestic Saving is GDP minus final consumption expenditure. It is expressed as a percentage of GDP. Gross Domestic Saving consists of savings of household sector, private corporate sector and public sector. Gross domestic savings had followed a downward trajectory after 2008. The more concerning issue is the perceptible shift of investors' preference towards physical assets as compared to financial assets. This can be attributable to a

rise in inflationary pressures. Gross capital formation is a function gross domestic savings.

$$y_t = \theta y_t^{'} + \varepsilon_t$$

Exports (exp)

An export is a function of international trade whereby goods produced in one country are shipped to another country for future sale or trade. The sale of such goods adds to the producing nation's gross output. If used for trade, exports are exchanged for other products or services in other countries. Exports are one of the oldest forms of economic transfer and occur on a large scale between nations that have fewer restrictions on trade, such as tariffs or subsidies. Most of the largest companies operating in advanced economies derive a substantial portion of their annual revenues from exports to other countries. The ability to export goods helps an economy to grow, by selling more overall goods and services.

One of the core functions of diplomacy and foreign policy within governments is to foster economic trade in ways that benefit both parties involved. Exports are a crucial component of a country's economy. Not only do exports facilitate international trade, they also stimulate domestic economic activity by creating employment, production and revenues.

Data Processing and Analysis

The study which is quantitative and descriptive in nature comprises graphs and charts which aid in the descriptive analysis of the results. Unit root test is conducted for all the three variables to ascertain the order of integration.

The study further adopts the GARCH model to determine the volatility measure of inflation and its subsequent impact on economic growth in Ghana. All estimations were carried out using econometric views (e-views) 7.0 package.

Unit Root Test Results

In an attempt to avoid the possibility of a spurious regression results, it is apt to carry out unit root test to confirm whether the variables are not integrated of an order higher than one. From Table 2 in the appendix, the order of integration was tested using Augmented Dickey Fuller (ADF) test with Philips Perron (PP) as a confirmatory test. From the results below, it can be observed that all the variables are stationary at first difference I (1) and that by taking into consideration intercept, we reject the null hypothesis of the existence of unit root in all the variables after first difference.

Serial Correlation Test

This is a test of the assumption that there is no serial correlation in the model used in the empirical analysis. From Table 3 in the appendix, all the probability values range between 0.720 and 0.998 and are therefore greater than 0.05 and by this, we can fail to reject the null hypothesis that there is no serial correlation. We can therefore conclude that there is no serial correlation and therefore the model is good for study.

Arch Test Results

This is one of the tests on the assumption of GARCH Model which determines the suitability of the GARCH Model. The assumption is that there should be no Arch effect in the Model. From Table 4 in the appendix, the P-value of 0.7298 is greater than 0.05 so we fail to reject the null hypothesis and conclude that there is no Arch effect making the Model a suitable one for the study.

Mean Equation

Inflation volatility could impact on growth through various channels. These could include, among others, investor confidence, savings levels, real interest rate and demand for credit. Whatever the channel, policy makers need to ensure stability of the general price level to support economic recovery and growth particularly in developing economies. The chart depicting the actual and the fitted values (Figure 1 in the appendix) indicates low standard error of regression and goodness of the fit. Apart from this, the visual observation indicates that the residuals are mean reverting and are fairly normally distributed.

Conditional Variance of Consumer Inflation

Figure 4 in the appendix captures conditional variance of consumer inflation generated from the GARCH process for the period 1960-2015. As can be observed from the chart, consumer price inflation rate increased significantly between the 1960s and 1980. This period also corresponded to the gradual increases in the consumer

inflation rates particularly after the 1960s. The level of volatility tended to gradually decline after the late 1980s. In brief, lower volatility levels correspond to lower inflation periods while higher volatility correspond to the period of higher inflation rates. The result conforms to Freidman (1977) hypothesis that higher inflation rate it likely to be more volatile.

