

INFLATION AND ECONOMIC GROWTH: AN ESTIMATE OF AN

OPTIMAL LEVEL OF INFLATION IN NAMIBIA

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Abstract

This study empirically investigates the inflation-economic growth relationship to determine whether a threshold effect exists and if so to estimate the optimal inflation level which is conducive for economic growth in Namibia. With this view, various tables and charts, correlation matrices, pair-wise Granger Causality tests and a quadratic regression equation was estimated by OLS. Time series annual data covering a sample period from 1980 to 2012 were used in the estimation process. Stationarity tests on the variables revealed that all variables are stationary in levels. While the Granger Causality test revealed that there is a two-way causality between economic growth and inflation. A quadratic equation by OLS estimated generated a threshold level of inflation to be at 12.0 per cent, which is conducive for economic growth in Namibia. The implication is that any inflation above this optimal level seems to affect economic growth negatively. South African Reserve Bank (SARB) pursues an inflation targeting framework and the target range for CPI, excluding interest on mortgage bonds (CPI-X) is defined as 3 per cent to 6 per cent, hence the upper band of 6 per cent seems to be rather low for the case of Namibia since the optimal level of inflation conducive for economic growth is 12.0 per cent. This is bearing in mind that the Bank of Namibia do not conduct independent monetary policy implying that the monetary policy is closely linked to the South African monetary policy. The result of the study might be useful for policymakers in providing some clue in setting an optimal inflation target.

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Declarations

I, Abel N.M. Sindano, declare hereby that this study is a true reflection of my own research, and that this work, or part thereof has not been submitted for a degree in any other institution of higher education.

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Abel N.M. Sindano

Chapter One

Introduction

1.1 Background

Sustaining economic growth and ensuring price stability are two of the most important macroeconomic policy objectives of any economy. Policymakers and economic managers are always confronted with the arduous task of meeting these macroeconomic policy objectives which sometimes can be elusive and difficult to attain simultaneously. There appears to be a consensus among economists that macroeconomic stability, specifically defined as low inflation, is negatively related to economic growth. Hence, rapid output growth and low inflation are the most common objectives of macroeconomic policy. Also, it is agreed by most economists and policymakers that deflation (i.e. a continuous fall of the general price level over a sustained time period) can be harmful to the economy.

Policymakers and macroeconomists are often confronted with the task of finding the optimal rate of inflation within these two extreme cases or an optimal range of inflation that is neither too low nor too high in order not to harm medium and long-term growth targets. As Khan and Senhadji (2001) put it, if a relationship between inflation and economic growth exists, then it should be possible in principle to estimate the inflexion point, or threshold, at which the sign of the relationship between the two variables would switch. The answer to this question obviously depends on the nature and structure of the economy and hence varies from country to country. In Namibia inflation rates have varied between 2.2 per cent and 11.0 per cent during the period

1993 - 2012, while GDP growth rates have varied between -1.7 per cent and 12.3 per cent during the same period.

Over the years, the existence and the link between these two variables have become the subject of considerable interest and debate. Economic theories reach a variety of conclusions about the responsiveness of output growth to inflation. Several empirical studies confirm the existence of either a positive or negative relationship between these two major macroeconomic variables. For instance, Sweidan (2004), Thirlwall and Barton (1971), Mallik and Chowdhury (2001) found a positive relationship, while others such as De Gregoria (1991) found a negative relationship. Mundell (1965) and Tobin (1965) found a positive relationship between the rate of inflation and the rate of capital accumulation, which in turn, implies a positive relationship to the rate of economic growth. He argued that since money and capital are substitutable, an increase in the rate of inflation increases capital accumulation by shifting portfolio from money to capital, and thereby, stimulating a higher rate of economic growth.

Studies by Ghosh and Phillips (1998), Sarel (1996), and Khan and Senhadji (2001), generally found that for economies with initially low rates of inflation, modest increases in the rate of inflation do not affect long-run rates of real economic growth. But for economies with initially high rates of inflation, further increases in the rate of inflation have adverse effects on real economic growth. Khan and Senhadji (2001) found that the threshold rate of inflation is fairly low for industrialised countries around 1-3 per cent and around 7-11 per cent for developing countries. Empirical results by Nell (2000) suggest that inflation within the single-digit zone may be

beneficial, while inflation in the double-digit zone appears to impose slower growth. Similarly, Gillman, Harris, and Matyas (2002), using panel data of Organisation for Economic Cooperation and Development (OECD) and Asia-Pacific Economic Cooperation (APEC) countries, found that the reduction of high and medium inflation (double-digits) to moderate (single-digit) figures has a significant positive effect on economic growth both for the OECD and APEC countries.

1.2 Statement of the problem

Within the Common Monetary Area (CMA) Agreement comprising of Lesotho, Namibia, South Africa and Swaziland, the South African Reserve Bank (SARB) pursues an inflation targeting framework and the target range for CPI, excluding interest on mortgage bonds (CPI-X) is defined as 3 per cent to 6 per cent, hence all other members of the CMA do not conduct independent monetary policy implying that the monetary policy within the three countries are closely linked to the South African monetary policy. This raises an interesting policy issue of how much of inflation is too much; that is, how much inflation impedes on economic growth in Namibia? The hypothesis is that; at some low rate of inflation, the relationship between the two variables is non-existent, or perhaps even positive, but at higher rates it becomes negative.

Inflation rates in Namibia have varied between 2.2 per cent and 11.0 per cent during the period 1993 - 2012, while GDP growth rates have varied between -1.7 per cent and 12.3 per cent during the same period. In 1993 inflation rate rose by 8.5 per cent, while GDP contracted by 1.6 per cent. In 2004, inflation rate registered a slow growth of 3.9

per cent compared to 7.3 per cent in the previous year, while GDP grew by 12.3 per cent in 2004 compared to 4.2 per cent in 2003. Thus, in years when inflation rate was high, the real GDP growth rate was low, and vice versa. However, it should be taken into account that the impact is not instantaneous. Inflation affects economic growth with a significant lapse of time.

The simple analysis suggest that there is an inverse relationship between inflation and economic growth in Namibia, thus it should be possible in principle to estimate the inflexion point, or threshold, at which the sign of the relationship between the two variables would switch. Here, policymakers would be interested in a threshold level of inflation above which inflation adversely affects economic growth while below that level inflation is favourable for economic growth. With price stability as the dominant objective of monetary policy, the choice of an appropriate rate of inflation which is conducive for economic growth attains importance to many policy makers. An estimation of optimal inflation rate is important as it assist policy makers in ascertaining the Vision 2030 goal in which the Namibian economy is expected to grow by 7 per cent per annum. Hence, the study estimates the optimal level of inflation consistent with maximising economic growth for Namibia.

1.3 Research objective

The objective of the study is to estimate the optimal level of inflation for Namibia.

1.4 Significance of the study

The study is important to the institution like the Bank of Namibia, whose primary objective is the achievement and maintenance of price stability, with an ideal (optimal) rate of inflation, which is conducive for economic growth. Within the Common Monetary Area (CMA) Agreement, the South African Reserve Bank (SARB) pursues the inflation targeting framework and the target range for CPI, excluding interest on mortgage bonds (CPI-X) is defined as 3- 6 per cent, hence the study does assess whether Namibia's ideal optimal level of inflation is within this target range. Seleteng (2004) found that the ideal optimal level of inflation conducive for economic growth for Lesotho which is also a member of CMA is 10 per cent making the inflation target range by SARB rather low for the case of Lesotho.

1.5 Organisation of the Study

The rest of the study is organised as follows: chapter two discusses the historical overview of inflation and economic growth in Namibia, followed by chapter three which presents theoretical and empirical literature review. Chapter four considers the methodology, while chapter five contains the empirical analysis and interpretation. Chapter six entails the conclusions, policy implications and areas of further research.

