The results showed that adopting both inflation targeting and fiscal rules led to better fiscal and monetary outcomes by improving the primary and overall fiscal balances and also bringing down the average inflation rate, compared to cases where only fiscal rules or inflation targeting was adopted. The paper suggested that, for policy implications, considerations were not only to be made for the interactions between inflation targeting and fiscal rules but also for the timing of the adoption of the two frameworks. In addition the paper suggested that in the event of considering the adoption of both inflation targeting and fiscal rules, it was suitable for countries to first introduce fiscal rules before adopting inflation targeting instead of adopting inflation targeting before enacting fiscal rules.

Gathoni (2011) also worked over the period 1990-2009 on providing a theoretical and empirical framework that analyzed the pre-requisites relating to the adoption of inflation targeting in low-income countries and emerging markets. The study used panel data comprising of macro-economic variables and institutional arrangements that could make it possible for the adoption of the inflation-targeting framework in the sampled countries. Data analysis was done using a logit model comprising of both macro variables (money and quasi money growth, liquid liabilities to GDP, central bank assets to GDP ratio and the ratio of private credit to deposit money banks to GDP) and institutional variables like the Central Bank Independence Index. The dataset covered a sample of low-income and upper-income level countries who were either inflation targeting or non-targeting. The inflation targeting countries included Brazil, Chile, Colombia, Czech Republic, Ghana, Hungary, Indonesia, Israel, South Korea, Peru, Philippines, Poland, Romania, Thailand, Turkey and South Africa. The findings suggested that countries with low inflation rates

stood a better chance of adopting inflation targeting as a framework and that institutional development was not an important pre-requisite to the initial adoption periods of inflation targeting as a framework.

Considering some inflation targeting countries particularly, Kamal (2010) conducted an empirical investigation of the policy frameworks of Brazil, Chile and South Africa. This paper presents a different approach and only focused on inflation targeting countries in its sample. The paper used the unrestricted Vector Auto-regression (VAR) and Structural Vector Auto-regression (SVAR) approaches based on the data that covered the period from 1970(q1) to 2007(q4). In addition, the paper used the Likelihood Ratio (LR) Statistic to test for possible structural changes due to the adoption of inflation targeting in the countries sampled. The main findings of the study were that inflation targeting did not a make a difference in the performance of monetary policy in the sampled countries, as these countries had been adept in keeping inflation on a low and stable trajectory in the early years of adoption. More so, the paper suggested the experience of Brazil, Chile and South Africa as important lessons that other emerging economies could learn from if they wished to adopt a framework such as inflation targeting.

For South Africa as an inflation targeting country, Kumo (2015) investigated the impact of inflation targeting monetary policy and inflation volatility on economic growth in South Africa. The paper used a Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model for seasonally adjusted annualized quarterly consumer price inflation for the period 1960Q1-2013Q3. The measure of volatility used, together with macroeconomic control variables, were used to estimate economic growth models for periods that corresponded to two monetary policy regimes and a third model

that covered the full sample period. The study found that inflation volatility had a significantly negative impact on economic growth during the pre-inflation targeting period covering 1960Q1-1998Q4. For the post-inflation targeting period, the study found that inflation volatility did not have significant impact on economic growth. The implication from these findings was that for South Africa, the adoption of the inflation-targeting framework had succeeded in achieving low and stable general price levels hence creating the right environment for economic growth. Accordingly, higher growth periods in the mid 2000s followed after inflation targeting had been adopted as a monetary policy.

2.2.2 Monetary Policy and Money Demand

There exists large and growing literature on money demand and monetary policy. Most of these studies aimed to test stability of the money demand function in the face of structural changes, financial innovations and even shocks such as food shortages in order to inform monetary policy action. Nigeria comes up more often in the list of countries in Africa however, whose money demand function has been tested (see Kumar et al., 2010; Omotor and Omotor, 2010; Bitrus, 2011; Bassey et al., 2012; Nduka and Chukwu, 2013).

Other countries in which studies on money demand have been carried out include Ethiopia (Sterken, 1999), Zambia (Mutoti, 2006), Pakistan (Sarwar et al., 2013), Kenya (Nyamongo and Ndirangu, 2013; Kiptui, 2014), Rwanda (Rutayisire, 2010), Sierra Leone (Mansaray and Swaray, 2013), South Africa (Wesso, 2002; Niyimbanura, 2013) and Ghana (Kovanen, 2011). Many of these studies discussed the implications for monetary policy in their countries in the face of different shocks or economic activities and mostly

estimated long-run and short run functions but failed to add causality tests in their analysis.

However, tracing back from years after the Great Depression, Tobin (1947) studied the relationship between money demand and interest rates in the United States (U.S). His methodology separated transactions balances from idle balances based on the assumption that transactions balances were solely dependent on income. He investigated the relationship between idle balances and interest rates by plotting the average level of idle balances from 1922-1941 against the interest rates on commercial papers and discovered an inverse relationship between idle balances and interest rates. He concluded that money demand was sensitive to interest rates and this was backed up in the 1950s and 1960s (Schmitt, 2003). In the view of Schmitt (2003), although the money demand function of Tobin was found remarkably stable until the mid-1970s, the problem with it was the difficulty in separating idle balances and transactions balances since both transactions and idle balances depended on income and interest rates.

Following this, Schmitt (2003) extended the study by Tobin (1947) by studying the breakdown in the stability of the money demand (M1) function in the United States (US) starting in 1974. Because policy makers relied on the demand for M1 function for effective monetary policy, the breakdown created a problem where actual money demand was lower than what the old demand functions predicted. His results revealed that this was due to financial innovations in the 1970s that changed working definitions of money. Even though the problem grew worse in the 1980s, policy makers turned to alternative money demand functions (M2), which also broke down in the 1990s thus causing the Federal Reserve to stop targeting M2 in 1992. Comparatively, while Tobin's study

proved the theory of money demand by Keynes (1936), the study by Schmitt went further to add evidence to the causes of the break in the demand for money.

Also, Kumar (2000) used a panel cointegration approach to estimate the demand for narrow money for a panel of five Pacific Island Countries (PIC) - Fiji, Vanuatu, Samoa, Solomons, and Papa New Guinea, over the period 1975-2007. The study found that there was a unique long-run association between real narrow money, real income and the nominal interest rate. In addition, the study suggested that aside stable money demand function, financial reforms were yet to have any significant effects in the countries considered.

Similarly, Kumar and Singh (2009) worked on the demand for money for the same set of five PICs. For this study, the exchange rate was not captured because of the under-developed nature of the financial markets. The study used the time series approaches of LSE- Hendry General to Specific (GETS) and the Johansen Maximum Likelihood (JML) and agreed with Kumar (2000) that real income, nominal interest rate and real narrow money moved together in the long run. In addition, the study found the money demand function to be stable implying that money supply could be targeted for policy. The study differs in that it suggested the need for the countries to focus on targeting money supply instead of targeting bank rates since there was no evidence of instability in their money demand functions.

For Kumar and Rao (2011), their work focused on the demand for money in the United States. The study used annual data from 1960-2008 and used the Gregory and Hansen (1996) test. Their method varies in that they used alternative specifications including

trend and additional variables to proxy the interest rate. The results showed a structural change in 1998 with income elasticity being unity even with smaller sample regressions. The study suggested that real income, nominal interest rate and real narrow money moved together in the long run.

Also from Fiji, one of the PICs, Katafono (2001) employed data covering the years 1975-1990 to estimate the demand for narrow money (M1) using the Johansen Maximum Likelihood (JML) technique. Her study revealed a low-income elasticity thus asserting that the demand for M1 in Fiji was unstable in the short run. Even though Katafono was probably in support of the central bank of Fiji's monetary policy of targeting interest rate, Rao and Singh (2005) used alternative time series approaches of General to Specific (GETS) and JML and disagreed on the use of the interest rate for policy. Their study concluded that the demand for M1 in Fiji was stable and well determined with data covering the period 1971-2002.

For the PIC of Papua New Guinea (PNG), Kannapiran (2001) also used the Engel-Granger method of cointegration to estimate the demand for M2 in PNG and obtained a very low-income elasticity of 0.20 using data covering the period 1979-1995. The findings support that of Rao and Singh (2005) and implied that the probability of using money supply as a monetary policy was high just like the case of Fiji.

In Africa, Treichel (1997) examined broad money demand and monetary policy in Tunisia. This work found lower income elasticity as compared to the one applied by the Central Bank and ultimately proposed a different methodology for achieving monetary targets. The study used co-integration and error correction techniques and included the

monthly rate of return on treasury bills being and other interest rates like the discount rate (DISC) and the money market rate (MMINT). The paper found demand for money to be stable and suggested a base or price regime that would help the Central Bank to achieve its monetary objectives.

In addition, Nigeria's demand for money was examined in the study done by Teriba (1974). With a double log specification and static Ordinary Least Squares (OLS) technique, the study revealed high significant income-elasticity of demand deposits in Nigeria while interest rates were not statistically significant using annual data over the period 1958-1972 (Teriba, 1974). Studies of Nwaobi (2002) and Nwafor et al. (2007) also used the vector auto regression approach to test the stability of broad money demand in Nigeria and their results confirmed a stable money demand function for Nigeria whiles Omotor (2009) also used the Bounds Testing Autoregressive Distributed Lag (ARDL) technique and equally found Nigeria's money demand as stable. Nduka and Chukwu (2013) also used the Engle-Granger approach to cointegration and CUSUM charts to test the stability of long-run demand for real broad money over the period 1986-2011. The results of the study showed positive income elasticity of income and foreign interest rates while domestic interest rates, inflation and the exchange rate had negative coefficients.

Also Okonkwo, Ajudua and Alozie (2014) used the Johansen Cointegration approach to test the stability of the demand for broad money in Nigeria over the period 1981 to 2012 and found demand for broad money to be stable. The paper recommended the monetary authority to be structured in the growing challenges posed by financial innovations. Comparatively, Aiyedogbon et al. (2013) used data over the period 1986-2010 and introduced new variables such as gross capital formation, government expenditure and

economic openness and found cointegration with broad money supply. The study employed vector error correction modeling in its analysis and also found interest rates, inflation and economic openness to have negative coefficients.

Also for Nigeria, Bitrus (2011) examined demand for money. The study used time series data covering both narrow and broad money, interest rates, exchange rates and the stock market. The methods employed were multiple regression analysis, unit root testing and CUSSUM tests using data from 1985 to 2009. This study added dividend yield in its specification and found that this had significant influence on demand for broad money in Nigeria. Also, the study found income as the most important determinant of the demand for money while mentioning that stock market variables could improve the performance of money demand. The study recommended that stock market activities and monetary targeting could help improve inflation control.