Chapter Summary

The quantitative design is employed in examining the impact of inflation targeting on economic growth in Ghana. The macroeconomic data used the analysis was obtained from the bank of Ghana website. The various variables were established to be first order of integration and the study adopted the GARCH model to determine the measure of inflation and its impact on economic growth in Ghana.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents and discusses the results of the study by analyzing the inflation targeting monetary policy in Ghana. The results of the descriptive statistics of the relevant variables, both ADF and PP unit root tests, GARCH model are presented and discussed in relation to the objectives of the study.

Descriptive Statistics

Table 1- *Descriptive Statistics*

	GDP	DS_GDP	DRGFKF	DINF	DEXP01
Mean	3.645926	0.108975	0.130946	-0.185994	0.538702
Median	4.551230	0.364808	0.650545	0.172177	0.223631
Maximum	14.04600	6.404964	9.410170	100.5789	16.72392
Minimum	-12.43163	-8.994460	-7.366475	-94.20804	-11.25659
Std. Dev.	4.625884	3.487044	3.416836	29.70178	4.363726
Skewness	-1.139033	-0.453475	-0.147729	0.055037	0.682535
Kurtosis	5.141335	2.871257	3.302880	7.202993	5.851891
Jarque-Bera	20.36439	1.748191	0.372982	36.82764	20.82646
Probability	0.000038	0.417239	0.829866	0.000000	0.000030
Sum	182.2963	5.448755	6.547321	-9.299711	26.93512
Sum Sq. Dev.	1048.541	595.8142	572.0635	43227.60	933.0632
Observations	50	50	50	50	50

Note: Std. Dev. and Sum Sq. Dev. Represent Standard Deviation and Sum of Squared Deviation respectively
Source: Field Survey, Yartel (2016)

Descriptive statistics was conducted for the variables involved to designate the basic features of the data in this research and summarize the data in a meaningful way. The results in Table 1 above indicate that all the variables have a positive mean or average values except for inflation.

The mean values indicate that on the average, real GDP growth, gross savings / GDP ratio, real gross fixed capital formation, inflation and real export of goods and services are 3.65, 0.11,.013, -0.18 and 0.54 respectively annually. The minimum values of the variables are -12.43, -8.99, -7.36, -94.21 and -11.26 whilst their respective maximum values are 14.04, 6.40, 9.41, 100.58 and 16.72. Inflation rate exhibiting a minimum of -94.20 and a maximum of 100.57 implies that the mean of -0.18 is closer to the minimum value and thus most of the inflation rate values are skewed to the minimum value. Real GDP growth also has a minimum value of -12.43 and a maximum value of 14.04 with a mean of 3.64 which also indicates that majority of the values for real GDP growth are skewed to the minimum values considering its closeness.

However, gross savings / GDP ratio has a minimum value of -8.99 and a maximum of 6.40 with a mean of 0.11 is closer to the minimum rather than the maximum and that gross savings / GDP ratio is skewed to the minimum. The standard deviation indicates the minimal deviation of the variables from the mean. Inflation deviates greater from its mean than all the other variables since its standard deviation and sum of squared deviation is greater than that of the other variables. Inflation and real export of goods and services are both positively skewed whilst the other variables are negatively skewed. In an ideal situation, the absolute value of skewness should approach zero i.e. $|SK| < 1$.

From the results, skewness of all the variables are all closer to zero.

The Jarque-Bera statistics of inflation, real export of goods and services and real GDP have a probability value less than 0.05 whilst that of gross savings / GDP ratio and real gross fixed capital formation are greater than 0.05. By this, we can reject the null hypothesis that the data is not different from a normal distribution for inflation, real export of goods and services and real GDP and fail to reject the null hypothesis for gross savings /GDP ratio and real gross fixed capital formation. This implies that inflation, real export of goods and services and real GDP are not normally distributed but interest rate and gross savings/GDP ratio and real gross fixed capital formation are normally distributed.