Chapter Two

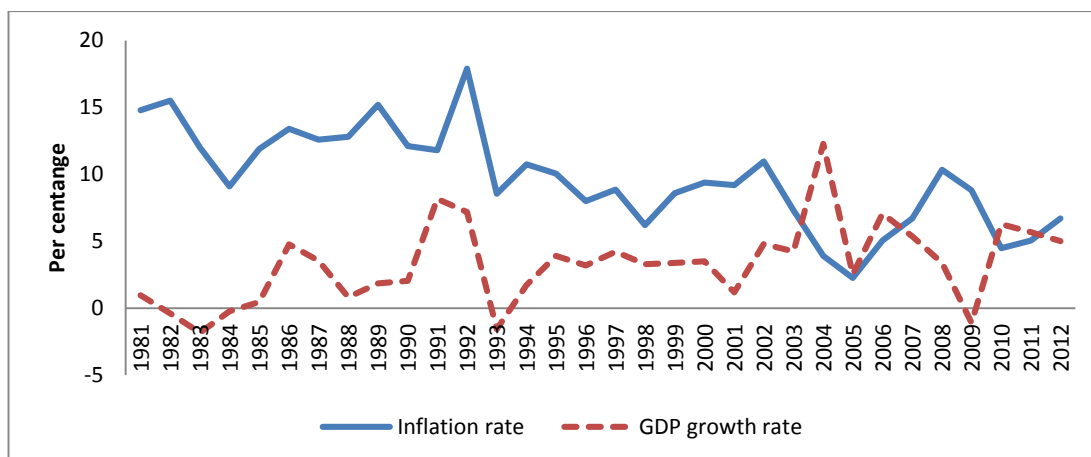
Overview of Inflation and Economic Growth in Namibia

2.1. Inflation and Economic Growth in Namibia

Namibia achieved independence on the 21st March 1990. Namibia's population stood at 1.4 million in 1991, however it has grown to 2.1 million people in 2011, with an average growth rate of 1.4 per cent per annum, (Namibia Statistics Agency, 2011). The unemployment rate was estimated to be 37 per cent according to the broad definition of unemployment in 2004 but has since reduced to 27.4 per cent in 2012. (Namibia Statistics Agency, 2012). A dispersed population, erratic climate, unemployment, poverty, HIV/AIDS and other contagious diseases such as Tuberculosis are amongst the major challenges facing the country's economy and its population. One feature of the economy is the predominance of the primary industries in the economy. With this strong primary industry, Namibia has an ideal opportunity to develop its secondary industries. The reason why this development has not materialised is that raw materials are exploited and exported in a relatively unprocessed state.

Namibia had very high and volatile rates of inflation particularly in the 1980s through to early 1990s. Various reasons have been assigned to these trend notable drought and external shocks. Figure 2.1 shows the trends in annual average CPI and GDP growth rates. The trend clearly indicates a downward trend in inflation rate over the period 1981 – 2012, while indicating an upward trend in GDP growth rates.

Figure 2.1: Trends in Inflation rates and real GDP growth rates



Source: Authors own construction using data from Namibia Statistics Agency, 2013

The Namibian economy has had an upward trend in terms of its growth path between 1981 and 2012, even though the economy had episodes of negative growth rates in five years: 1982 (-0.4 per cent), 1983 (-1.8 per cent), 1984 (-0.2 per cent), 1993 (-1.9 per cent) and 2009 (-1.1 per cent). The economy was in recession from 1982 to 1984, mainly due to the cyclical drought that affected the agricultural sector and the drop in production in the mining sector. Since the highest growth rate of 12.3 per cent recorded in 2004, the economy has not recorded a double digit growth rate. The lowest GDP growth thus far was recorded in 1983, registering a decline of 1.8 per cent.

For the period 1980 – 1989 before independence, the economy recorded an average growth rate of 1.1 per cent. The engine behind this growth was mainly the tertiary industry which recorded an average growth rate of 3.8 per cent, while the secondary and primary industries recorded an average growth of 0.8 per cent and -1.4 per cent, respectively. The low average growth rate recorded during this period was mainly due

to poor performance in the mining industry. The growth rate improved to an average of 3.3 per cent for the period of 1990-2001. During this period primary industry on average grew by 3.0 per cent, while the secondary and tertiary industries grew by 3.2 per cent and 3.7 per cent, respectively. This was mainly attributed to good performance in the fishing industry. Further improvement was recorded during the period of 2002-2012, registering an average growth rate of 5.0 per cent. For this period the primary industry recorded an average growth rate of 3.8 per cent, while the secondary and tertiary industries registered growth rate of 5.2 per cent and 5.4 per cent, respectively.

The structure of the economy has basically remained the same as it was before independence. The contribution of the primary industry to GDP on average was 30.0 per cent for the period 1980-1989, which has since declined to 19.2 per cent and 19.5 per cent for the period 1990-2001 and 2002-2012, respectively. This was mainly due to the mining and quarrying sector which recorded an average contribution of 21.7 per cent for the period 1980-1989, drastically declining to 10.1 per cent for the period 1990-2001 and registering 10.8 per cent for the period 2002-2012. The secondary industry average contribution to GDP was 14.5 per cent for the period 1980-1989, while for the period 1990-2001 and 2002-2012 the industry recorded average contribution of 14.2 per cent and 18.4 per cent, respectively. The tertiary industry is the biggest contributor to GDP recording an average contribution of 50.0 per cent for the period 1980-1989. The role of this industry increased further during the period 1990-2001 recording an average contribution of 58.3 per cent, while for the period 2002-2012 the industry contributed on average 55.2 per cent to the GDP.

Annual inflation rate of 14.8 per cent was recorded in 1981, which has significantly dipped to 6.7 per cent in 2012. Inflation levels have remained generally high since 1981 with rates ranging between 14.8 per cent in 1981 and 15.2 per cent in 1989. The 1980's in particular saw a dramatic upward trend in inflation especially between 1981 and 1992. By 1992, average annual inflation rate peaked at 17.9 per cent (an all-time high). The decade 1981-1991 recorded an average inflation rate of 12.8 per cent, compared to an average rate of 9.9 per cent for the decade 1992-2002. During the period 2003-2012, inflation rate only averaged around 6.1 per cent.

A decade-by-decade, an analysis of both inflation and GDP growth shows that whilst the lowest mean GDP growth rate of 1.8 per cent occurred during the 1981-1990 period corresponding to 12.9 per cent average inflation rate, the highest GDP growth rate was recorded during the decade period of 2001-2010 at 5.0 per cent with an average inflation rate of 6.6 per cent.

2.2. Namibia's Monetary Policy Framework

The objective of the central bank of Namibia is to serve as the State's principle instrument to control the money supply, the currency and the institutions of finance, and to perform all other functions ordinarily performed by a central bank. The Bank of Namibia's Monetary Policy Committee (MPC) is responsible for the formulation of monetary policy. The MPC is a committee constituted by the Governor of the Bank of Namibia, and comprises the Governor as the MPC Chairperson, the Deputy Governor, the Assistant Governor, and three senior staff members appointed on the basis of their

expertise in the area of monetary policy. With the exception of the Governor, all MPC members hold office for such period as determined by the Governor.

The MPC's key mandate in relation to monetary policy matters is derived from the Bank of Namibia Act, 1997 (Bank of Namibia, 2008). According to the Act, one of the mandates of the Bank of Namibia is to ensure internal and external monetary stability and to assist in the attainment of national economic goals. Moreover, in terms of Article 4 of the Common Monetary Area (CMA) Bilateral Monetary Agreement between Namibia and South Africa, it is stipulated that "the Bank of Namibia shall maintain reserves equivalent in the form of Rand assets and freely usable foreign currencies in such proportion as the Bank of Namibia considers appropriate"(Bank of Namibia, 2008). The Bank enjoys operational autonomy in its decision-making on matters pertaining to monetary policy. The key objective that the MPC focuses on is to maintain the parity of the Namibia Dollar to the South African Rand. However, since the ultimate objective of monetary policy is stable prices, the MPC keeps a close watch on the domestic inflation rate.