Galen and Oskooee (2007) also investigated the stability of money demand in 21 African countries. The methodology included the design of a standard money demand function following the works of Domowitz and Elbadawi (1987) and Bahman Oskooee (1996), and estimated using a bounds testing approach for co-integration and error correction. Some of the countries studied included Ivory Coast, Burkina Faso, Egypt, Ghana, Ethiopia, Gabon, Burundi and Cameroon. Data used for the study was quarterly data over the period 1971-2004. The study found that the demand for money (M2) was stable in almost all the 21 countries. For this study, a notable difference was that inflation was suitable as a measure of opportunity cost because of the lack of well-developed financial markets,

For Gambia, Sriram (2009) investigated demand for money and discussed the implications for monetary policy conduct in that country. The study employed the cointegration methods of Johansen (1991) and Johansen and Juselius (1990). The study was conducted using data for the period beginning from January 1988 to June 2007. The results showed a long run relationship for real broad money, which was not stable, contrary to the case of Nigeria. Reasons for such instability included output shocks, financial innovation, changes in income velocity and inadequate data quality. The study recommended the authority to apply a flexible monetary targeting regime with the overall objective of preserving price stability; with a possible option being inflation targeting lite.

Similarly, Lungu et al. (2012) worked on the demand for money in Malawi and discussed implications for monetary policy conduct in that country. The study also used the Johansen-Juselius approach to cointegration, just like Sriram (2009). The data used was over the years 1985-2010. For this study, financial depth was included as an additional variable to income, inflation and exchange rates. Results from the study showed the stability of the demand for money function as co-integration results indicated a long-run relationship between real money balances, prices, income, exchange rate, Treasury bill rates and financial innovation. The study recommended a direction of policy in the short-run, to increasing financial innovation, open market activities and increased productivity in order provide higher returns on alternative investments.

Sarwar et al. (2013) tested the stability of the money demand function in Pakistan. The study also used the Johansen and Juselius approach to cointegration although it tested three official monetary aggregates and settled on the broader aggregate (M2), which provided a stable money demand function for Pakistan. The data used was from the year

1972 to 2007. The findings showed that real GDP and interest rates were positively and negatively related to money demand respectively. However, as a recommendation, the study mentioned that the role of financial innovation would best help monetary policy if it had more attention given to it.

For South Africa, Husein et al. (2012) worked on estimating long run demand for real money. They used a cointegrated VAR approach with data from 1985 to 2008. The VAR model had short-term interest rates, long-term interest rates, inflation, the exchange rate, real money and real income as arguments. The study found three cointegration relations between long run constant money velocity and inflation, exchange rate and the short-term interest rate and the bond rate, inflation and real income. However, the study found the long run money demand relation to be unstable with deviations from equilibrium not converging in the short term.

However, Niyimbanira (2013) on the other hand, worked on the stability of money demand also for South Africa. The paper worked with quarterly data using cointegration and error correction methods over a shorter time period (1990-2007). In contrast to the findings of Husein et al. (2012), the results confirmed the stable relationship and proved the effectiveness of monetary policy. In addition, the study found a lag in the time to which any disequilibrium would be restored to be approximately four quarters (a year), thus making monetary policy slow in dealing with emerging situations.

For Ghana and its inflation-targeting regime, not much literature exists investigation the role of the demand for money in monetary policy. The study by Dagher and Kovanen (2011) is the last recent empirical evidence of demand for money specifically for Ghana.

Prior to this, studies by Ghartey (1998) and Bawumia and Abradu-Otoo (2003) present mixed evidence on the stability of money demand for Ghana. Ghartey (1998) used quarterly data covering the period from 1970-1992 and found evidence of a stable demand function while Bawumia and Abradu-Otoo (2003) used vector error correction modeling and the Johansen cointegration approach with monthly data from 1983-1999 and found a stable relationship between inflation and broad money in Ghana. Following this, Amoah and Mumuni (2008) also estimated a long run demand for money function and used quarterly data from 1980 to 2007. Also using cointegration and error correction models, they found an unstable money demand function, which they attributed to structural reforms and the deregulation of the financial sector. The study concluded that money was no longer relevant in predicting future inflation and output.

However, Dagher and Kovanen (2011) investigated the long-run demand for money using the Bounds Testing approach to cointegration. The study used quarterly data from the year 1990 to 2009 and found strong evidence for the presence of a stable and well-identified money demand function, despite substantial changes in the financial markets. The evidence suggests that there are complex dynamics between money demand and its determinants and those deviations from equilibrium were short-lived.

2.3 Conclusion

From the works mentioned above, lessons could be drawn. Firstly, inflation proved to be a significant measure of opportunity costs in countries where financial markets were not completely developed. Following the work of Galen and Oskooee (2007), the study used inflation equally as a measure of opportunity cost since the interest rate was used comparatively as a dependent variable in a separate estimation.

Secondly, the work of Galen and Oskooee (2007) identify a role for exchange rates in their model. The study employed the use of exchange rates in its model estimation because of the role that the exchange rates played in the demand for money in countries like Ghana as observed in their work.

Also structural changes, output shocks and financial innovation could contribute to the stability or instability of money demand functions, which would affect the plans of policy makers to control price. Where such influences were managed well, the effect on price would be minimal in the face of a stable demand for money; noting that countries and their economies differed in their structures.

Lastly, the methods employed in the literature reviewed failed to account for causality analysis and focused mainly on cointegration approaches and how long deviations from equilibrium took to restore. This is the case specifically for studies on Ghana. This is a gap that this study fills. With Ghana being one of the first emerging market economies to have formally adopted inflation-targeting[10], studies such as this add value to the debate

[10] See Alichi et al. (2010). A Model for Full-fledged Inflation Targeting and Application to Ghana. IMF Working Paper.

on the whether monetary aggregate targeting is still relevant for Ghana, despite the transition into an inflation targeting regime.

CHAPTER THREE

TRENDS ON ECONOMIC GROWTH, INFLATION, AND MONEY SUPPLY AND A BACKGROUND TO POLICY FRAMEWORKS IN GHANA

3.0 Introduction

This chapter discusses trends and statistics on inflation, economic growth and money supply growth in Ghana over the time period of the study. The chapter then concludes with some fundamental facts about monetary policy frameworks that Ghana experienced.

3.1 Trends of GDP Growth, Inflation and the Growth of Money Supply in Ghana

There exists literature on inflation and economic growth in the case of Ghana[11] as well as literature on inflation and money supply in Ghana. Most of these papers considered methods that tested causal relationships, the presence of structural breaks and the optimal threshold level that guaranteed maximum growth.

Major structural transformations such as changes in government, political unrests, or even changes in policy regimes affected Ghana largely between the end of the 1970s and the early 1980s. Coupled with severe drought, bush fires, the arrival of Ghanaians from Nigeria and policies that completely ignored external obligations, inflation was recorded at its highest in the early 1980s. Particularly in 1983, exchange rate overvaluation as well as the development of a buoyant parallel market contributed to the hike in prices

[11] See Marbuah (2012), Quartey (2010), Ahortor et al. (2012) and Frimpong and Oteng-Abayie (2010).

(Aryeetey et al., 2007, Fosu, 2003 and Akoena et al., 2007). Inflation was recorded at its highest in the history of the country at 123% in 1983. Prior to this, double-digit inflation of between 50-54% had been recorded from 1979 to 1980. Afterwards, triple digit inflation crept in at 117% in 1981. However, inflation was very low the year after (1982) and raised many hopes with regards to the economic fortunes of the country with a record of about 23%. Clearly, pre-1983 inflation reflected excessive demand pressure sustained by fiscal expansion and consequent monetary growth. The problem was made worse by inadequate growth of output and supplies due to particular structural constraints faced by the economy (Sowa and Kwakye, 1993).

With the highest record of inflation in 1983, the Economic Recovery Programme (ERP) was the best shot for Ghana. The government of the Provisional National Defence Council (PNDC) launched the ERP in mid-1983 with the support of the World Bank and the International Monetary Fund (IMF). The main purpose of the program was to stem the slide in the economy, minimize imbalances and establish a path of sustainable growth (Sowa and Kwakye, 1993). The program was to help refocus and restore debt levels, an overly devalued currency and negative growth rates that had been seen from 1979. Specifically, between 1979 and 1983, the economy contracted at an average rate of 3.4% and observed the largest contraction of 6.92% in 1982. However, the economy appeared to have responded positively to the ERP. According to Fosu (2000), the economy recovered from a negative growth rate of about 5% in 1983 to a significantly positive growth rate of 8% in 1984. The favorable growth appeared to have continued since that the time despite little slowdown in the growth rate of the economy from 1990.

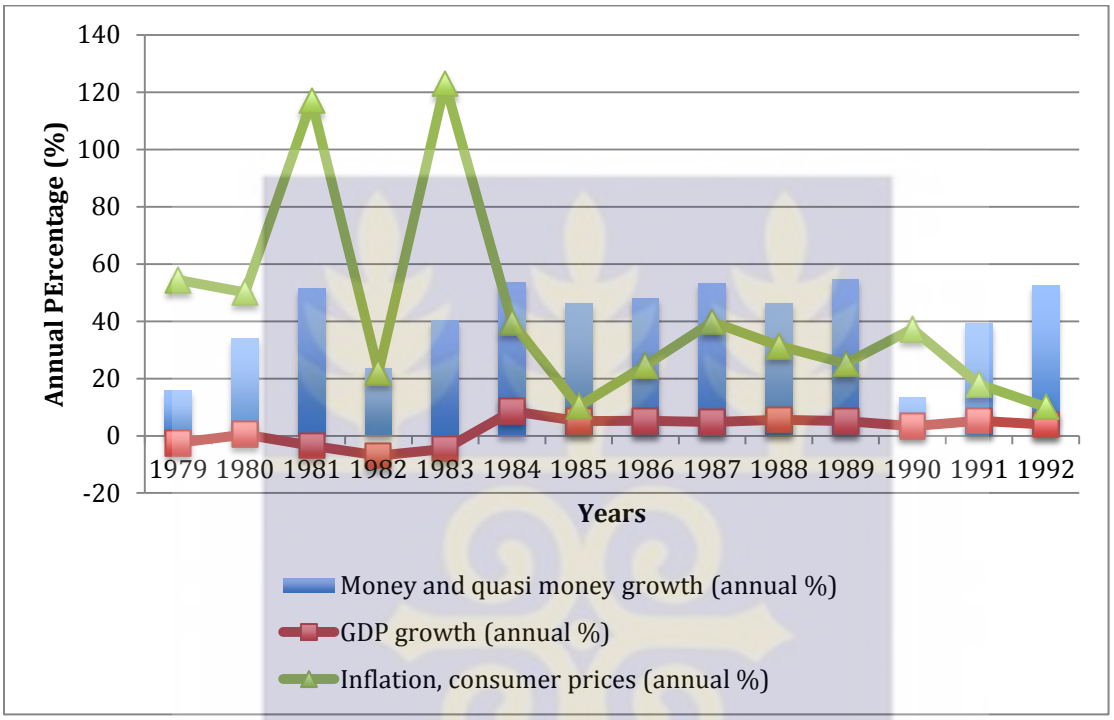
A year after the ERP was introduced, inflation dropped from its highest to 40% in 1984. While this change was mostly attributed to the program, the implementation of the program only began in 1984 and for that matter the reduction in inflation could have come from increased external inflows and liberalization that allowed the agricultural production to recover quickly (Sowa and Kwakye, 1993).