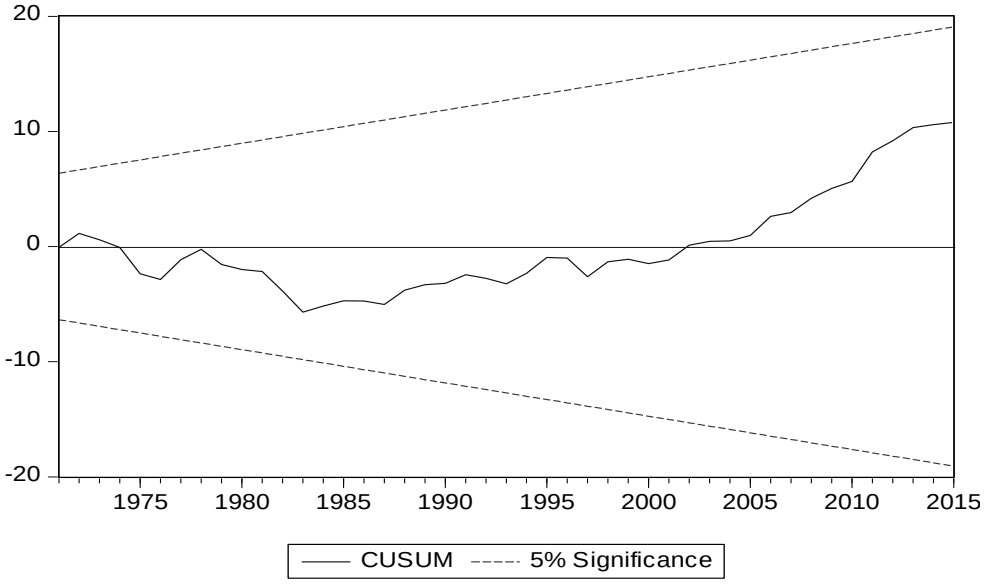

Figure 1: Stability Test for Growth Regression *CUSUM 1960-2015*
Source: Field Survey, Yartel (2016)

The study also examined the stability of the model and found that the model was stable over the sample period as observed from the plot of the CUSUM of Squares. The plot of CUSUM of Square

stability tests also indicates that all the coefficients of the estimated model was stable over the study period since it was within the five percent critical bounds and can therefore withstand shocks.

In addition to the diagnostic tests reported on, stability test was conducted for the growth regression using recursive CUSUM and CUSUM of squares tests both of which indicate variable stability within 5% of significance as indicated by figure 1 above. In all the assumptions of the GARCH Model are met as per above results shown by the above figures and tables .i.e. there was no serial correlation, there was no ARCH effect, there was stationary of the variables apart from normality which is most often does not considered to be a requirement for the use of the GARCH model.

Inflation Rate and Economic Growth during the Pre-Inflation Targeting Monetary Policy Regime

Table 2- *Inflation rate during the pre-inflation targeting monetary policy regime*

I. Coefficients and Level of Significance

Variable	Coefficient	Standard Error	t-value	t-probability
α	15.10495	25.23311	0.598616	0.5494
EXP01	-1.704792	1.774047	-0.960963	0.3366
RGFKF	-3.072953	3.662383	-0.839058	0.4014
S_GDP	-0.040171	4.635589	-0.008666	0.9931
INF	-0.050763	0.009134	-5.557642	0.0000

II. Model Criteria/Goodness of Fit

R-squared	-0.108539	Mean dependent var	2.552288
Adjusted R-squared	-0.140211	S.D. dependent var	4.658950
S.E. of regression	4.974858	Akaike info criterion	5.641847
Sum squared resid	866.2225	Schwarz criterion	6.033691
Log likelihood	-95.37416	Hannan-Quinn criter.	5.779990

Durbin-Watson stat	1.325192

Source: Field Survey, Yartel (2016)

The estimation results of the growth equation indicates that, controlling for the impact of the conventional determinants of growth, inflation rate in Ghana had significant negative impact on economic growth during the pre-inflation targeting monetary policy regime (i.e. 1960-2002). The inflation rate coefficient has negative sign and is significant at 5% level. This finding is in support of the Classical Theory which states that "there is a negative relationship between the two variables .i.e. real growth and inflation.