The MPC meets six times a year to deliberate on monetary policy matters and decides on the appropriate stance of monetary policy for the next two months. During an MPC meeting, members from relevant line departments in the Bank are invited to make presentations to the MPC on recent economic developments in the world and domestic economies, and on the inflation outlook. At times, certain invited persons are allowed to attend MPC deliberations in order to provide clarification on issues raised in their reports. However, only the views of MPC members are taken into consideration when

a decision on the stance of monetary policy is taken. All decisions relating to monetary policy matters are taken by consensus. Where consensus does not emerge, the Chairperson may exercise his/her casting vote. Each member also needs to state his/her decision clearly, along with the reasons for taking such decision.

There is no formal operating target in Namibia, the Bank of Namibia monitors the level of official reserves, as the fixed currency peg requires the country to fully back its currency in circulation with international reserves in order to import stable prices from South Africa. The operational target is an economic variable that the central bank wants to influence, largely on a day-to-day basis, through its monetary policy instruments. The Bank would use its best endeavours to maintain the international reserves at a level which, in its opinion, is adequate for Namibia's international transactions. In this regard, a minimum threshold obtains at which foreign reserves are considered inadequate. The minimum threshold is defined as the currency in circulation plus 30 day moving average of commercial bank net foreign transfers. If international reserves are at such a level that the Bank considers its adequacy to be in jeopardy, it would submit a report to the Minister of Finance on the reserve position, together with recommendations on measures that the Bank considered necessary to forestall or otherwise remedy the situation.

The ultimate goal of monetary policy in Namibia is to ensure price stability in the interest of sustainable growth and development. Namibia's monetary policy framework is underpinned by the fixed currency peg to the South African Rand. Under a fixed exchange rate arrangement, a country cannot operate monetary policy

independently from the anchor country, as this will eventually disturb the fixed peg through the workings of the capital account. However, a country with a fixed exchange rate policy could use sterilisation operations, capital controls and regulatory barriers to influence, to a certain degree, short-term interest rates, money supply and, possibly, credit extension to the private sector to control domestically induced inflation through expectations and aggregate demand.

Although Namibia has forgone the option of having a fully independent monetary system, the stance of monetary policy can deviate to a certain degree from that of the anchor currency by using capital controls and prudential requirements imposed on banking and other financial institutions. These powers make it possible for the Bank of Namibia to maintain a Repo rate different from the Repo rate of the South African Reserve Bank (SARB), when required, and allow it the discretion to control the domestic money supply. Thus enabling the Bank of Namibia to control domestically induced inflation. The repo rate channel influences the pricing of retail financial products.

In Namibia, almost immediately after the official rate is changed, commercial banks accordingly adjust their lending rates. Theoretically, firms and individuals respond to the change in commercial bank lending rates by altering their spending and investment decisions. In Namibia's case, changes in the borrowing behaviour of individuals in response to interest rate changes are more pronounced than those of businesses (Bank of Namibia, 2008). Changes in household demand patterns eventually filter through to output and domestic inflation. Thus, the repo rate channel is the most important

channel in Namibia in terms of influencing domestic inflation. The asset price channel through bonds and stocks prices is less effective in Namibia because the greater percentage of stocks and bonds are held by institutional investors, and not by households. However, the asset price channel is effective in Namibia through physical assets such as real estate.

Countries that adopt flexible or managed exchange rate systems can rely on other transmission channels, such as the exchange rate and asset price channels to implement monetary policy. In contrast, Namibia, due to its fixed exchange rate system and the characteristics of the Namibian securities market, only relies on the interest rate/repo rate channel and, to a lesser extent, the asset price channel to influence domestically induced inflation. Under a fixed exchange rate regime, monetary policy remains submissive to the fixed peg. The maintenance of the peg ensures that Namibia imports stable prices. However, due to existing prudential measures that limit the outflow of capital, Namibia can afford to deviate, albeit in a limited sphere, from the policies of the anchor country in order to affect domestically induced inflation. The decision of the central bank ultimately affects inflation through the repo rate/credit and asset price channels.

Chapter Three

Literature Review

3.1 Theoretical Review

Theoretical literature on the relationship between inflation and economic growth reach a variety of conclusions about the responsiveness of output growth to inflation. While some postulates a negative relationship, others indicate a positive relationship.

3.1.1 Classical Growth Theory

The Classicalists, championed by the works of Adam Smith, David Ricardo, and Karl Marx among others as cited in Ahoritor, Adenekan & Ohemeng, (2010), presumed a supply-side driven growth model. Supply is specified as a function of land, labour, and capital. Consequently, output growth is driven by population growth, investment growth, and land growth, as well as the increase in the overall productivity. Smith assumed a self-reinforcing growth (increasing return to scale) and that savings creates investment, hence growth, therefore, he saw income distribution as being one of the most important determinants of how fast (or slow) a nation should grow. Profit declines, not necessarily because of decreasing marginal product of labour, but because competition for labour drives wages up. Implicitly, the classical growth theory postulates a negative relationship between inflation and growth through higher wage cost.

A variant of the neo-classical theory pioneering by Stockman (1981) found a negative relationship between inflation and economic growth. According to the Stockman

model, an increase in the inflation rate results in a lower steady state level of output. High inflation reduces the purchasing power of money, thereby forcing people to reduce their purchases of both cash goods and capital, resulting in a fall in the steady-state level of output.

3.1.2 Neo-classical Theory

One of the earliest neo-classical models was postulated by Solow (1956) and Swan (1956). The model exhibited diminishing returns to labour and capital separately and constant returns to both factors jointly. Technological change replaced investment (growth of K) as the primary factor explaining long-term growth, and its level was assumed by Solow and other growth theorists to be determined exogenously, that is, independently of all other factors, including inflation. Mundell (1965) was one of the first to articulate a mechanism relating inflation and output growth separate from the excess demand for commodities. According to Mundell's model, an increase in inflation or inflation expectations immediately reduces people's wealth. This works on the premise that the rate of return on individual's real money balances falls. To accumulate the desired wealth, people save more by switching to assets, increasing their price, thus driving down the real interest rate. Greater savings means greater capital accumulation and thus faster output growth.

3.1.3 Keynesian Theory

The Keynesian view states that money supply increases affect inflation through interest rate movements. In this view, money is considered a close substitute for a limited number of financial assets (i.e., bonds), and thus an increase in money supply

causes excess demand for these assets, leading to an increase in their prices and subsequent fall in the interest rate. The decline in the latter leads to an increase in investment depending on the interest rate sensitivity of the investment. In turn, increased investment leads to increased aggregate demand, thereby triggering inflationary pressures in the economy. This theoretical explanation may, however, only apply in the short run. A fall in the interest rate may stimulate increased investment, thereby aggregate demand and increased inflation in the short run. But, in the long run, increased inflation may cause output to contract thereby leading to the reduced demand for money in the economy. According to the money demand relationship the reduced demand for money would lead to a rise in the nominal interest rate in the long run.

Keynesians tend to attribute inflation more to demand pressures within an economy. Keynesians' explanation of the long run economic growth path is implicitly captured in the business cycle concept (a short run phenomenon) developed within the aggregate demand (AD) and aggregate supply (AS) framework. According to this model, AS is assumed to be upward sloping in the short run, and changes in the demand side of the economy affect both prices and output, arising from changes in expectations, labour force, fiscal and monetary policy, among others. Therefore, Keynesians advocate that there is a positive relationship between inflation and output, such that even if there is an increase in prices of goods in the economy, output would not decline because producers have to satisfy the demand requirements of consumers.