Enhancing the benefits of improved external inflows and the improvement in the productivity of the agricultural sector was the drop in inflation to about 10% in 1985. This was associated with an especially good harvest where food prices actually fell. After the take off of the recovery programme, inflation between 1983 and 1986 was about 25% on average with the economy recovering by 6.3% on average over the same time period. Money supply had grown by 47% averagely from 1983 to 1986, compared to 33% from 1979 to 1983. The success of the ERP seemed short-lived as inflation rose again to about 40% in the year 1987, the highest since 1979. In that same year, money supply growth had increased to 53% from 48% in 1986 and the growth of the economy retarded to 4.8% in 1987. The next couple of years saw the introduction of a program of structural adjustment that was meant to reshape the economy as an export oriented one after clearing debts and balance of payment pressures. In between 1987 and 1992, the highest growth rate of 5.3% was recorded in 1991 with inflation hovering around 18% and money supply remaining at 39%.

As a result of tight fiscal and monetary controls, inflation dropped to 10% in 1992, which happened to be the year Ghana witnessed the commencement of democratic rule. At this point, monetary policy regimes had shifted from the direct credit controls to monetary aggregate targeting, which began in 1983. After three years of implementing the money-

targeting regime, inflation had reached its lowest of 10%, which happened to have been recorded in 1985, after the ERP was introduced.

Figure 3.0 Trends in Inflation, Money supply and Growth under Monetary Targeting



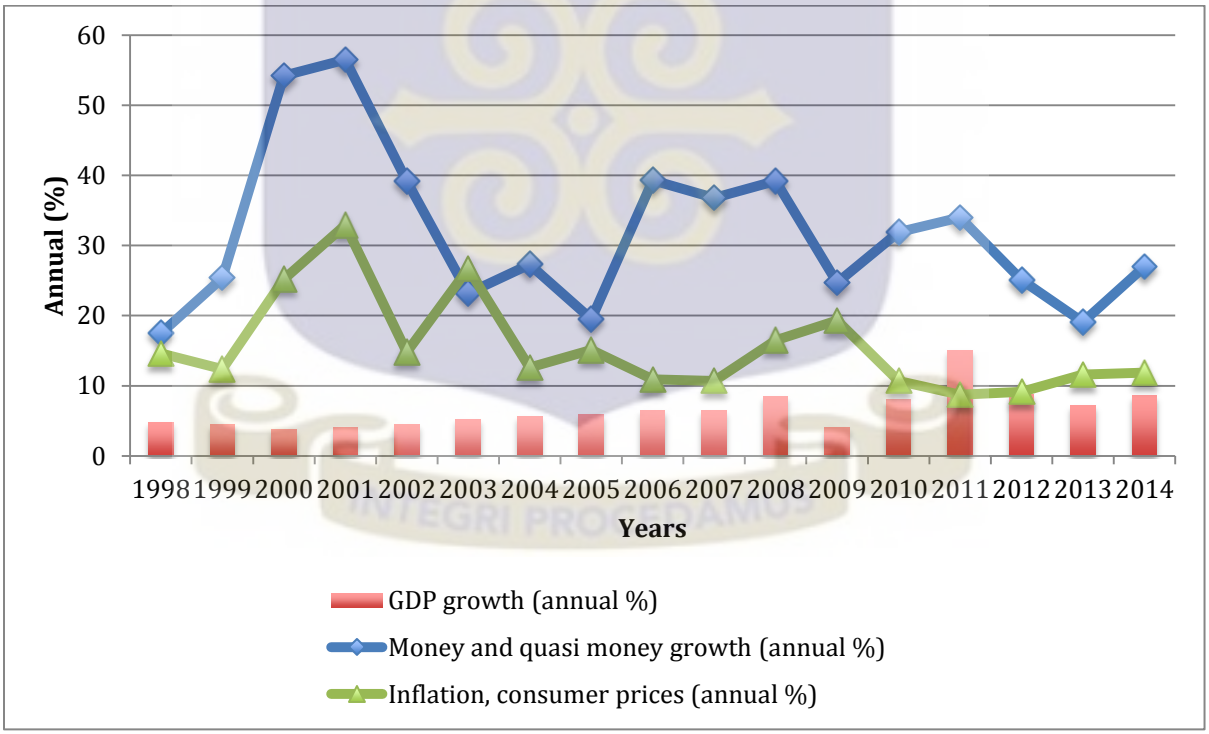
Source: Author's computation from WDI, 2014

Notably, the influence of politics in trends of inflation, growth and money supply is shown in the comparison between election periods from 1992 to 2012. Before the election year 1992, inflation was recorded at 23% between 1989 and 1992, while the economy had recovered by about 4.4% over this time period compared to decadal average of 1.6% between the years 1979 to 1989. Money growth in between 1989 and 1992 was recorded at about 40% compared to the decadal average of 42.4% in between 1979 and 1989.

Interestingly, the first four years after democratic elections in 1992 saw average inflation rise by 10% from 1992 to 1996, to settle at 33%, while the economy contracted by 2% to settle at about 4.2% over the period 1992 to 1996. Over the same period money supply had grown to about 44% compared to the average of 40% over the period of 1989 to 1992. Substantial government expenditure increases in 1992 contributed immensely to inflation rates rising from 10% in 1992 to about 60% in 1995. In 1996, inflation stood at 46.6% while the average inflation between 1996 and 1999 was 25.4% (Marbuah, 2012). Average economic growth over the years 1996 to 1999 was 4.5% whiles money supply growth was 31.5% on average. The four years after the 1996 elections (1996 to 2000) saw inflation at a lower rate. Average inflation over this period was about 25% and the economy had recovered by about 4.3% over this same period, while average money supply growth was at 36% over this period. With a much better performance of the economy over this period, the next four years after the change of hands in government saw massive expenditures because of the elections in 2000. The evidence from national statistics showed that the end of period inflation as at December 2000 had almost tripled from 13.8% in 1999 to 40.5% in 2000 due to expansionary monetary policies, depreciation of the domestic currency which was as high as 49.5%, the terms of trade shocks, the general loss of confidence in the domestic economy and deficit financing practiced by the central bank in respect of the elections in 2000 (Marbuah, 2012). However, over the period 2000 to 2004, average inflation had reduced to 22.4%, average money supply growth was about 40% and the economy had grown at an average of 5%.

There was a notable change in the monetary policy regime in the early years of 2002 where the central bank had decided to implicitly practice targeting inflation (See Figure 3.1 below). This was well received as inflation more than halved from 33% in 2001 to 15% in 2002 allowing the economy to expand to 4% in 2002 from 3.7% in 2001. Also, money supply growth reduced significantly from 56.5% in 2001 to 39.2% in 2002. For the last quarter of 2002, the inflationary trend was as a result of the payment of cocoa purchases. In 2003, inflation was 23.6% and was mainly caused by the increase in prices of petroleum products given that Ghana remained susceptible to supply shocks from commodity prices.

Figure 3.1 Trends in Inflation, Money supply and Growth Under Inflation Targeting



Source: Author's computation from WDI, 2014

The government did not change hands after the 2004 elections, and some stabilization measures had been put in place to ensure Ghana grew and attained macroeconomic stability with growth, especially after securing the mandate of the people. There was a trend of disinflation, which began in 2004. Inflation reduced from 27% in 2003 to 12.6% in 2004 and ended up at 11% in 2007. Over this time, the economy had grown from 5.2% in 2003 to 6.5% in 2007. Major determinants of this trend included the use of resources from debt relief and debt cancellation from the HIPC and Multilateral Debt Relief Initiative (MDRI), new aid flows and external loans and inward private transfers (including remittances) by the central bank to avert accelerated inflation in the economy (CEPA, 2009). Even so, the trend could also have been because of the inflation targeting framework that the central monetary authority adopted. The framework, until the second quarter of 2008, had well anchored expectations surrounding inflation and had clearly redefined the goal of the central bank to be price level stability (Marbuah, 2012).

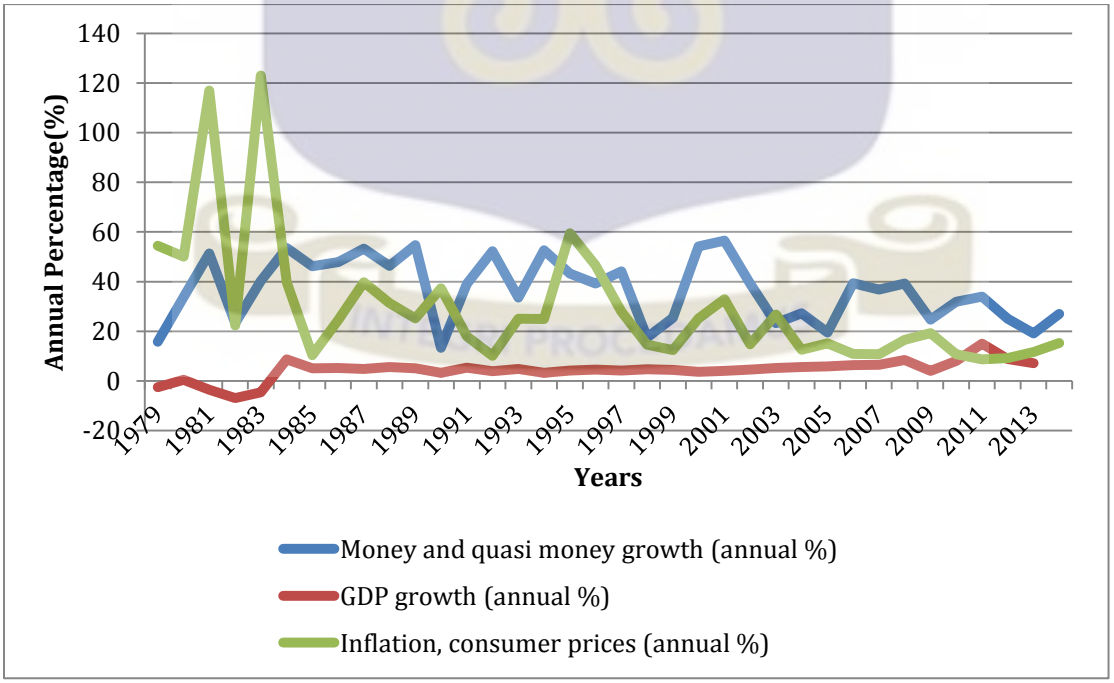
However, over the period 2004 to 2008, average money growth was recorded at 32% whiles average inflation had been observed to be the lowest ever since 1979. The economy had expanded averagely by about 7% over this period and this record was enough political capital for the government of the day at the time. Perhaps the beginning of what was popularly known as 'single digit' inflation, average inflation over the years 2008 to 2012 was about 13% while average growth in the economy had increase to about 9% over this time. Average money supply growth over this period was about 31% and this showed good evidence of the monetary policy stance, after the formal declaration of a new policy stance in 2007.