On the other hand, the coefficients of conventional determinants of economic growth, i.e. real gross fixed capital formation, gross savings/ GDP ratio and real exports of goods and services are statistically insignificant during the period under consideration at 5% level.

Inflation Rate and Economic Growth during the Inflation Targeting Monetary Policy Regime

Table 3- *Inflation rate during the inflation targeting monetary policy regime 2003-2015*

I. Coefficients and Level of Significance

Variable	Coefficient	Standard Error	t-value	t-probability
α	5.215435	9.610931	0.542657	0.5874
EXP01	0.665447	3.703767	0.179667	0.8574
RGFKF	0.055460	1.730734	0.032044	0.9744
S_GDP	0.406104	4.440356	0.091457	0.9271
INF	0.059098	0.472967	0.124951	0.9006

II. Model Criteria/Goodness of Fit

R-squared	-0.029866	Mean dependent var	6.888470
Adjusted R-squared	-0.132853	S.D. dependent var	2.927831
S.E. of regression	3.116253	Akaikeinfo criterion	5.298857

Sum squared resid	97.11032	Schwarz criterion	5.662537
Log likelihood	-22.79314	Hannan-Quinn criter.	5.164209
Durbin-Watson stat	1.342076		

Source: Field Survey, Yartel (2016)

The results captured by Table 3 for the inflation targeting period indicate that inflation rate did not have statistically significant impact on real economic growth during the inflation targeting monetary policy regime, i.e. 2003-2015.

Another interesting result for this period is that growth in real export of goods and services, real gross fixed capital formation and gross savings/ GDP ratio all did not have any statistical significant impact on real economic growth as expected in economic literature.

As expected, for the inflation targeting monetary policy period of 2003-2015, inflation rate did not have any significant negative impact on economic growth.

Inflation Rate and Economic Growth Full Sample 1960-2015

This sections combines data for the pre-inflation targeting and inflation targeting period into a single series to assess the robustness of the growth regression results for each of these periods. The expanded model is expressed as:

$$GDP_t=\alpha+\beta_1 RFKF_t+\beta_2 EXP_t+\beta_3(S-GDP)_t+\gamma INF_t+\varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Equation (8) was estimated using the OLS technique to assess the impact of inflation volatility on growth during the full sample, 1960-2015. The data set for the remaining control variables, growth of real exports of goods and services (EXP), and growth of real gross fixed capital formation (RGFCF)

and Savings / GDP ratio(S-GDP) is the same except that it now consists of observations for both periods in one. The data source is the same.

The results of the combined growth model are consistent with the growth estimates for the pre-inflation targeting and inflation targeting periods. For this period, economic growth was not driven by growth in real fixed capital formation and real exports, as well as the savings rate.

The coefficients for these control variables are all positive and not significant at 5% levels respectively. As expected, the coefficient of inflation rate is negative and statistically significant at 5% level. This implies once again that inflation rate was higher prior to the introduction of the inflation targeting monetary policy and the result had negative impact on real economic growth during that period. This result was in line with the results obtained for the pre-inflation targeting monetary policy regime where inflation rate had statically significant negative impact on real economic growth.

Ghana's inflation targeting monetary policy has to some extent achieved its main objective of ensuring low and stable inflation. As indicated in the preceding section, however, due to the entrenched structural challenges, low and stable inflation did not translate into higher economic growth particularly after the 2008/09 global financial crisis shock. Monetary policy alone is not the remedy for the slacks in economic growth. Ghana needs a compressive mix of macroeconomic

policy reforms to address growth, poverty, inequality and unemployment.