3.1.4 Neo-Keynesian

Neo-Keynesians initially emerged from the ideas of the Keynesians. One of the major developments under Neo-keynesianism was the concept of potential output, which at times is referred to as natural output. This is a level of output where the economy is at its optimal level of production, given the institutional and natural constraints. This level of output also corresponds to the natural rate of unemployment, or what is also referred to as the non-accelerating inflation rate of unemployment (NAIRU). NAIRU is the unemployment rate at which the inflation rate is neither rising nor falling. In this particular framework, the built-in inflation rate is determined endogenously, that is by the normal workings of the economy. According to this theory, inflation depends on the level of actual output (GDP) and the natural rate of employment.

First, if GDP exceeds its potential and unemployment is below the natural rate of unemployment, all else equal, inflation will accelerate as suppliers increase their prices and built-in inflation worsens. This causes the Phillips curve to shift in the stagflationary direction; towards greater inflation and greater unemployment. Second, if the GDP falls below its potential level and unemployment is above the natural rate of unemployment, holding other factors constant, inflation will decelerate as suppliers attempt to fill excess capacity, reducing prices and undermining built-in inflation, leading to disinflation. This causes the Phillips curve to shift in the desired direction, towards less inflation and less unemployment. Finally, if GDP is equal to its potential and the unemployment rate is equal to NAIRU, then the inflation rate will not change, as long as there are no supply shocks. In the long-run, the Neo Keynesians believe that the Phillips curve is vertical. That is, the unemployment rate is given and equal to the

natural rate of unemployment, while there are a large number of possible inflation rates that can prevail at that unemployment rate. However, one problem with this theory is that, the exact level of potential output and natural rate of unemployment is generally unknown and tends to change over time. Inflation also seems to act in an asymmetric way, rising more quickly than it falls, mainly due to the downward rigidity in prices.

3.1.5 The Tobin's Framework

The Tobin's (1965) framework also revealed a positive relationship between inflation and economic growth. It showed that higher inflation increases output growth although temporary. The Tobin's model suggests that individual's hold their assets as interest-earning securities during inflationary period. This leads to greater capital intensity and hence promotes economic growth. Quite simply, the Tobin effect suggests that inflation causes individuals to substitute out of money and into interest earning assets, which leads to greater capital intensity and promotes economic growth. In effect, inflation exhibits a positive relationship to economic growth. Tobin also argued that, because of the downward rigidity of prices (including wages), the adjustment in relative prices during economic growth could be better achieved by the upward price movement of some individual prices.

3.1.6 Monetarism

Monetarists propounded by Milton Friedman as cited in Ahortor, Adenekan & Ohemeng, (2010), tend to concentrate on the importance of (domestic or international) money supply and on policies to control money supply growth. They argue that money is a close substitute for real assets (houses, land, etc.) and financial assets (bank

deposits, treasury bills, bonds, etc.) and that any extra cash balances realised from increased money supply will be spent on those assets rather than held as idle money balances. This situation will give rise to excess demand for assets, which will cause prices to rise, thereby ultimately leading to increased inflation.

Friedman also challenged the concept of the Phillips Curve. His argument was based on the premise of an economy where the cost of everything doubles. Individuals have to pay twice as much for goods and services, but they don't mind, because their wages are also twice as large. Individuals anticipate the rate of future inflation and incorporate its effects into their behaviour. As such, employment and output is not affected. Economists call this concept the neutrality of money. Neutrality holds if the equilibrium values of real variables including the level of GDP are independent of the level of the money supply in the long-run. Superneutrality holds when real variables including the rate of growth of GDP are independent of the rate of growth in the money supply in the long-run. If inflation worked this way, then it would be harmless. In reality however, inflation does have real consequences for other macroeconomic variables. Through its impact on capital accumulation, investment and exports, inflation can adversely impact a country's growth rate.

In summary, Monetarism suggests that in the long-run, prices are mainly affected by the growth rate in money, while having no real effect on growth. If the growth in the money supply is higher than the economic growth rate, inflation will result.

3.1.7 Endogenous Growth Theory

Endogenous growth theories championed by the works of Paul Romer as cited in Ahortor, Adenekan & Ohemeng, (2010), describes economic growth which is generated by factors within the production process, for example; economies of scale, increasing returns or induced technological change; as opposed to outside (exogenous) factors such as the increases in population. In endogenous growth theory, the growth rate depends on one variable: the rate of return on capital. One feature accounts for the foremost difference between the endogenous growth models and the neo-classical economies is that in the neo-classical economies, the return on capital declines as more capital is accumulated. In the simplest versions of the endogenous growth models, per capita output continues to increase because the return on capital does not fall below a positive lower bound. The basic intuition is that only if the return on capital is sufficiently high, people will be induced to continue accumulating it.

Models of endogenous growth also permit increasing returns to scale in aggregate productions, and also focus on the role of externalities in determining the rate of return on capital. Endogenous models that explain growth further with human capital, develop growth theory by implying that the growth rate also depends on the rate of return to human capital, as well as physical capital. The rate of return on all forms of capital must be equal in the balanced growth equilibrium. A tax on either form of capital induces a lower return.

Some versions of the endogenous growth economies find that the inflation rate effects on growth are small. Efficient allocations satisfy the condition that the marginal value

of the last unit of today's consumption equals the marginal cost of the last unit of work (Gomme, 1983). A rise in inflation reduces the marginal value of today's last unit of consumption, thus inducing people to work less. With less labour, the marginal product of capital is permanently reduced, resulting in a slower rate of capital accumulation. Gomme found that in this economy, eliminating a moderate inflation rate (for example, 10 per cent) results in only a very small (less than 0.01 percentage point) gain in the growth of output.

Alternative models examined how inflation might directly affect capital accumulation and hence output growth. Haslag (1997) specified economies in which capital and money are complementary goods. In Haslag's research, banks pool small savers but are required to hold money as deposits to satisfy a reserve requirement. Thus, an inflation rate increase drives down the return to deposits, resulting in deposits being accumulated at a slower rate. Since capital is a fraction of deposits, capital accumulation and output growth are slow. In Haslag study, the inflation rate effects on growth are substantially greater than those calculated in Gomme.

3.2 Empirical framework

One of the most important contributions to the inflation-economic growth literature has been made by Khan and Senhadji (2001). They examined the issue of the existence of threshold effects in the relationship between inflation and growth, using econometric techniques. Their study focused on whether there is a statistically significant threshold level of inflation above which inflation affects growth differently than at a lower rate. It also examined whether the threshold effect is similar across

developing and industrial countries. The study used data set of 140 countries and growth rate of GDP recorded in local currencies and inflation measured by percentage change in CPI index. To test for the existence of a threshold effect, a log model of inflation was estimated. The log of inflation was preferred, as the inflation growth relationship was relatively more apparent. The study suggested that regressions of real GDP growth on the level of inflation instead of the log, would give greater weight to the extreme observations, with the potential to skew the results. The study proposed that the log transformation eliminated, at least partially, the strong asymmetry in the inflation distribution. With the threshold level of inflation unknown, the study estimated it along with the other regression parameters. The estimation method used in the study was the non-linear least squares (NLLS). Furthermore, since the threshold level of inflation enters the regression in a non-linear and non-differentiable manner, conventional gradient search techniques to implement NLLS were inappropriate. Instead, estimation was carried out with a method called conditional least squares.

The study's results indicated that the threshold is lower for industrialized countries (1-3 per cent) than it is for developing countries (7-11 per cent). The thresholds were statistically significant at 1 per cent or less, implying that the threshold estimates were very robust. The negative and significant relationship between inflation and growth above the threshold level is argued to be robust with respect to the type of estimation method used. Empirical results suggested that inflation levels below the threshold levels of inflation have no effect on growth, while inflation rates above the threshold have a significant negative effect on growth. The study suggest that while the results of the paper are important, some caution should be borne in mind. The estimated

relationship between inflation and growth does not provide the precise channel through which inflation affects growth, beyond the fact that, because investment and employment are controlled for, the effect is primarily through productivity. This also implies that the total negative effect may be understated. The study results provide strong evidence for supporting the view of low inflation for sustainable growth

Ghosh and Phillips (1998) used a data set of 3,603 annual observations on real per capita GDP growth, and inflation rate, corresponding to 145 countries, over the period of 1960-1996. The objective of the study was to determine whether inflation and economic growth correlation is robust. The primary analytical tool used in the study was a panel regression, in which the main contribution was to combine a nonlinear treatment of the inflation and economic growth relationship with an extensive examination of robustness. The study checked whether the inflation-growth relationship appears in multivariate regression analysis. The intent was not to develop an explanatory model of GDP growth, but rather to determine whether the inflation and economic growth correlation is robust. Their analysis also checked for nonlinearity of the inflation and economic growth relationship.