More so, there were setbacks to the disinflationary process that occurred between 2001 and 2007 (Andinuur, 2013). These setbacks were as a result of external shocks from the global financial crisis, high food prices, excessive government spending, fiscal deficits beyond 10% of GDP and a depreciating currency. At the end of 2009, the depreciation of the local currency had reached about 19.3% of GDP. However, the central bank was able to halt the depreciation of the currency and contributed to inflation reducing from 20.7% in June 2009 to a single digit of 8% at the end of 2010. At that time, the successes of the inflation targeting regime were hailed and the government used the achievement of single digit inflation as a means to earn itself some political capital. Along with the talk about single digit came the news about exchange rate stabilization.

The trends changed in the early months of 2013, as inflation began rising again, going past the 10% ideal target and ending at 13.5% in December 2013. More pressure came the way of the central bank as inflation spiked through the months of 2014 with some allegations of incompetence on the part of the governor of the monetary institution. Inflation spiked largely because of pressures from world markets for crude, wider fiscal deficits, largely caused by a huge public wage bill and large amounts of debt owed to by the government that contributed to high lending rates. In addition the policy rate was increased as a form of contractionary monetary policy but the central bank was found to be financing deficits of the government and state owned enterprises by the IMF team that reviewed the performance of the economy as a result of the request by Ghana for an extended credit facility.

Considering trends over the period (1979-2014), inflation, money supply and output growth have shown differences. In earlier monetary policy regimes such as direct controls and sole monetary targeting, money supply growth was comparatively higher and inflation was not well controlled and thus eventually resulted in negative trends in the growth rates of real output. Even though programs were instituted to ensure economic restructuring, pressures from politics, fiscal dominance and shocks from external markets resulted in inflation that caused the slower growth of output and a higher growth in money supply, compared to the period between 2002 and 2014 where inflation targeting was the policy regime. The trends in inflation and money supply go downward especially from the year 2003 with the successful practice of inflation targeting for the Ghanaian economy as this anchored expectations surrounding inflation. Growth of real output took an upward trend especially in between 2005 and 2009.

Figure 3.2 Trends in Inflation, Money supply and Growth from 1979-2014



Source: Author's computation from WDI, 2014

The figure above shows that the period between 2005 and 2014 exhibited a downward trend in inflation while GDP growth on the other hand showed an upward trend but only goes close to 20% over this period, especially in the year 2011. The data showed that the highest recorded growth in GDP of 15% occurred in 2011 with the most contraction of 6.92% in 1982. This record high growth could not be sustained in subsequent years even though the growth of the country had exceeded that for Sub-Sahara Africa. Growth of real output in 2013 was 5.4%, much lower than the growth rate of 7.9% in 2012. The double-digit growth of 15% recorded in 2011 was partly due to the revenue from the exploration of oil resources that had come to add to the size of the economy. Despite this, growth rates in 2013 and 2014 have been much lower than the 7.8% in 2012 and the 9.4% in 2011, especially as a result of the increased susceptibility of the economy to shocks from foreign markets and the depreciating local currency (ISSER, 2014). Holistically, average inflation over the period 1979 to 2014 still remained in double-digits at about 30%. The economy of Ghana had averagely grown by 4.4% over this thirty-two year period and average money supply growth from 1979 to 2014 still remained at 37%, which followed average trends over this period.

Analysis by decade in between 1979 and 2009 showed that average money supply growth remained above 30%, average inflation rates had all been above the optimal inflation rate of 10% and the growth rates of national output for Ghana had all been below 10% indicating that trends in inflation, growth and money supply had not been appreciably controlled by monetary policy for the economy to fully experience improvement.

Table 3.0 summarizes the average inflation, GDP growth and money growth figures for Ghana, along with their medians.

Table 3.0 Decadal Mean and Median Inflation, GDP and Money Supply Rates

Year	Inflation (CPI, Annual%)		GDP growth (Annual %)		Money Supply (M2) Growth Rates (Annual %)	
	Mean	Median	Mean	Median	Mean	Median
1979-1989	48.89	39.7	1.6	4.79	42.4	46.3
1989-1999	27.41	25	4.34	25	37.72	39.2
1999-2009	17.92	15.1	5.33	15.1	35.03	36.8
1979-2014	29.7	24.6	4.38	4.79	37.05	39.2

Source: Author's computation from WDI, 2014

3.2 Background to Monetary Policy Frameworks in Ghana

The time period considered for the study covered all three policy frameworks for Ghana. Ghana has had three monetary policy regimes since its independence. The first was direct monetary controls, which lasted for twenty-six years (1957-1983) until the economic and fiscal challenges hit the Ghanaian economy in 1983. Monetary aggregate targeting was the next policy regime for Ghana and this lasted for 18 years (1983-2001) until Ghana opted for the Highly Indebted Poor Country (HIPC) programme to retrace its steps back to economic growth and poverty reduction. [12]

[12] The HIPC Initiative was a World Bank programme that was meant to help poor countries that were highly indebted re-focus their strengths on debt reduction, economic growth and poverty alleviation. Ghana accepted to join this program in March 2001.

In that time (2001), money supply growth had risen from 25.6% in 2000 to 56.5%, the economy had grown from 3.6% in the year 2000 to about 4%, and inflation had surged up from about 25% in the year 2000 to almost 36%.

The third policy framework for Ghana was inflation targeting which took over from monetary aggregate targeting in 2001. This is the framework that Ghana is using currently although the years from 2001 to 2007 had been periods of implicit inflation targeting. This meant that the central bank had been taking steps in line with the targeting framework whiles complimenting such steps with monetary aggregate targeting. The bank formally announced its decision to use the inflation targeting framework in May 2007 and after, the use of the framework required setting an interest rate for which policy linkages could be triggered to ensure that monetary policy worked.

In prior times, direct monetary controls and monetary aggregate targeting would not have directly considered the policy rate, although with other tools like open market operations and discount rates, the policy rate remained a tool that central banks could use to control the liquidity in the economy through their dealings with commercial banks.

The table below shows the average growth rates of GDP, inflation and money supply growth of each of the regimes that Ghana has experienced.

Table 3.1 Inflation, GDP and Money Supply Growth Rates per Policy Regime

Regime	Period	Inflation (average %)	Money and Quasi Money Growth (%)	GDP Growth (Average%)
Direct Controls	1979-1983	73	33	-3.4
Monetary Aggregate Targeting	1983-2001	33	43	4
Inflation Targeting	2001-2014	16	32	7

Source: Author's computation from WDI, 2014

The results in the table above showed that the inflation targeting regime produced the lowest average inflation and money supply growth rates compared to inflation and money supply growth rates for the other frameworks. Average GDP growth on the other hand was the highest in the inflation-targeting framework compared to the direct control and monetary aggregate targeting frameworks. This growth rate of 7% is higher than the period average of 4.38% in table 3.0 and speaks positively about the benefits of the inflation targeting framework for Ghana.

According to Bawumia (2010), 'of all the monetary policy regimes implemented since independence, the inflation targeting regime (and the accompanying fiscal framework) had yielded the best performance in terms of key macroeconomic indicators'. The Ghanaian economy also dealt better with external shocks under the inflation targeting regime (2001-2008) than under the monetary targeting regime (1983-2001) and the direct controls regimes (1957-1983).

Bawumia (2010) mentioned that the inflation targeting regime implemented had been very supportive of economic growth. The data in table 3.1 proves the first part of the statement of this statement. Although the book by Bawumia discussed monetary policy performance from 1957 till 2008, it made no room for discussion on the resilience of the economy to shocks, especially after the 2012 elections. Notable among these shocks was the drop in foreign aid and donor support funds that occurred because of the Election Petition, in which the election results of 2012were challenged in the Supreme Court of Ghana .

This was primarily a result of low investor confidence that the external development partners had for the country. Furthermore, the economy experienced severe exchange rate depreciations, real sector shocks such as shortages in commodities such as Liquefied Petroleum Gas (LPG) that affected homes and the transport business of cab drivers, crude oil price shocks that affected quantities of crude on Ghanaian markets and most of all, energy generation challenges that affected the supply of power to various businesses, industries and individuals. In the midst of all these challenges, pressure had been built on the central bank to put in place strict measures to control inflation and even the exchange rate. The measures put in place helped solve some of the economic problems and slowed inflation. Despite the challenges of the inflation-targeting framework, the period of performance had been better as compared to earlier policy regimes in entirety. Improving on its performance would therefore work best to the benefit of the economy of Ghana.

3.3 Conclusion

The chapter presented a review of inflation, GDP growth and money supply growth in Ghana from 1979-2014. Inflation was shown to have revolved around a cyclical and rising trend while GDP growth had been steadily rising until after 2012. Finally with declining GDP growth, trends in money supply remained steady in the early 2000s and took an upward trend in the last three years, contributing to the increase in inflation and the decline in GDP growth. The next chapter presents the econometric models for the study.

CHAPTER FOUR

METHODOLOGY

4.0 Introduction

This chapter discusses the analytical framework used for the study. It presents the theoretical and empirical models used in investigating the causal and long-term relationships between money supply, the policy regime and demand for money in Ghana. Finally, concluding remarks are provided.