Chapter Summary

The descriptive statistics of the variables in terms of the mean values, Skeweness, Jergure-Bera statistics, Serial Correlation, Arch Test, Conditional Variance were al in favour of the variables and for that matter the model. The stability test conducted on the model established that the model was stable over the sample period.

The coefficient of inflation rate is negative and statistically significant at 5% level. This implies that inflation rate was higher prior to the introduction of inflation targeting policy and the result had negative impact on economic growth in Ghana.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents the summary, conclusions and recommendations obtained by the study. Whereas the summary presents a brief overview of the research problem, objective, methodology and findings, the conclusions capture the overall outcomes regarding the findings of the study in light of the hypotheses. The recommendations also present specific remedies to be implemented by specific bodies. The chapter again presents the limitations and direction for future research.

Summary

Ghana's monetary policy regimes can be divided into two distinct periods. The first period corresponds to 1960-2002 when the country had adopted a number of monetary policy frameworks including exchange-rate targeting, discretionary monetary policy, monetary-aggregate targeting and an eclectic approach. The pre-inflation targeting monetary policy regime was largely characterized by high level of inflation rates. An empirical GARCH (1, 1) model fitted to the annual consumer price inflation for the period 1960-2015. Using the inflation rates obtained from the 1960-2015 sample, and including other macroeconomic control variables, we estimated a growth model for the pre-inflation targeting period.

Conclusions

From the results, the inflation rates were found to have a significant negative impact on economic growth during the pre-inflation monetary policy regime. This finding is in line with previous empirical studies which find strong negative correlation between inflation volatility and economic growth.

The same process was repeated for the inflation targeting monetary policy regime but it was established that inflation rates did not have any statistically significant negative effect on real economic growth. By adopting the inflation targeting monetary policy framework Ghana has to some extent succeeded in achieving its primary objective of low and stable general price level. This may be due primarily to a progressive increase in policy transparency, communication mechanism and the flexibility of the inflation targeting regime. Meanwhile, for real fixed capital formation, real exports of goods and services, as well as the savings/GDP ratio which were used as the control variables (conventional determinants of growth) indicated positive coefficient with statistically insignificant impact on economic growth.

The results of the combined growth model was consistent with the results obtained for the growth regression in pre-inflation targeting and inflation targeting monetary policy regimes. Inflation volatility had statistically significant negative impact on real economic growth during the period under consideration.

Recommendation

In addressing this policy challenge, the government may consider implementing structural policy reforms to unlock the economic growth potentials. Introduction of reforms can also help improve the competitiveness of the goods and services market, increase the gross savings rate and improve infrastructure supply in the country to enhance economic growth.

Suggestion for Future Research

The study examined the inflation targeting monetary and economic growth in Ghana using inflation rate and real GDP as the main variables and real fixed capital formation, real exports of goods and services, as well as the savings/GDP ratio as a control variables. The study however did not determine the level of inflation rates that are required to promote or distort economic growth and stability. Hence, future direction of research on this topic should consider the possibility of exploring the desired levels at which inflation rates would either propel or harm pr general economic growth in the country.

The study employed the GARCH (1, 1) model approach to establish the relationship between inflation and economic growth. Future direction of research on this topic should consider the possibility of exploring other estimation techniques to further confirm the impact of inflation targeting monetary policy on economic growth.

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APPENDIX

Unit Root Test Results

Variable	GDP	INF	RGFKF	EXP	S-GDP
Levels	(P-Statistic)	(P-Statistics)	(P-Statistics)	(P-Stats)	(P-Stats)
ADF	-4.777402 (0.0003)	-2.511554 (0.1190)	-1.657454 (0.4469)	-0.828416 (0.8029)	-1.97197 (0.2980)
PP	-4.777402 (0.0003)	-4.405332 (0.0009)	-1.550699 (0.5007)	-0.997766 (0.7481)	-3.73335 (0.0061)
First difference					
ADF	-	-12.36920 (0.0000)	-7.175362 (0.0000)	-6.975401 (0.0000)	-11.8294 (0.0000)
PP	-	-14.71540 (0.0000)	-8.168637 (0.0000)	-6.977502 (0.0000)	-11.7782 (0.0000)