The study revealed that there is a negative relationship between inflation and economic growth that is statistically significant and of an economically interesting magnitude. These findings were put through numerous robustness checks. As an interesting by-product of the studies, a sequential decision tree technique was developed in order to prove that inflation is not only a statistically significant determinant but also one of the most important determinants of growth. At very low rates of inflation (around 2 -

3 per cent a year or lower), inflation and economic growth are positively correlated. Otherwise, inflation and economic growth are negatively correlated, but the relationship is convex, so that the decline in growth associated with an increase from 10 per cent to 20 per cent inflation is much larger than that associated with moving from 40 per cent to 50 per cent. Taking both these nonlinearities into account, the study found that the negative inflation and economic growth relationship is evident in both the time and cross-section dimensions of the data, and that it is quite robust. The study also found a threshold at 2.5 per cent, and a significant negative effect above this level. The negative relation survived all additional robustness checks and tests for endogeneity. The study policy message suggests that even lowering moderate inflation rates can yield gains in GDP growth of up to 0.8-0.9 percentage points. Similarly, the empirical results by Nell (2000) suggest that inflation within the single-digit zone may be beneficial, while inflation in the double-digit zone appears to impose slower growth.

Sarel (1996) used panel data set of 87 countries so as to test whether inflation had a negative effect on economic growth. In addition, the paper also examined the level of inflation at which the structural break occurs. The study, first attempted to uncover nonlinear features in the function that relates economic growth to inflation. For this test, the observations were divided into 12 equal groups with dummy variables assigned to each group. Then, an OLS regression was estimated for the growth rate on the inflation dummies and others. This test presented evidence that the function that relates economic growth to inflation may contain a structural break. Following this preliminary test, the study, using a simple estimation technique (OLS regressions), endeavoured to answer relevant questions: At what level of inflation does the structural

break occur? Is the break significant? What are the estimated values of the inflation effects on growth? The study also introduced additional tests as variations to the main test, with the inclusion of other explanatory variables. This was done largely to better understand the effects of inflation on economic growth, and to use changes in the specifications of the regression to check the robustness of the main test results, regarding the nonlinear effects of inflation on economic growth.

The study found that there is evidence of a structural break that is significant. The break is estimated to occur when the inflation rate is 8 per cent. Below that rate, inflation does not have any effect on growth or it may even have a slightly positive effect. When the inflation rate is above 8 per cent, however, the estimated effect of inflation on growth rates is negative, significant, robust and extremely powerful. The study also demonstrated that when the structural break is taken into account, the estimated effect of inflation on economic growth increases by a factor of three. The results suggest that the existence of a structural break also suggests a specific numerical target for policy: keep inflation below the structural break.

Bruno and Easterly (1995) examined the determinants of economic growth using annual CPI inflation of 26 countries which experienced inflation crises during the period between 1961 and 1992. In their empirical analysis, inflation rate of 40 per cent and over is considered as the threshold level for an inflation crisis. The study found inconsistent or somewhat inconclusive relationship between inflation and economic growth below this threshold level when countries with high inflation crises are excluded from the sample. In addition, the empirical analysis suggests that there exists

a temporal negative relationship between inflation and economic growth beyond this threshold level. The robustness of the empirical results was examined by controlling for other factors such as shocks (e.g., terms of trade shocks, political crises, and wars). Finally, the study found that countries recover their pre-crisis economic growth rates following successful reduction of high inflation and there is no permanent damage to economic growth due to discrete high inflation crises.

Barro (1997) used a panel data for 100 countries over the period 1960-1990 and estimated growth regression using Instrumental Variables (IV) technique. To assess the effect of inflation on economic growth, a system of regression equations were used in the study, in which many other determinants of growth were held constant. The framework was based on an extended view of the neoclassical growth model. A general notion in the framework is that an array of government policies and private-sector choices determine where an economy will go in the long-run. To get a first-pass estimate of the effects of inflation on economic growth, the study included the inflation rate over each period as an explanatory variable along with the other growth determinants. The results indicated with significance that inflation had a negative effect on economic growth, with a coefficient of -0.024. The bottom line from the empirical analysis is that the estimated effects of inflation on growth are negative when some plausible instruments are used in the statistical procedures. Thus, there is some reason to believe that the relations reflect causation from higher long-term inflation to reduced growth.

The results of the study showed that if a number of the country characteristics are held constant, then regression results indicate that the impact effects from an increase in average inflation by 10 percentage points per year are a reduction of the growth rate of real per capita GDP by 0.2 - 0.3 percentage points per year, and a decrease in the ratio of investment to GDP by 0.4 - 0.6 percentage points. Although the adverse influence of inflation on growth looks small, the long-term effects on standards of living can be substantial. For example, a shift in monetary policy that raises the long-term average inflation rate by 10 percentage points per year is estimated to lower the level of real GDP after 30 years by 4-7 per cent.

Gillman and Matyas (2002), used a panel data of Organization for Economic Cooperation and Development (OECD) and Asia-Pacific Economic Cooperation (APEC) countries to test the relationship between economic growth and inflation. Their results indicate that the reduction of high and medium inflation (double digits) to moderate single digit figures has a significant positive effect on growth for the OECD countries, and to a lesser extent for the APEC countries. They further add that the effect of an expected deceleration of inflation might only be observed when the world economy is not facing a sudden growth rate deceleration due to shocks. If there are no such shocks, a reduction in inflation rate can produce considerably higher growth rate. Similarly, Alexander (1997) finds a strong negative influence of inflation on growth rate of per capita GDP using a panel of OECD countries.

Mallik and Chowdhury (2001) examined the short-run and long-run dynamics of the relationship between inflation and economic growth for four South Asian economies: Bangladesh, India, Pakistan, and Sri Lanka. Applying co-integration and error correction models to the annual data retrieved from the International Monetary Fund (IMF) International Financial Statistics (IFS), they found two motivating results. First, the relationship between inflation and economic growth is positive and statistically significant for all four countries. Second, the sensitivity of growth to changes in inflation rates is smaller than that of inflation to changes in growth rates. These results have important policy implications, that is, although moderate inflation promotes economic growth, faster economic growth absorbs into inflation by overheating the economy. Therefore, these four countries are on the turning point of inflation-economic growth relationship.

Fischer (1993) used cross-sectional data covering 93 countries to investigate the nonlinear relationship between inflation and growth, using the growth accounting framework in order to detect the channels through which inflation impacts on growth. The study used a simple alternative approach to mixed regressions, a production function based approach. The approach is a regression analogue of growth accounting, which helps identify the channels through which macroeconomic variables affect growth. As a matter of accounting, growth can be attributed to increases in the supply of factors, and to a residual productivity category, reflecting changes in the efficiency with which factors are used. Cross-sectional regressions were run on these to determine the results in the growth accounting framework.

The results of the study indicated that inflation is significantly correlated with the growth rate. The simple panel regressions confirm the relationships between inflation, inflation variability and growth. The growth accounting framework made it possible to identify the main channels through which inflation reduces growth. The study pointed out that, in line with past theory and studies, the results of the study implied that inflation impacted on growth by reducing investment, and by reducing the rate of productivity growth. Examination of exceptional cases also showed that while low inflation and small deficits were not necessary for high growth even over long periods, high inflation was not consistent with sustained growth. In a related study, Sarrel (1995) used a panel data sample of 87 countries over 21 years (1970-1990) to investigate the relationship between inflation and economic growth with a fixed effect technique framework. He found evidence of a structural break in the interaction between inflation and growth. However, the main findings of his study was that the estimated threshold level was 8 per cent, and an inflation rate exceeding this threshold would lead to robust negative impact of inflation on economic growth.