4.1 Theoretical Framework

The review of literature on the theories of demand for money which try to establish how and why demand for money exists has provided mixed conclusions about the factors that accurately explain demand for money and whether the velocity of money is really a fixed variable. According to the Classical model, the quantity theory posits that demand for money is solely explained by income and that because velocity remains constant at full employment, increases in money supply are bound to cause inflationary pressures. Modifying this school of thought is the Monetarist theory led by Milton Friedman who insist that demand for money is not only dependent on income but on all assets that a consumer owns which yield different levels of interest. Hence the demand for money can be likened to the demand for any commodity thus making the demand for money a function of the asset that offers the highest return. Furthermore, the Keynesian model mentions that demand for money is influenced by transactionary, precautionary and speculative motives. As a result, the Keynesian model explained the demand for money

as a function of income and interest rates on bonds, which represented all forms of interest earning assets in the financial market. Hence, the question of which model holds perfectly for the Ghanaian economy becomes an empirical one, given that the other influences such as the exchange rate have come in strong under the current monetary policy regime, which is one that specifically targets low and stable price levels.

In this respect, the Autoregressive Distributed Lag (ARDL) technique was employed to model the long run relationship between money and the factors that determine demand for money in line with the model by Keynes. The model differs from the traditional money demand function by Keynes in that additional factors (exchange rates and policy regime) were included in the specification. The advantage of the ARDL approach is that it is easy to apply in time series models and the approach yields consistent estimates of the long-run coefficients that are asymptotically normal irrespective of whether the underlying regressors are I (0) or I (1).

4.2 Empirical Models

To explore the long-run money demand function for Ghana, the study used the Bounds Testing approach of testing for cointegration developed by Pesaran and Shin (1999) and further extended by Pesaran, Shin and Smith (2001). This method is advantageous over other methods for testing long run relationships like Johansen (1991) and Johansen and Juselius (1990), in that it allows for the combination of variables that may be I (0) or I (1) but not I (2). This implies that the method does not require specific identification of the order of the underlying data. In addition, the method is simple to estimate using Ordinary

Least Squares (OLS) after the lag length criteria are appropriately determined and is suitable for small or finite sample sizes (Pesaran et al., 2001). Another advantage is that the approach allows for the estimation of both long run and short-run models by the inclusion of the first difference terms of the residual of the long-run equation (Narayan and Narayan, 2006). Hence, the equilibrium correction model is likely to have much more robust estimations compared to the Engle-Granger method. For that matter, the bounds testing approach to cointegration gives assurance in the production of efficient results for a relatively small sample such as that for this study.

Following Pesaran et al., (2001), the general vector autoregression (VAR) of order p, is identified in equation (1) below:

$$\boldsymbol{Z_t = \mu + \sum_{i=1}^{p} \beta_i Z_{t-1} + \varepsilon_t} \text{ ---------- (1)}$$

where Z_t is the vector of both x_t and y_t, where y_t is the dependent variable defined as money supply growth (M), x_t is the vector matrix representing a set of explanatory variables – nominal income growth (GDP), inflation (INF), exchange rates (EX), policy regime (PR) and *t* is a time or trend variable. According to Pesaran et al., (2001), y_t must be integrated of the first order – I (1). However the regressor $x_t$can either be integrated of order zero or one – I (0) or I(1). Following from equation one, the vector error correction model (VECM) is specified as follows:

$$\boldsymbol{\Delta Z_t = \mu + \alpha t + \lambda Z_{t-1} + \sum_{i=1}^{p-i} \gamma_t \Delta y_{t-i} + \sum_{i=1}^{p-1} \gamma_t \Delta x_{t-i} + \varepsilon_t} \text{ ---------- (2)}$$

Where:

- Δ is the first difference operator.
- λ is the long-run multiplier matrix which is defined as:

$$\lambda = \begin{bmatrix} \lambda_{YY} & \lambda_{YX} \\ \lambda_{XY} & \lambda_{XX} \end{bmatrix}$$

As a result of the diagonal elements of the matrix being unrestricted, the selected series could either be I (0) or I(1). Y then would be I (1) if $\lambda_{YY} = 0$. However, if $\lambda_{YY} < 0$, then Y would be I (0).

The procedures highlighted above are necessary for the estimation of at least one cointegrating vector between the dependent variable, y_t, and the set of regressors, x_t. According to Pesaran et al., (2001), a major assumption is that the intercepts are unrestricted and that there are no trends. Hence, assuming a long-run relationship exists between M, GDP, INF, EX and PR and imposing the restrictions $\lambda_{YY} = 0$, $\mu \neq 0$ and $\alpha = 0$, the Unrestricted Error Correction Model (UECM) can be specified as:

$$\Delta(\boldsymbol{M})_t = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}(\boldsymbol{M})_{t-1} + \boldsymbol{\beta_2}\boldsymbol{PR}_{t-1} + \boldsymbol{\beta_3}\boldsymbol{GDP}_{t-1} + \boldsymbol{\beta_4}\boldsymbol{INF}_{t-1} + \boldsymbol{\beta_5}\boldsymbol{EXC}_{t-1} + \sum_{i=1}^{p} \boldsymbol{\beta_6}\, \Delta(\boldsymbol{GDP})_{t-1} + \sum_{i=1}^{q} \boldsymbol{\beta_7}\, \Delta(\boldsymbol{M})_{t-1} + \sum_{i=1}^{r} \boldsymbol{\beta_8}\, \Delta(\boldsymbol{INF})_{t-1} + \sum_{i=1}^{s} \boldsymbol{\beta_9}\, \Delta(\boldsymbol{EXC})_{t-1} + \boldsymbol{\varepsilon_t} \quad \text{---------- (3)}$$

Where:

- M is the log of nominal money supply from 1979-2014,
- GDP is the log of nominal income from 1979-2014,
- PR is a binary variable that represents periods of inflation targeting and non-targeting regimes from 1979-2014,
- EXC is the log of the US Dollar exchange rate from 1979-2014,
- INF is the log of the consumer price index (inflation) from 1979-2014,
- β (0-9) are parameters to be estimated.
- ε is an error term.

The equation (3) above shows that real money supply is explained by its past values. The optimal lag length criterion is determined by the minimum of the Akaike Information Criteria (AIC) or the Schwartz Information Criteria (SIC).

In order to determine if a unique long run relationship exists between money supply, income, inflation rates, exchange rates and the policy regime (inflation targeting), the equation (3) is first estimated by the OLS technique. Once coefficients of the lagged level variables are restricted to zero in a null hypothesis, the long run relationship can be traced by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables. The following hypotheses are tested:

$H_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ (There exists no long-run relationship)

$H_1 = \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$ (there exists a long-run relationship between real money supply and its lagged level regressors)

The Wald test produces the computed F-statistic that is compared to critical values produced by Pesaran et al., (2001), where the lower bound values imply the regressors are integrated of order zero and the upper bound values imply that the regressors are integrated of order one.

From the Wald test, if the computed F-statistic is less than the lower bound critical value, the null hypothesis cannot be rejected and hence there will be no evidence of cointegration between the variables. Alternatively, if the computed F-statistic is greater than the upper bound critical value, there will be enough evidence to reject the null hypothesis and suggest that there exists a long-run equilibrium relationship between the variables considered. The test fails to conclude once the computed F-statistic falls in between the lower and upper bound critical values.

The next step after establishing the existence of cointegration was to estimate the long-term relationship represented below

$$\Delta(M)_t = \gamma_0 + \beta_0 PR_{t-1} + \sum_{i=1}^{p} \gamma_1 \Delta(GDP)_{t-1} + \sum_{i=1}^{q} \gamma_2 \Delta(M)_{t-1} + \sum_{i=1}^{r} \gamma_3 \Delta(INF)_{t-1} + \sum_{i=1}^{s} \gamma_4 \Delta(EXC)_{t-1} + \boldsymbol{\beta_1 (M)_{t-1}} + \boldsymbol{\beta_2 PR_{t-1}} + \boldsymbol{\beta_3 GDP_{t-1}} + \boldsymbol{\beta_4 INF_{t-1}} + \boldsymbol{\beta_5 EXC_{t-1}} + \varepsilon_t \quad \text{---------- (4)}$$

General- to-Specific modeling technique of Hendry and Ericsson (1991) was used in selecting the final long run model from equation (4). The procedure involves eliminating the lagged terms with the highest insignificant parameters until the model has only significant variables remaining, a high adjusted R-squared, significant estimates with

correct signs according to theory and is devoid of problems relating to autocorrelation, Heteroskedasticity or misspecification (Gomez et al., 2012).

Following this, the short-run coefficients were obtained by estimating an error correction model associated with the long run estimates. This is specified in equation (5):

$$\Delta(M)_t = \gamma_0 + \sum_{i=1}^{p} \gamma_1 \Delta(GDP)_{t-1} + \sum_{i=1}^{q} \gamma_2 \Delta(M)_{t-1} + \sum_{i=1}^{r} \gamma_3 \Delta(INF)_{t-1} + \sum_{i=1}^{s} \gamma_4 \Delta(EXC)_{t-1} + \boldsymbol{\beta_1}(\boldsymbol{M})_{\boldsymbol{t-1}} + \boldsymbol{\beta_2 PR_{t-1}} + \boldsymbol{\beta_3 GDP_{t-1}} + \boldsymbol{\beta_4 INF_{t-1}} + \boldsymbol{\beta_5 EXC_{t-1}} + \lambda_t E_{t-1} + \varepsilon_t \quad \text{---------- (5)}$$

Where,

- E_{t-1} is the error correction term lagged by one period
- λ_t is the speed of adjustment.

The coefficient of the error correction term measures the speed of adjustment back to equilibrium in the event of shocks to the system.

In order to test the stability of the long run money demand function, the study uses the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests developed by Brown, Durbin and Evans (1975). The CUSUM test statistic is the sum of recursive residuals normalized by the standard errors of the residuals whiles the CUSUMSQ statistics is the sum of squared residuals normalized by the residual sum of squared errors for the sample period of the study. The critical values for the CUSUM and CUSUMSQ test are given by Harvey (1981). Statistics from both tests are plotted against the critical values at 5 percent significance level. According to Bahmani-Oskoee and Wing (2002), once the plot of test statistics remained within the critical bounds of the 5 percent

significance level, the null hypothesis (i.e that all coefficients of the estimated error correction model are stable) cannot be rejected. This method was employed because it has been widely used to test the stability of the money demand functions for countries including Ghana.

Following this, the study employs the Toda and Yamamoto (1995) causality testing approach instead of the traditional Granger Causality test for testing causality. The objective of the test is to determine directional causality between money supply growth, income growth, inflation, the policy regime (inflation targeting) and exchange rates,. Despite the very simple nature of the Granger causality test, it remains a test of predictive ability based on the significance of a variable in a regression in order to be termed as 'granger causing'.

Another demerit of the Granger causality test is that it is based on asymptotic theory and critical values are only effective for stationary variables that are not cointegrated (Granger, 1988). This highlights a weakness of test results because causality is determined on the absence of a long-run relationship between the variables of interest. For cointegrated systems, the existence of unit roots gives various complications in statistical analysis especially with the risk of concluding wrongly about causality due to the incorrect identification of the order of integration of the series or number of cointegration vectors among the variables.