Source: Author's Analysis at 5% significance level

Serial Correlation Test

Sample: 1965 2015

Included observations: 51

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. | . |	. | . |	1	-0.049	-0.049	0.1284	0.720
. | . |	.*| . |	2	-0.065	-0.067	0.3604	0.835
. |*. |	. |*. |	3	0.165	0.159	1.8908	0.595
. | . |	. | . |	4	-0.038	-0.028	1.9718	0.741
.*| . |	. | . |	5	-0.069	-0.054	2.2545	0.813

. | . |	. | . |	6	-0.005	-0.042	2.2562	0.895
. |*. |	. |*. |	7	0.177	0.186	4.1891	0.758
.*| . |	. | . |	8	-0.076	-0.050	4.5497	0.804
. |*. |	. |*. |	9	0.127	0.155	5.5888	0.780
. | . |	.*| . |	10	-0.001	-0.073	5.5888	0.849
. | . |	. | . |	11	-0.048	0.005	5.7477	0.890
. | . |	.*| . |	12	-0.024	-0.073	5.7864	0.926
. | . |	. | . |	13	-0.061	-0.035	6.0493	0.944
. | . |	.*| . |	14	-0.053	-0.092	6.2533	0.960
. | . |	. | . |	15	-0.064	-0.033	6.5622	0.969
. | . |	. | . |	16	0.008	-0.059	6.5667	0.981
. | . |	. | . |	17	-0.055	-0.021	6.8038	0.986
. | . |	.*| . |	18	-0.050	-0.078	7.0082	0.990
. | . |	. | . |	19	-0.045	-0.040	7.1824	0.993
. | . |	. | . |	20	-0.047	-0.042	7.3736	0.995
. | . |	. | . |	21	-0.061	-0.033	7.7104	0.996
.*| . |	.*| . |	22	-0.076	-0.066	8.2460	0.996
. | . |	. | . |	23	-0.048	-0.050	8.4716	0.997
. | . |	. | . |	24	-0.060	-0.060	8.8308	0.998