Lee and Wong (2005) estimated the threshold levels of inflation for Taiwan and Japan using quarterly data set for the period 1965–2002 for Taiwan and 1970–2001 for Japan. Their estimation of the threshold models suggests that an inflation rate beyond 7.25 per cent is detrimental for the economic growth of Taiwan. On the other hand, they found two threshold levels for Japan, which are 2.52 per cent and 9.66 per cent. This suggests that inflation rate below the estimated level of 9.66 per cent is favourable to economic growth and beyond this threshold value it is harmful for economic growth.

Ahmed and Mortaza (2005) empirically explored the relationship between inflation and economic growth in Bangladesh, using annual data set on real GDP and CPI for the period of 1980 to 2005, and the co-integration and error correction models. The empirical evidence demonstrates that there exists a statistically significant long-run negative relationship between inflation and economic growth for the country as indicated by a statistically significant long-run negative relationship between CPI and real GDP. The estimated threshold model suggests 6 per cent as the threshold level beyond which inflation adversely affects growth.

Kremer, Bick, and Nautz (2009) expanded the scope of Khan and Senhadji (2001) by empirically modelling a large panel-data set of 124 industrialized and non-industrialised countries over the period 1950-2004. Using a dynamic panel threshold model to shed light on the impact of inflation on growth, they found an inflation target of about 2 per cent for industrialised countries and 17 per cent for non-industrialised economies. Below the 17 per cent threshold, the impact of inflation on growth remained insignificant, thus failing to support the growth-enhancing effects of inflation on growth in developing countries.

Phiri (2010) similar to Sarel (1996) found that the least adverse effects of inflation on finance-growth activity are established at an inflation level of 8 per cent for South Africa. Similarly, Hodge (2005) had earlier found in the case of South Africa that inflation has a drag on growth in the longer term and that in the short run, growth above its trend required accelerating inflation.

Mubarik (2005) estimated the threshold level of inflation for Pakistan using an annual data set for the period 1973-2000. He employed the Granger Causality test as an application of the threshold model and the relevant sensitivity analysis of the model. His estimation of the threshold model suggests that an inflation rate beyond 9.0 per cent is detrimental for the economic growth of Pakistan. This in turn, suggests that inflation rate below the estimated level of 9 per cent is favourable for the economic growth.

Faria and Carneiro (2001) also investigated the relationship between inflation and economic growth in the context of Brazil, a country that had experienced persistent high inflation. Analysing a bivariate time series model (that is, vector auto regression) with annual data for the period 1980-1995, they found a negative relationship between inflation and economic growth in the short-run. However, their result showed that inflation does not affect economic growth in the long-run. The results also support the super neutrality concept of money in the long run. Their empirical results also support the super neutrality concept of money in the long run. This in turn provides empirical evidence against the view that inflation affects economic growth in the long run.

Espinoza, Leon and Prasad (2010) constructed a panel of 165 countries using a smooth transition model to investigate the speed at which inflation becomes costly after the threshold level. They established a threshold level of 10 per cent for most of the country groups except advanced economies. For oil exporting economies, they found a threshold level that was not robust enough according their own analysis. They also

estimated a fairly high speed of transition from a low inflation regime to a regime above the threshold level.

Tan (2008) ascertained whether there is any trade-off between inflation and economic growth in the founding members of ASEAN namely Malaysia, Singapore, Thailand, the Philippines and Indonesia and Japan and South Korea. The purpose of the study was met by integrating the Phillips curve framework with Okun's theory. Quarterly data of these countries spanning from 1991 through 2006/7 were mobilized for the study. The empirical results suggest that a trade-off albeit small exists between economic growth and inflation in Singapore, South Korea and Thailand after the 1997/98 Asian financial crisis years while none in the other countries.

Erbaykal and Okuyan (2008) examined the relationship between inflation and economic growth in Turkey using data that covered 1987:1-2006:2 periods. The existence of the long term relationship between these two variables was examined using Bound Test and the existence of a cointegration relationship between the two series was detected following the test result. Whereas no statistically significant long term relationship was found with the formed ARDL models, a negative and statistically significant short term relationship was found. The causality relationship between the two series showed no causality relationship from economic growth to inflation, while a causality relationship was found from inflation to economic growth.

Saaed (2007) explored the relationship between inflation and economic growth in the context of Kuwait, using annual data set on real GDP and CPI for the period of 1985

to 2005. The estimated result of the relationship showed a long-run and strong inverse relationship between CPI and real GDP in Kuwait.

Sweidan (2004) examined whether the relationship between inflation and economic growth has a structural breakpoint effect or not for the Jordanian economy from the period between 1970 and 2003. The study found that this relation tends to be positive and significant below an inflation rate of 2 per cent and the structural breakpoint effect occurs at an inflation rate equal to 2 per cent. Beyond this threshold level inflation affects economic growth negatively.

Shitundu and Luvanda (2000) used the Least Trimmed Squares (LTS) method, as introduced by Rousseeuw and Leroy (1987), which detects regression outliers and produces robust regression, to examine the impact of inflation on economic growth in Tanzania. The empirical results obtained suggest that inflation has been harmful to economic growth in Tanzania.

Malla (1997) conducted an empirical analysis using a small sample of Asian countries and countries belonging to the Organization for Economic Cooperation and Development (OECD) separately. After controlling for labor and capital inputs, the estimated results suggest that for the OECD countries there exists a statistically significant negative relationship between economic growth and inflation including its first difference. However, the relationship is not statistically significant for the developing countries of Asia. The crucial finding of this empirical analysis suggests that the cross-country relationship between inflation and long-term economic growth

experiences some fundamental problems like adjustment in country sample and the time period. Therefore, inconclusive relationship between inflation and economic growth can be drawn from comparing cross country time-series regressions with different regions and time periods.

In Nigeria, Fabayo and Ajilore (2006) found that a significant positive relationship between inflation and growth exists, while, above 6 per cent threshold level, inflation begins to harm growth. Also, Salami and Kelikume (2010), using data from 1970 to 2008, found an 8 per cent threshold for Nigeria. In Ghana, Frimpong and Oteng-Abayie (2010) found an inflation threshold of 11 per cent using data for the period 1960-2008.

Chapter Four

Methodology

4.1 Model Specification

The model adopted in this study is a variant of the model used by Younus (2012) that has estimated a quadratic equation by Ordinary Least Square Method (OLS) to determine the threshold level in Bangladesh. The model uses two variables namely inflation rate and economic growth. Although it is reasonable to argue that economic growth-inflation regression needs to include other plausible determinants of growth but considering argument of Ghosh and Phillips (1998) that inflation growth findings might not be robust once conditioning variables are included in the regression analysis. Thus, inclusion of these variables in a growth regression may reduce apparent effect of inflation. Therefore, this study uses a bivariate model specified as follows:

$$Growth = C + \beta_1 (INF) + \beta_2 *D (INF)^2 + u \quad [1]$$

Table I: Definition of variables

Variable	Definition
Growth	Growth rate of real gross domestic product
INF	Inflation rate
u	Stochastic error term

4.2 Data Analysis

The study uses E-views, “Econometric Views” software to estimate the optimal inflation level for Namibia. The study uses two variables namely the Consumer Price Index (base year = 2012), and real GDP (at constant 2004 prices) covering 1981-2012 period. Since the study uses time series data that is subject to non-stationarity due to trends we employed unit root test for stationary or non-stationary of the variables and their order of integration.