More so, the Granger causality test works best on the assumption of stationarity. Alternatively, the variables must be of the same order of integration even if they are not stationary. However, once there is no evidence of stationarity or cointegration, the test

may not be appropriate and differencing may be required (Granger, 1969). Once differenced, the underlying long-run relationship between the variables is lost (Darat, 1998).

The Toda and Yamamoto (1995) causality approach can be applied irrespective of the presence or absence of cointegration or stationarity. Essentially the method involves the estimation of an augmented VAR (*k+dmax*) model. The Granger no-causality test works with a Modified Wald test that places zero restrictions on the parameters of the original VAR (*k*) model. The rest of the *dmax* autoregressive parameters are considered as zeros and disregarded in the VAR (*k+dmax*) model. The test uses an asymptotic χ^2 distribution when the augmented VAR (*k+dmax*) is estimated (Oteng and Frimpong, 2006)

From equation (1), the causality between money supply, output growth, the dollar exchange rates, inflation and the policy regime can be tested using the following VARs:

$$M_t = \alpha_0 + \sum_{i=1}^{k+d_{max}} \lambda_1 M_{t-i} + \sum_{i=1}^{k+d_{max}} \gamma_0 PR_{t-i} + \sum_{i=1}^{k+d_{max}} \lambda_2 GDP_{t-i} + \sum_{i=1}^{k+d_{max}} \lambda_3 INF_{t-i} + \sum_{i=1}^{k+d_{max}} \lambda_4 EXC_{t-i} + \varepsilon_t \quad \text{---------- (6)}$$

$$GDP_t = \alpha_0 + \sum_{i=1}^{k+d_{max}} \lambda_1 M_{t-i} + \sum_{i=1}^{k+d_{max}} \gamma_0 PR_{t-i} + \sum_{i=1}^{k+d_{max}} \lambda_2 GDP_{t-i} + \sum_{i=1}^{k+d_{max}} \lambda_3 INF_{t-i} + \sum_{i=1}^{k+d_{max}} \lambda_4 EXC_{t-i} + \varepsilon_t \quad \text{---------- (7)}$$

$$INF_t = \alpha_0 + \sum_{i=1}^{k+d_{max}} \lambda_1 M_{t-i} + \sum_{i=1}^{k+d_{max}} \gamma_0 PR_{t-i} + \sum_{i=1}^{k+d_{max}} \lambda_2 GDP_{t-i} + \sum_{i=1}^{k+d_{max}} \lambda_3 INF_{t-i} + \sum_{i=1}^{k+d_{max}} \lambda_4 EXC_{t-i} + \varepsilon_t \quad \text{---------- (8)}$$

$$EX_t = \alpha_0 + \sum_{i=1}^{k+d_{max}} \lambda_1 M_{t-i} + \sum_{i=1}^{k+d_{max}} \gamma_0 PR_{t-i} + \sum_{i=1}^{k+d_{max}} \lambda_2 GDP_{t-i} + \sum_{i=1}^{k+d_{max}} \lambda_3 INF_{t-i} + \sum_{i=1}^{k+d_{max}} \lambda_4 EXC_{t-i} + \varepsilon_t \quad \text{---------- (9)}$$

Where,

- k is the optimal lag length in the original VAR system,
- dmax is the maximal order of integration of the variables in the VAR system
- M is the log of money supply
- EXC is the log of the US dollar exchange rates
- INFT is the log of consumer price index (inflation)
- GDP is the log of nominal income
- PR is the policy regime
- α, λ, γ are parameters to be determined.

The Wald Test is used in testing the null hypotheses for each of the equations listed above (6-9). From equation (6), the null hypothesis that the current policy regime, income, inflation and the exchange rates cause money supply is

$$H_0 = \gamma_0 = \lambda_2 = \lambda_3 = \lambda_4 = 0$$

Also, from equation (7), the null hypothesis that the current policy regime, money supply, inflation and the exchange rates cause real income is

$$H_0 = \lambda_1 = \gamma_0 = \lambda_3 = \lambda_4 = 0$$

From equation (8), the null hypothesis that the current policy regime, income, money supply growth and the exchange rates cause inflation is

$$H_0 = \lambda_1 = \gamma_0 = \lambda_2 = \lambda_4 = 0$$

Finally, from equation (9), the null hypothesis that the current policy regime, income, inflation and money supply growth cause exchange rates is

$$H_0 = \lambda_1 = \gamma_0 = \lambda_2 = \lambda_3 = 0$$

4.3 Stationary Tests

Kwablah et al. (2014) explained the relevance of unit root tests in time series analysis. They mentioned that unit root tests were important because as an implication to estimation using the Ordinary Least Squares (OLS) approach, the variables to be included were assumed to have a constant mean and variance, which were not expected to change over time. Therefore, if a variable was found not to have unit roots, the series would have to be differenced in order to establish the existence of unit roots and hence prove stationarity; constant mean and variance over time. After unit roots had been established, estimations using such data would not be spurious. The study employed the Augmented Dickey Fuller (ADF) Unit Root Test and the Phillips-Perron (PP) Unit Root Test.

The ADF test employs the following model to check for unit root in variables:

$$\Delta y_t = \beta_0 + \beta_1 t + \delta y_{t-1} + \alpha_t \sum_{i=1}^{m} \Delta y_{t-1} + \varepsilon_t \quad \text{---------- (10)}$$

Where,

- Y_t is the variable in question
- t is a time trend
- Δ is the difference operator.
- ε_t is a white noise process.

From equation (10), the null hypothesis of stationarity is expressed as:

$H_0: \delta = 0$ (y_t is non-stationary)

$H_1: \delta < 0$ (y_t is stationary)

The ADF test uses the τ-statistic instead of the t-statistic. Once the calculated τ-statistic is less than the critical values provided by MacKinnon (1996), the null hypothesis cannot be accepted and the alternative hypothesis of stationarity is accepted. The study also employed the Phillips-Perron (PP) test as a confirmation to the results of the ADF test. Perron (1989) showed that the ADF test could not reject the null hypothesis of non-stationarity in the event that the true data generating process was stationary around a trend function, subject to exogenous shocks. However, the PP test involves comparing a PP test statistic with critical values also provided by MacKinnon (1996). The test employs a correction factor that calculates the variance of the error process using the Newey-West formula (Andinuur, 2013).

4.4. Lag Length Determination Tests

Hundie (2014) mentioned that the lag length of any system must be selected using one of the standard information criteria. As a result, models that have large number of lags tend to result in residuals that seem to approach a white noise process but may not be parsimonious Conversely, models with shorter lag lengths are likely to be parsimonious but do not produce residuals that have enough stochastic properties for a white noise process. With the help of information criteria, lag length determination is possible. The study used the Akaike Information Criteria (AIC) and the Schwartz Information Criteria (SIC), among others, to determine the optimal lag length of the models tested.

4.5 Estimation Methods

From the UECM specified earlier, once a cointegration relationship is determined, the long-run relationship can be further obtained by OLS. In addition, the causality between nominal money supply, nominal income, inflation, the exchange rates and the current policy regime were determined by estimating level VARs using the Seemingly Unrelated Regression (SUR) method. After estimation, a Wald test (restricted F-test) can be used to determine the rejection or otherwise of the null hypothesis of no causality of appropriate variables.

4.6 Data

Secondary data was used in this study. Annual observations of broad money supply growth (M), inflation (INF), income growth (GDP), the Dollar exchange rate (EXC) and the monetary policy regime (PR) over the study period 1979-2014 are used in the study. Data was obtained from the World Development Indicators (2014), Bank of Ghana (BOG) Official Website and Inflation bulletins of the Ghana Statistical Service.

4.6.1 Description and Measurement of Variables

The variables used in the study are described in this section. In addition, the measurement of each variable is discussed.

4.6.1.1 The Demand for Money (M)

Taking note of money market equilibrium where demand for money and supply of money are assumed to be equal, the demand for money is measured as the log of the Broad money (M2), in millions of local currency. From the literature, Awad (2010), Omotor and Omotor (2010), Kovanen (2011), Mansaray and Swaray (2013) and Owen (2015) used

broad money as a dependent variable. The demand for broad money is used interchangeably with money supply and the measure, which is nominal money supply growth, is expected to have a positive relationship with nominal income, a positive relationship with inflation and a negative one with exchange rates.

4.6.1.2 GDP Growth (GDP)

Nominal income growth is measured as the log of the total monetary value of national income (GDP). From the literature, Waliullah and Rabbi (2011) and Nduka and Chukwu (2013) find a positive relationship between income growth and money supply. Nominal income growth is expected to have a positive relationship with money supply, a negative one with inflation and a negative relationship with exchange rates.

4.6.1.3 Exchange Rate (EXC)

Exchange rate appreciation or depreciation is measured as the log of the quantity of US Dollar units that are equivalent to one unit of local currency. From the literature, Aiyedogbon et al. (2013) and Awad (2010) found a positive relationship between exchange rates and money demand. Exchange rate is expected to have a positive relationship with money supply, nominal income and inflation.

4.6.1.4 Inflation (INF)

Inflation is measured as the annual percentage change in the consumer price index. From the literature, Okonkwo, Ajudua, and Alozie (2014) found a negative relationship between inflation and money supply. Nyong (2014), however, found a positive relationship between inflation and money supply. Inflation is expected to have a positive

relationship with money supply, a positive relationship with exchange rates and a negative relationship with income.

4.6.1.5 Policy Regime (PR)

The monetary policy regime is measured as a binary variable that represents both inflation targeting and non-targeting regimes over the study period. The policy regime variable is expected to have a positive relationship with money supply, income and a negative relationship with inflation and exchange rates.

Table 4.0 Summary of Description of Variables

Variable	Description	Measurement	Prior Expectation
GDP	GDP Growth	Log of the total monetary value of good and serviced produced over time	+
EXC	Exchange Rate	Log of the US dollar Exchange Rate	+
INF	Inflation	Annual Percentage Change in Consumer Price Index	+
M	Demand for Broad Money	Log of the Broad Money Supply, in millions of GHS	+/-
PR	Policy Regime	Binary Variable showing periods of inflation targeting (1) and periods of Non-Inflation targeting (0)	+/-

Source: Author's Own.

4.7 Conclusion

This chapter discussed the theoretical basis of the study and subsequently developed a model, which will be later estimated. The methodology used in estimating the results and the diagnostic tests conducted are all clearly explained. Two econometric techniques; Bounds Testing Approach to Cointegration, the Toda and Yamamoto Causality technique are identified in estimating the long run money demand function and examining the causality between money demand and inflation targeting in Ghana. The recursive residual test is used in determining the stability of the long-run money demand function. All the variables used in the study are well explained as well as their prior expectations.