Source: Author's Analysis

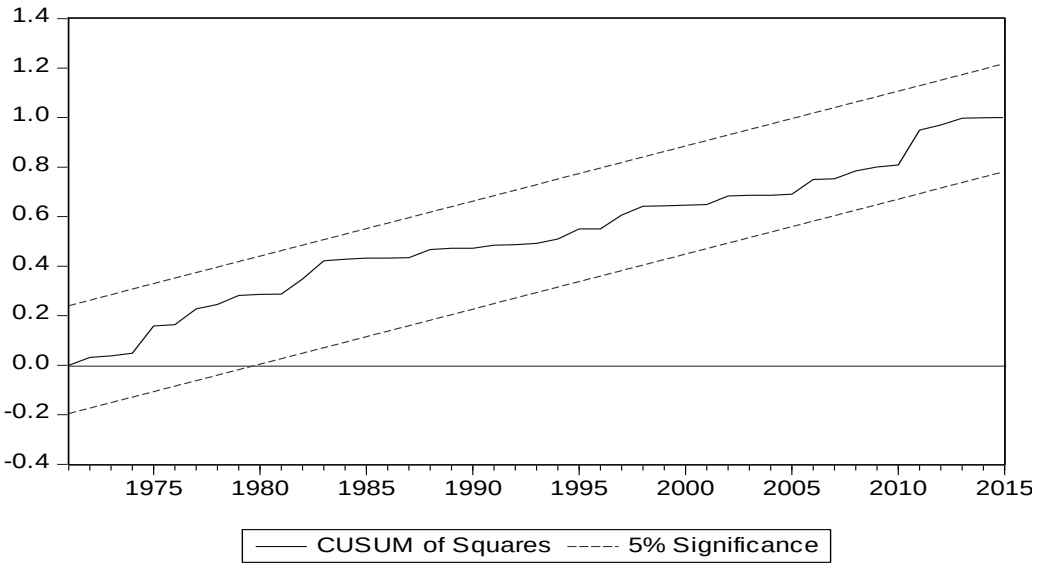
ARCH Test Results

Hetroskedasticity Test: ARCH

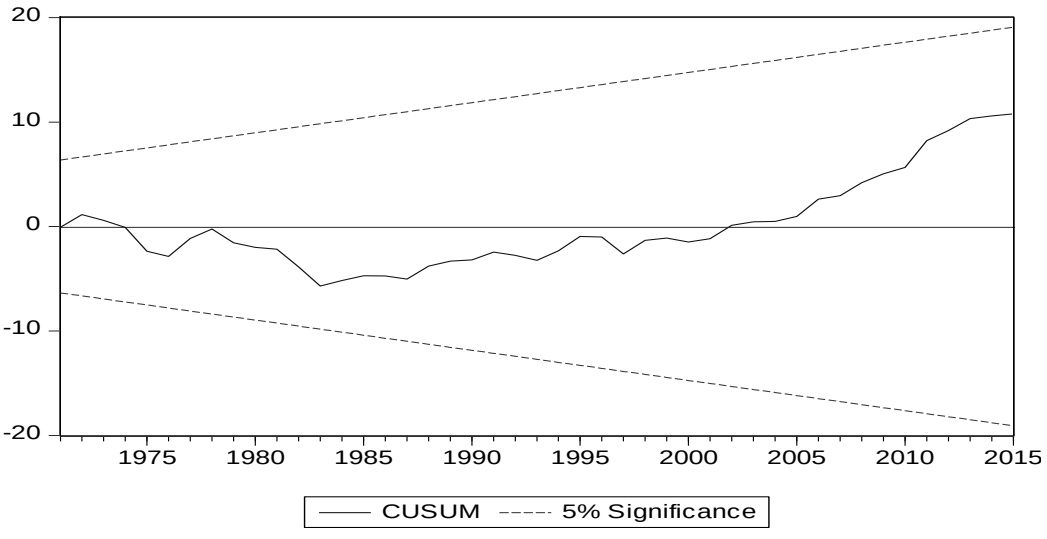
F-statistic	0.114756	Prob. F(1,48)		0.7363
Obs*R-squared	0.119252	Prob. Chi-Square(1)		0.7298
Test Equation:				
Dependent Variable: WGT_RESID^2				
Method: Least Squares				
Date: 09/06/16 Time: 09:38				
Sample (adjusted): 1966 2015				
Included observations: 50 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.160596	0.386033	3.006470	0.0042
WGT_RESID^2(-1)	-0.048830	0.144144	-0.338757	0.7363
R-squared	0.002385	Mean dependent var		1.106624
Adjusted R-squared	-0.018399	S.D. dependent var		2.463767
S.E. of regression	2.486329	Akaike info criterion		4.698669
Sum squared resid	296.7278	Schwarz criterion		4.775150
Log likelihood	-115.4667	Hannan-Quinn criter.		4.727794
F-statistic	0.114756	Durbin-Watson stat		1.959474
Prob(F-statistic)	0.736271			

Source: Author's Analysis at 5% significance level

Source: Author's Analysis



Source: Author's Analysis



I. Coefficients and Level of Significance

Variable	Coefficient	Standard Error	t-value	t-probability
α	15.10495	25.23311	0.598616	0.5494
EXP01	-1.704792	1.774047	-0.960963	0.3366
RGFKF	-3.072953	3.662383	-0.839058	0.4014
S_GDP	-0.040171	4.635589	-0.008666	0.9931
INF	-0.050763	0.009134	-5.557642	0.0000