4.2.1 Stationarity

A time series data is said to be stationary if the mean and variance are constant through time and the value of the covariance between the two time periods depends only on the distance or lag between the two periods and the actual time at which the covariance is computed (Gujarati, 2003). However, if the mean and variance change in samples for different time spans then, this type of variable is known as a non-stationary variable and regression equations with non-stationary variables have serious limitations. Among other problems, their t-ratios and the adjusted R-square will be overestimated by a large magnitude resulting in the tests to be invalid. This is known as the spurious regression problem. In order to avoid the problem of spurious regression, trended data is differenced a minimum of time to generate a stationary series.

Although there are several tests of stationarity, such as the graphical analysis, the correlogram test and the unit root test, in this study we only discuss one test: the unit root test using the Augmented Dickey Fuller test and Phillips-Perron test.

The *Augmented Dickey Fuller Test* (ADF) was first developed by Dickey and Fuller in 1970 and is named after them as Dickey-Fuller test. The Dickey-Fuller (DF) test is applied to regression analysis in the following forms:

$$\Delta X_t = \delta X_{t-1} + \varepsilon_t \quad (2)$$

$$\Delta X_t = \alpha_1 + \delta X_{t-1} + \varepsilon_t \quad (3)$$

$$\Delta X_t = \alpha_1 + \alpha_{2t} + \delta X_{t-1} + \varepsilon_t \quad (4)$$

where X denotes the variable to be tested and t is the time variable. In each equation, the null hypothesis is that $\delta = 0$ that implies the existence of a unit root, thus the time series is non stationary. Rejecting the null hypothesis implies that the series are stationary. The DF test assumes that the error terms ε_t are uncorrelated, thus the use of the standard DF test critical values would be invalidated if the error terms in the test are correlated over time, violating the white noise assumption of the DF test, thus Dickey and Fuller developed a test known as the Augmented Dickey-Fuller test. This study uses an Augmented Dickey-Fuller (ADF) test that takes into account any auto correlation present by adding the lagged values of the dependent variable ΔX_t .

$$\Delta X_t = \alpha_1 + \alpha_{2t} + \delta X_{t-1} + \sum_{i=1}^m \beta_i + \Delta X_{t-i} + \varepsilon_t \quad (5)$$

where ΔX_t is the variable, whose time series properties are being investigated, Δ is the difference operator, m is the number of lagged variables, and where ε_t is the random error term.

The *Phillips-Perron* (PP) unit root test differs from the ADF tests mainly in how they deal with serial correlation and heteroskedasticity in the errors. In particular, where the ADF tests use a parametric auto regression to approximate the ARMA structure of the

errors in the test regression, the PP tests ignore any serial correlation in the test regression. The test regression for the PP test is

$$Y_t = \beta D_t + \pi y_{t-1} + \mu_t$$

Where μ_t is I (0) and may be heteroskedastic. The PP tests correct for any serial correlation and heteroskedasticity in the errors μ_t of the test regression.

4.2.2 Correlation Analysis

Correlation refers to the strength of a relationship between two variables. A strong or high correlation means that two or more variables have strong relationship with each other while a weak or low correlation means that the variables are hardly related. Correlation coefficients range from -1.0 to +1.0. The value of -1.0 represents a perfect negative correlation while a value of +1.0 represents a perfect positive correlation. While, a value of 0.0 means that there is no relationship between the variables that is being tested. Correlation analysis does not indicate the direction of the relationship between inflation and economic growth, thus, Granger causality test is used to examine the direction of the relationship that exists between the two variables.

4.3 Data Sources

The data used for the empirical analysis covering the period 1981 to 2012 were obtained from the national accounts time series 1980-2012 publication produced by Namibia Statistics Agency.

Chapter Five

Estimation and Interpretation of the Results

5.1 Stationarity Test

The results of the ADF and PP tests (see Table II) indicate that all variables are stationary in levels, thus there was no need to be differenced in order to be rendered stationary. Table II shows that at the significant level of 5 per cent the critical value for GDPR variable is less than the computed t-value, meaning that the GDPR time series is stationary. At the significant level of 10 per cent the critical value of INF variable is less than the computed t-value, based on the ADF test using intercept, while testing on trend and intercept, the significant level of 5 per cent the critical value of INF variable is less than the computed t-value, thus the INF time series is stationary. At the significant level of 5 per cent the critical value for INF^2 variable is less than the computed t-value, meaning that the INF^2 time series is stationary.

Table II: Stationarity Test of Variables in Levels

		Augmented Dickey- Fuller	Phillips-Perron
GDPR	Intercept	-4.409 ^{xx}	-4.358 ^{xx}
	Trend and Intercept	-5.242 ^{xx}	-5.801 ^{xx}
INF	Intercept	-2.615 ^x	2.483
	Trend and Intercept	-4.105 ^{xx}	-4.082 ^{xx}
INF^2	Intercept	-3.105 ^{xx}	4.811 ^{xx}
	Trend and Intercept	3.081 ^{xx}	-4.791 ^{xx}

Significance level: xxx = 1%; xx = 5 %; x = 10 %

$INF = INF^2$

Source: Authors own computation

5.2 Correlation Analysis

Table III below shows that there is a weak negative correlation between inflation and economic growth.

Table III: Correlation Analysis

	INF	GDPR
INF	1	-0.323
GDPR	-0.323	1

Source: Authors own computation

5.3 Granger Causality Test

Based on minimum Akaike Information Criteria (AIC) both the variables up to second lags are used in Granger causality test. The test indicates (see Table IV) that we do not reject the null hypothesis GDPR does not Granger Cause INF, as $p \text{ value} > \alpha$, thus causality runs from economic growth to inflation which is statistically significant at 5 per cent level. Similarly, at 10 per cent level of significance we do not reject the second null hypothesis INF does not Granger Cause GDPR, which implies that there is a two-way causality between economic growth and inflation.

Table IV: Pairwise Granger Causality Tests

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
GDPR does not Granger Cause INF	30	0.33463	0.71876
INF does not Granger Cause GDPR		3.36391	0.05084

Source: Authors own computation

5.4 Model Estimation

The estimated results (see Table V) obtained from OLS using only inflation and its square to right hand side gives us the optimal inflation level for Namibia. The quadratic equation is estimated as follows:

$$\text{GDPR} = 11.18322 - 1.503187 \text{ INF} + 0.062638 \text{ INF}^2$$

As per simple rule of optimization setting first differentiation = zero

$$\text{GDPR}' = -1.503187 + 0.125276 \text{ INF} = 0$$

and solving the equation above equation

$$\begin{aligned} \text{INF} &= 1.503187/0.125276 \\ &= 12.0 \end{aligned}$$

Thus the threshold level of inflation is estimated at about 12.0 per cent, and up to this level of inflation, the impact of inflation on economic growth remains positive in Namibia. Any rise in inflation above that level will hurt economic growth.

Table V: Quadratic Equation Results

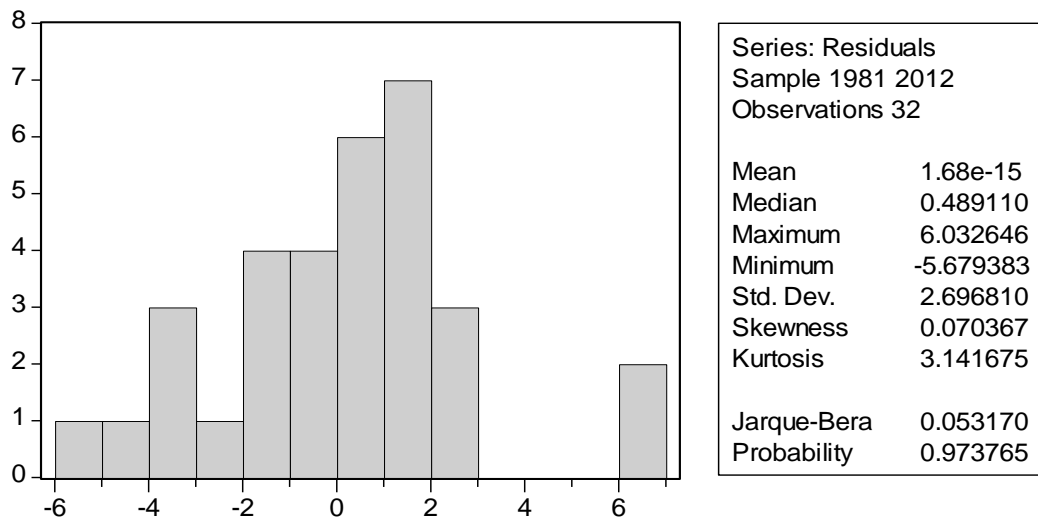
Dependent Variable - GDPR		
Variable	Coefficient	t-Statistics
C	11.1832	3.860989
INF	-1.503187	-2.469660
INF ²	0.062638	2.080072