CHAPTER FIVE

RESULTS AND DISCUSSION

5.0 Introduction

In the previous chapters, two econometric models- ARDL and multivariate VAR were identified to aid in examining the long-term association and causality between the demand for money and the inflation-targeting regime. In addition, two econometric techniques – the cointegration approach by Pesaran et al., (2001) and the causality testing procedure by Toda and Yamamoto (1995) were suggested as estimation techniques that would yield favorable results, in light of the challenges with time series data. Also, the stability of the demand for money function was determined by using the recursive residual test developed by Brown, Durbin and Evans (1975).

This chapter presents the results using data covering money supply, inflation, exchange rates, inflation targeting and GDP growth for Ghana (1979-2014). The chapter is structured in five sections. The first two sections present descriptive statistics and results of unit root tests respectively. The third section discuss the results from the Bounds Test of Cointegration while the fourth presents the findings from stability tests and the Toda-Yamamoto test for causality. The fifth section concludes this chapter.

5.1 Descriptive Statistics

Table 5.1 Summary Statistics of the Variables, 1979-2014

	EXC	GDP	INF	M	PR
Mean	-1.074654	4.494	29.286	36.765	0.389
Median	-0.736701	4.82	23.45	39.15	0
Maximum	0.290035	15	123	56.5	1
Minimum	-3.560667	-6.92	8.73	13.3	0
Std. Dev.	1.2422	3.993	26.119	12.762	0.494
Skewness	-0.805019	-0.741	2.401	-0.125	0.456
Kurtosis	2.477824	5.088	8.796	1.846	1.208
Jarque-Bera	4.297336	9.836	84.9731	2.09	6.065
Probability	0.116639	0.007	0.000	0.352	0.048
Sum	-38.68754	161.776	1054.299	1323.536	14
Sum Sq. Dev.	54.0071	558.136	23877.92	5700.688	8.556
Observations	36	36	36	36	36

Source: Author's computation from WDI, 2014

Over the time period considered in the study, GDP growth was at an average of 4.5%. This figure is considered moderate for a developing country. Inflation also was at an average of 29.3% over the period of the study, which still remained high for Ghana, given the current focus of monetary policy on low and stable price levels.

Money supply growth on average was 36.8% while the period average of the dollar exchange rate over the study period had depreciated by 1.07%.

The growth rate for Ghana over the study period was at a maximum of 15% whiles the minimum was -6.92%. For inflation, the maximum rate over the period was 123% whiles the minimum rate was 8.73%. Also, the maximum rate of money supply was 56.5% whiles the minimum was 13.3%. In addition, the maximum appreciation of the dollar exchange rate was 0.29% whiles the maximum depreciation was 3.56% over the study period.

Furthermore, the skewness of GDP growth of -0.741 implied that GDP growth for Ghana over the period was mostly low instead of high. Also, inflation was positively skewed, with a skewness of 2.401 implying that high levels of inflation prevailed for many years. The dollar exchange rate had a skewness of -0.805 and implied that the depreciation of the cedi was mostly prevalent over the study period. Lastly, the skewness of the policy regime was positive.

The Jargue- Bera for GDP growth, inflation, broad money supply growth and the policy regime showed that the data was not normally distributed whiles in the case of the dollar exchange rate, the Jargue-Bera failed to reject the null hypothesis of normality and implied that the data on dollar exchange rates was not normally distributed.

5.2 Unit Root Tests

Stationarity characteristics of the all variables used in the study, except the policy regime, were tested. The study employed the Augmented Dickey Fuller (ADF) Unit Root Test and the Phillips-Perron (PP) Unit Root Test. The results are presented in Table 5.2 below.

Table 5.2 Tests for Unit Root in the Variables at their Log Levels

	ADF		PP	
Variable	t-statistic	p-value	Adj. t-statistic	p-value
EXC	-2.863702	0.0603	-3.07562	0.0378
GDP	-2.917636	0.0534	-2.700248	0.0841
INF	-2.281135	0.1835	-4.653258	0.0007
M	-4.834101	0.0004	-4.834101	0.0004

Source: Estimated from Eviews 8

Both tests were conducted in order to ensure that the variables used corresponded to the right models. In addition, both tests provided verification of findings and ensured the results were robust. More so, both unit root tests were conducted to satisfy the pre-conditions for the econometric techniques adopted for the study. The variables were tested in their log levels. Both the ADF and PP tests rejected the existence of unit roots in the variables in their log levels since majority of the probabilities were less than 10%. However, the exception was with inflation that failed to reject evidence of unit roots in the ADF test.

The desirable implication of the results was that the variables would be stationary. Stationary variables provide great use in economics and statistical analysis. Stationary variables are especially useful in forecasting because most stationary variables have

strong evidence of moving together in the long-term. It is important to establish such relationships in macroeconomic analysis because the absence of stationarity leads to spurious regressions or relationships. In order to ascertain or certify the stationarity of the variables used, the variables are differenced. The variables were tested in their first differences to see whether they had unit roots, using both ADF and PP tests. The results of these tests are shown in Table 5.3

Table 5.3 Tests for Unit Root in the Variables at their Log Difference

	ADF		PP	
Variable	t-statistic	p-value	Adj. t-statistic	p-value
EXC	-3.169812**	0.0308	-3.169812**	0.0308
GDP	-6.620112**	0.0000	-17.32833**	0.0001
INF	-12.24496**	0.0000	-20.13149**	0.0001
M	-7.322227**	0.0000	-16.52788**	0.0000

Source: Estimated using Eviews 8
*MacKinnon (1996) one-sided p-values **implies rejection of the null hypothesis at 5% level of significance

The results in the table above showed that the logs of GDP, exchange rates, inflation and broad money supply did not have unit roots at their first differences since all the probabilities were less than 5%. Hence, all the variables proved to be stationary in their first differences. This meant that once these variables were used in a regression, the outcomes would not be spurious. In other words, the variables are integrated of order one- they are I (1) processes.

From the findings above, the precondition for the cointegration test by Pesaran et al. (2001) is satisfied for the first difference of the logs of GDP, dollar exchange rates, inflation and money supply as independent variables. In addition, all variables satisfied the Toda and Yamamoto causality testing procedure because no variable was integrated of the second order or more. Hence the first differences of the logs of GDP, dollar exchange rates, inflation and broad money supply are used in estimation.

5.3 Tests for Cointegration

The first difference of the logs of the variables of GDP, dollar exchange rates, inflation, and broad money supply as well as the inflation-targeting variable, were used for the cointegration test. The test was conducted to determine if there was any evidence of a long-term relationship between the variables considered. The results of the bounds test are presented in Table 5.4.

Table 5.4: Bounds Test for Cointegration

		5%		10%	
Dependent Variable	F-statistic	I(0)	I(1)	I(0)	I(1)
D(M)	7.3967**	3.03	4.06	3.47	4.57

**implies rejection of the null hypothesis of no cointegration at 5% and 10% levels of significance respectively.

The results in the table above showed that the F-statistic was greater than the upper bound critical values at 5% and 10% respectively. This meant that the null hypothesis of no cointegration was rejected. Based on the results above, there is cointegration between the log of GDP, dollar exchange rates, inflation, broad money supply and the inflation-

targeting variable in Ghana. The results also implied that the variable D(M), which is also demand for broad money under money market equilibrium, converged to long run equilibrium once there were deviations in the short run. The results obtained in the table above are in line with the work of Aiyedogbon et al. (2013) who also found evidence of cointegration between demand for money, inflation rate, exchange rate for the Nigerian economy, with the added variables such as the openness of the economy, government expenditure, interest rates and gross capital formation. In addition, the evidence of cointegration is also similar to the findings of Waliullah and Rabbi (2011), who found evidence of cointegration between demand for money, inflation and GDP in Pakistan. Also for the Gambia, the evidence of cointegration in this study are in line with the results of Nyong (2014), who also finds cointegration between demand for money, income, inflation, interest and exchange rates in the Gambia.

On the premise of cointegration, the long run and short run relationships were estimated using the equations 4 to 9, which were specified earlier in chapter four. The results are shown in the table below. By using a least squares approach (OLS), the estimates for the long run were obtained. The least squares approach was beneficial in that it provided estimates that have the least variance and remain consistent. After estimating the long-run coefficients, the short-run coefficients were also estimated using a least squares approach, taking in consideration the lagged residual term, which was the measure of the speed of adjustment to equilibrium.

Table 5.5 Estimated long-run coefficients

	D(M)	
Variable	Coefficient	Probability
GDP	-1.684107	0.1087
EXC	-4.584678	0.2355
INF	-0.502993	0.0123**
M2	-1.019419	0.0000**
PR	-3.847975	0.5291
D (GDP)	1.439241	0.1075
D (EXC)	38.14523	0.046**
D (INF)	0.25603	0.025**

Source: Estimated using Eviews 8
** means significant at 5% and 10% confidence levels

In the table above, the results show the inflation has a negative and statistically significant effect on demand for broad money in Ghana. From the results in Table 5.5, a 1% increase in inflation leads to a 0.5% decrease in the demand for broad money or the growth of broad money supply in Ghana in the long run. Also in the long run, the results showed that past growth rates of money supply had a negative influence on current money supply growth. This meant that a 1% increase in money supply growth in early time periods reduced current growth of money supply by 1.02% in the long run, keeping all other influences constant. In addition, the results suggest that the inflation-targeting regime has a negative impact (3.848) on money supply growth in the long run although this is not significant. This finding is in line with the work of Awad (2010), who found a negative relationship between inflation and demand for money in Egypt in the long run and a positive relationship between the exchange rate and demand for money in Egypt. In addition, this finding is consistent with evidence by Nduka (2014) on money demand for

Nigeria, which finds a negative relationship between inflation rates and the demand for money and a positive relationship between exchange rates and demand for money in the long run.

In the short run however, the dollar exchange rate was found to have a positive and significant effect on demand for money or money supply growth in Ghana. From the results above, a 1% increase in the dollar exchange rate will cause an increase in money supply growth by 38.145%, keeping all other influences constant. Also, inflation was also found to have a positive and significant effect on money supply growth in Ghana in the short-run. Table 5.5 reveals that a 1% increase in inflation leads to a 0.26% increase in money supply growth in Ghana.