II. Model Criteria/Goodness of Fit

R-squared	-0.108539	Mean dependent var	2.552288
Adjusted R-squared	-0.140211	S.D. dependent var	4.658950
S.E. of regression	4.974858	Akaike info criterion	5.641847
Sum squared resid	866.2225	Schwarz criterion	6.033691
Log likelihood	-95.37416	Hannan-Quinn criter.	5.779990
Durbin-Watson stat	1.325192		

Source: Author's Analysis at 5% significance level

I. Coefficients and Level of Significance

Variable	Coefficient	Standard Error	t-value	t-probability
α	5.215435	9.610931	0.542657	0.5874
EXP01	0.665447	3.703767	0.179667	0.8574
RGFKF	0.055460	1.730734	0.032044	0.9744
S_GDP	0.406104	4.440356	0.091457	0.9271
INF	0.059098	0.472967	0.124951	0.9006

II. Model Criteria/Goodness of Fit

R-squared	-0.029866	Mean dependent var	6.888470
Adjusted R-squared	-0.132853	S.D. dependent var	2.927831
S.E. of regression	3.116253	Akaikeinfo criterion	5.298857

Sum squared resid	97.11032	Schwarz criterion	5.662537
Log likelihood	-22.79314	Hannan-Quinn criter.	5.164209
Durbin-Watson stat	1.342076		

Source: Author's Analysis at 5% significance level

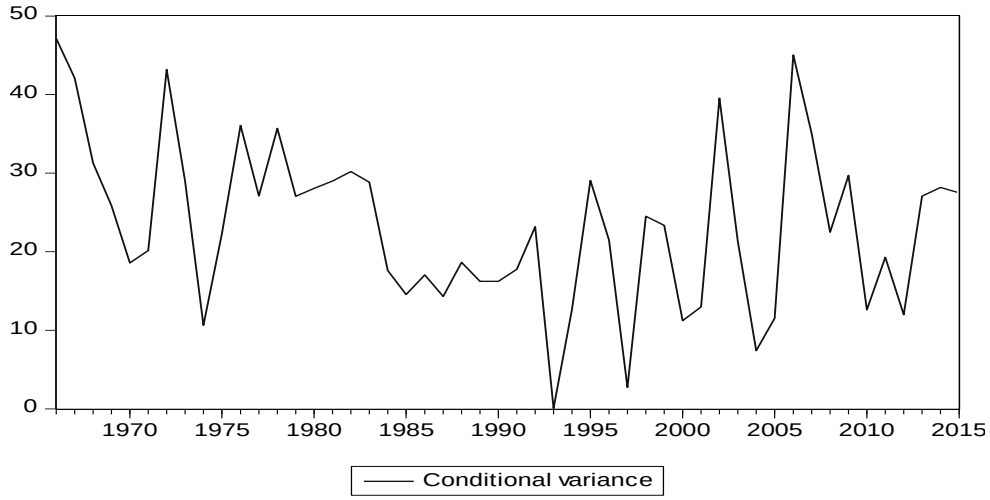
I. Coefficients and Level of Significance

Variable	**Coefficient**	**Standard Error**	**t-value**	**t-probability**
α	12.73058	22.20462	0.573330	0.5664
EXP01	-0.326546	1.837133	-0.177748	0.8589
RGFKF	-2.861097	1.784113	-1.603652	0.1088
S_GDP	1.019783	1.216785	0.838096	0.4020
INF	-0.030984	0.008774	-3.531202	0.0004

II. Model Criteria/Goodness of Fit

R-squared	-0.077825	Mean dependent var	3.645926
Adjusted R-squared	-0.100280	S.D. dependent var	4.625884
S.E. of regression	4.852285	Akaike info criterion	5.650300
Sum squared resid	1130.144	Schwarz criterion	5.994464
Log likelihood	-132.2575	Hannan-Quinn criter.	5.781359
Durbin-Watson stat	1.055560		

Source: Author's Analysis at 5% significance level



Source: Author's Analysis