Source: Authors own computation

Various diagnostic tests are applied to the model to see whether it passes the required diagnostic tests. Although several tests of normality are discussed in the literature, the

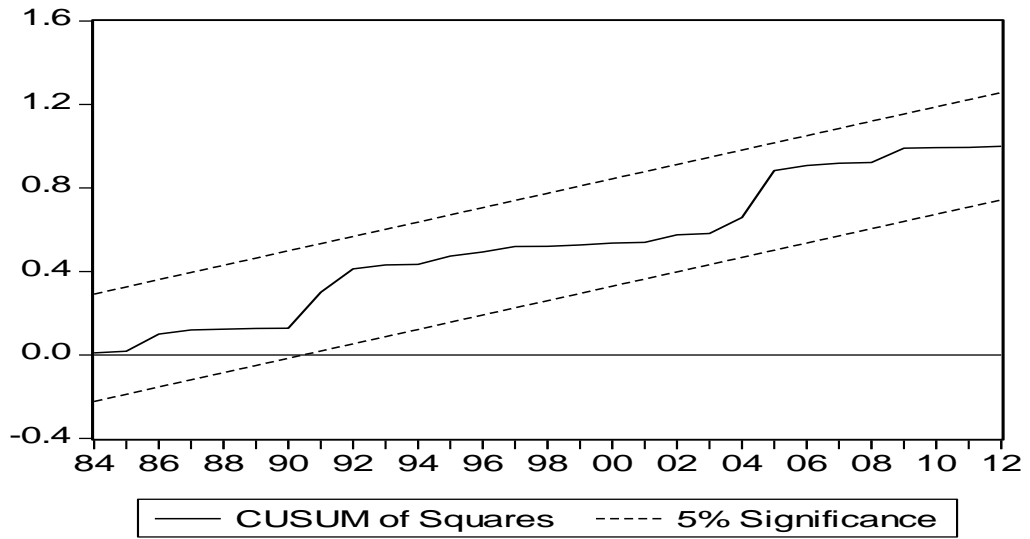
study only considered the Jargue-Bera (JB) test. From the histogram (see Figure 5.1) it seems that it is bell-shaped and the Jargue-Bera statistics is insignificant (probability = 0.9738 and Jargue-Bera = 0.0532) implying that the residuals are normally distributed.

Figure 5.1: Histogram of Residuals



Source: Authors own construction

The stability test indicates that the residual are within the band, implying no structural break in the estimated residual (see Figure 5.2).

Figure 5.2: Stability Test

Source: Authors own construction using

Chapter Six

Conclusion

Understanding the relationship between inflation and output growth is very crucial in setting the targets of policy goals, inflation in particular and formulating the policy framework. The objective of the study was to estimate the optimal level of inflation for Namibia. The study uses various tables and charts, correlation matrices, pair-wise Granger Causality tests and quadratic regression equation estimated by OLS using times series data covering a sample period from 1980 to 2012.

Looking specifically on Namibia, the study revealed that all variables are stationary in levels. While the Granger Causality test revealed that there is a two-way causality between economic growth and inflation. A quadratic equation by OLS estimated generated a threshold level of inflation at 12.0 per cent, which is conducive for economic growth. The implication is that any inflation above this optimal level seems to affect economic growth negatively. The empirical analysis suggests that the inflation below the estimated level of 12.0 per cent is conducive for economic growth. This findings of the study is in line with the results found by Seleteng (2004) that indicates the optimal level of inflation to be at 10 per cent for Lesotho. The result of the study also supports the findings of Khan and Senhadji (2001) that indicated that the threshold inflation levels for industrial and developing countries at 1-3 per cent and 11-12 per cent respectively.

The result of the study is useful to policymakers in providing some clue in setting an optimal inflation target which is conducive for economic growth in Namibia. This is bearing in mind that the Bank of Namibia does not conduct independent monetary policy implying that the monetary policy within Namibia is closely linked to the South African monetary policy. The South African Reserve Bank pursues the inflation targeting framework and the inflation target range is from 3-6 per cent, hence the upper band of 6 per cent seems to be rather low for the case of Namibia. This study does not estimate that level of inflation that is too low for economic growth, and this calls for further research on the topic.

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Appendix

Unit Root Test Results

Null Hypothesis: GDPR has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic based on SIC, MAXLAG=7)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.409126	0.0015
Test critical values: 1% level	-3.661661	
5% level	-2.960411	
10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: GDPR has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic based on SIC, MAXLAG=7)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.241515	0.0010
Test critical values: 1% level	-4.284580	
5% level	-3.562882	
10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: GDPR has a unit root
 Exogenous: Constant
 Bandwidth: 4 (Newey-West using Bartlett kernel)

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-4.357523	0.0017
Test critical values: 1% level	-3.661661	
5% level	-2.960411	
10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	8.778179
HAC corrected variance (Bartlett kernel)	7.818286

Null Hypothesis: GDPR has a unit root
 Exogenous: Constant, Linear Trend
 Bandwidth: 10 (Newey-West using Bartlett kernel)

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-5.801271	0.0002
Test critical values: 1% level	-4.284580	
5% level	-3.562882	
10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	7.400281
HAC corrected variance (Bartlett kernel)	2.584223

Null Hypothesis: INF has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic based on SIC, MAXLAG=7)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.615063	0.1008
Test critical values: 1% level	-3.661661	
5% level	-2.960411	
10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: INF has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic based on SIC, MAXLAG=7)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.105418	0.0152
Test critical values: 1% level	-4.284580	
5% level	-3.562882	
10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: INF has a unit root
 Exogenous: Constant
 Bandwidth: 2 (Newey-West using Bartlett kernel)

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-2.483180	0.1291
Test critical values: 1% level	-3.661661	
5% level	-2.960411	
10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	7.156676
HAC corrected variance (Bartlett kernel)	5.905224

Null Hypothesis: INF has a unit root
 Exogenous: Constant, Linear Trend
 Bandwidth: 2 (Newey-West using Bartlett kernel)

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-4.082436	0.0160
Test critical values: 1% level	-4.284580	
5% level	-3.562882	
10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	5.511705
HAC corrected variance (Bartlett kernel)	5.320038

Null Hypothesis: INF_INF has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic based on SIC, MAXLAG=7)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.105428	0.0365
Test critical values: 1% level	-3.661661	
5% level	-2.960411	
10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: INF_INF has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic based on SIC, MAXLAG=7)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.810601	0.0028
Test critical values: 1% level	-4.284580	
5% level	-3.562882	
10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: INF_INF has a unit root
 Exogenous: Constant
 Bandwidth: 4 (Newey-West using Bartlett kernel)

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-3.081199	0.0385
Test critical values: 1% level	-3.661661	
5% level	-2.960411	
10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	3564.777
HAC corrected variance (Bartlett kernel)	3444.331

Null Hypothesis: INF_INF has a unit root
 Exogenous: Constant, Linear Trend
 Bandwidth: 2 (Newey-West using Bartlett kernel)

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-4.790960	0.0029
Test critical values: 1% level	-4.284580	
5% level	-3.562882	
10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	2596.170
HAC corrected variance (Bartlett kernel)	2447.394