Table 5.5.1 Error Correction Model

	D (M)	
Variable	Coefficient	Probability
D (PR)	14.054	0.254*
D (GDP)	1.260	0.146*
D (EXC)	16.591	0.434*
D (INF)	0.193	0.076**
ECM (-1)	-0.849	0.035**

Source: Estimated using Eviews 8
*means not significant at 10% confidence level

** means significant at 5% and 10% confidence levels respectively

The results show that inflation has a positive and significant effect on the demand for broad money balances in Ghana. The results mean that a 1% increase in inflation leads to 0.193% increase in money supply growth in Ghana. The log of the period average dollar exchange rates had a positive effect on the demand for broad money, although not significant. This meant that a 1% increase in the dollar exchange rates would increase money supply growth in Ghana by 16.59%. In addition GDP growth and the policy regime (inflation targeting) had positive effects on the demand for broad money in Ghana, although this was not significant. The results shown in the table above conflict partially with the work of Mutsau (2013) who found a positive relationship between exchange rates and demand for money (M2) in South Africa and also found a negative relationship between inflation and the demand for money (M2) in South Africa. This finding is intuitive for Ghana and supports the fact that Ghana still has some more work to do to have a cashless economy[13]. In addition, with high interest rates on credit, people will still demand money to fulfill primary functions such as transactions, speculations or even for precautions.

The long run aspect of the model is determined by the lagged error correction term, ECM(-1). The results in the table showed that the ECM (-1) is correctly signed and significant. This meant that the variables D(PR), D(GDP), D(EXC) and D(INF) are truly causally related with the dependent variable D(M). The significance of ECM (-1) meant that holding all other influences constant, once the actual value of D (M) fell below the value consistent with its long-term equilibrium relationship, changes in D (PR), D (GDP), D (EXC) and D (INF) help bring it back to the long-run equilibrium value. The value of

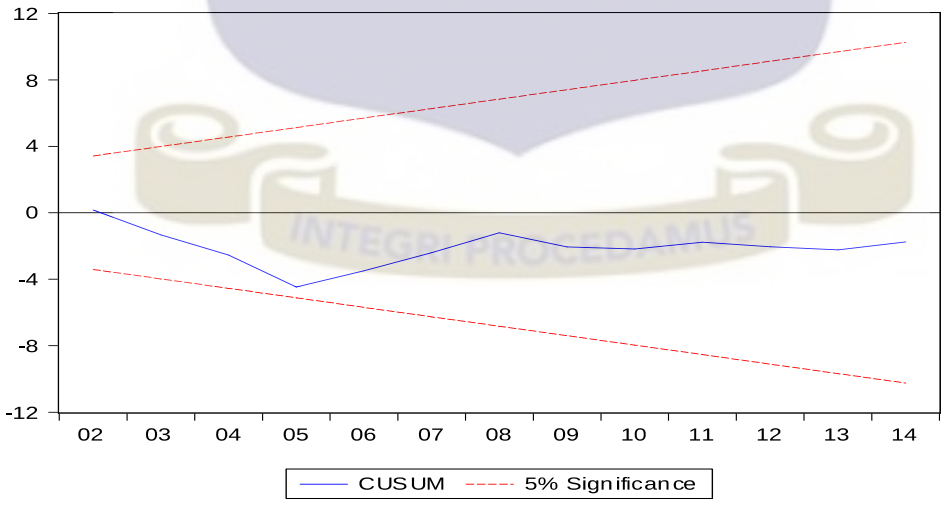
[13] See Online Article on Bank of Ghana advocacy for a cashless economy. Online Resource available at http://pulse.com.gh/finance/cashless-economy-bog-advocates-for-cashless-economy-id4681938.html

the coefficient indicates the speed of adjustment to equilibrium. From the results obtained, the speed of adjustment is about 84.9%. With evidence of such a high speed of adjustment, the significance of the error term confirms the existence of a stable long-run relationship. The results are in line with the work of Dagher and Kovanen (2011) and Osei (2015), who also found negatively signed error terms in their error correction models estimated after the determination of long-run relationships between demand for money and its regressors.

5.4 Stability Tests

In order to fully ascertain the stability of the long-run money demand function, the CUSUM and CUSUMSQ tests were conducted. The results obtained showed that the demand for broad money had remained largely stable, especially over the period of inflation targeting. The figures below show the results of the tests conducted.

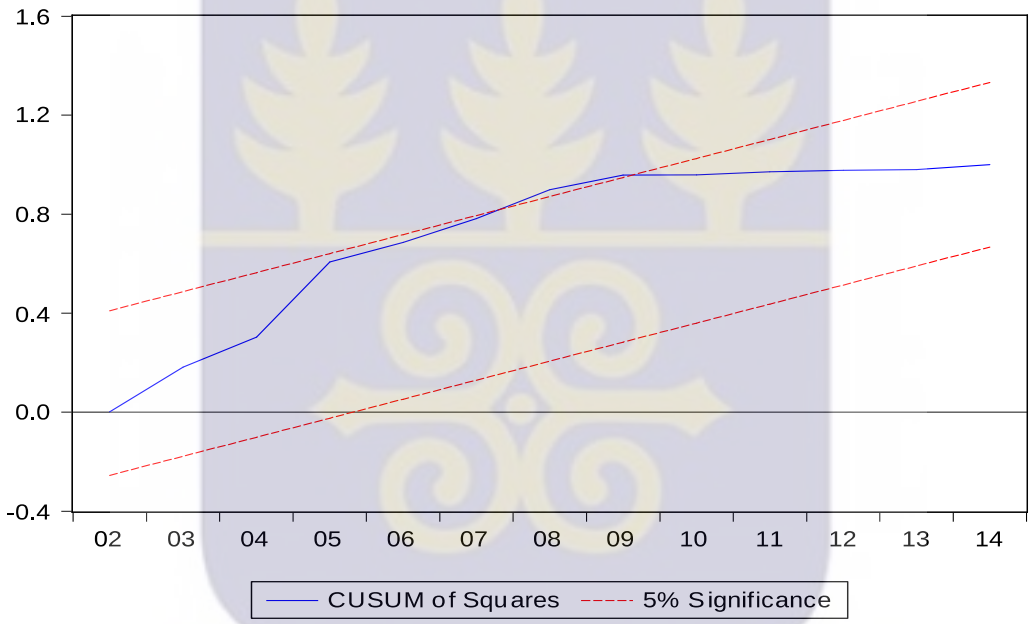
Figure 5.0 Plot of Cumulative Sum of Recursive Residuals (CUSUM)



Source: Estimated using Eviews 8

From the figure above, the dotted red lines indicate the critical bounds. The figure above shows that the residuals of long-run demand for broad money function are relatively stable. This is especially the case over the period where inflation targeting is the policy regime practiced. The results imply that the null hypothesis of no stability of the long run money demand function can be rejected at 5% significance level.

Figure 5.1 Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ)



Source: Estimated using Eviews 8

From the figure above, the dotted red lines also represented the critical bounds. The figure also shows that the sum of squares of the recursive residuals of the demand for broad money function is mostly stable. Most especially for the period of inflation targeting, the demand for broad money has remained within the critical bounds. The results imply that the null hypothesis of no stability of the long run money demand function can be rejected at 5% significance level.

The results are in line with the work of Dagher and Kovanen (2011) and Osei (2015) who found a stable long-run money demand function for Ghana. The results however contradict the work of Hussein et al (2012) who found an unstable long-run money demand function for South Africa. In addition, the results also contradict the work of Nyong (2014), who found an unstable money demand function for the Gambia.

5.5 Tests for Causality

Testing for Causality was the next step after establishing the stability of the long run money demand function. The analysis was to test the existence of causality between money supply growth, the dollar exchange rates, inflation, income growth and the inflation-targeting regime using the Toda and Yamamoto (1995) procedure. The test involves the addition of extra lags (*dmax*) determined by the order of integration of the series, to the optimal lag length (K) to correctly specify level VARs. The importance of this element of the procedure is to control for potential cointegration. With the appropriate lags, equations 6 to 9 in chapter four are re-specified to individually reflect the level link between the variables in a parsimonious way. The equations were estimated by using a seemingly unrelated regression technique.

As shown in Table 5.3, all the variables are integrated of order one. This means that all the variables became stationary after they were differenced once. Hence the value of *dmax* is one.

Furthermore, the Final Prediction Error (FPE), Akaike Information Criterion (AIC) and the Hannan-Quinn Criterion (HQ) chose an optimal lag of three to be included in the

Seemingly Unrelated Regression (SUR) Model. This meant that *k* was set at three lags. The choice of the optimal lag to be included in shown in the table below. The study employed four lags in the SUR estimation.

Table 5.6 Lag Selection Procedure

Lag	LogL	LR	FPE	AIC	SIC	HQ
0	-296.0936	NA	499.6516	20.38085	21.75498	20.83633
1	-234.2868	81.12143*	56.65195	18.08042	20.59966*	18.91548
2	-212.126	22.16074	95.73205	18.25788	21.92222	19.4725
3	-161.0151	35.13875	41.93175*	16.62595*	21.43539	18.22014*

Note: *indicated lag order selected by criterion

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

Finally, the study conducted coefficient restriction tests of the SUR model. The use of the Modified Wald (MWald) test for the Granger non-causality has been theoretically analyzed and shown to be efficient with the use of the Seemingly Unrelated technique (Rambaldi and Doran, 1996). The results of the Toda and Yamamoto causality test are presented in Table 5.7.

Table 5.7 Results of the Toda and Yamamoto Causality Test

Null Hypothesis	MWald Statistic	p-value
EXC, INF, GDP and PR cause M	32.1381**	0.0013
EXC, INF, PR, M cause GDP	17.552	0.13
EXC, PR, M, GDP cause INF	22.715**	0.0302
PR, GDP,INF, M cause EXC	5.091	0.9549

Note: ** means the null hypothesis is rejected at 5% level of significance.

With respect to the money supply equation, the null hypothesis that the coefficients on the first to third lags of the dollar exchange rates, inflation, GDP growth and inflation targeting are jointly different from zero was rejected at 5% significance level. This meant that there existed causality from dollar exchange rates, inflation, GDP growth and the inflation targeting policy regime to money supply growth.

The null hypothesis that the coefficients of the first to third lags of the dollar exchange rates, inflation, money supply growth and inflation targeting are jointly zero was not rejected at 5% level of significance. This meant that there was no causality from the dollar exchange rates, inflation, inflation targeting and money supply growth to GDP growth. Also, the null hypothesis that the coefficients of the first to third lags of the dollar exchange rates, inflation targeting, money supply growth and GDP growth are jointly zero was rejected at the 5% level of significance. This meant that there was causality from the dollar exchange rates, inflation targeting, GDP growth and money supply growth to inflation.

Lastly, the null hypothesis that the coefficients of the first to third lags of the GDP growth, inflation, money supply growth and inflation targeting are jointly zero was not rejected at the 5% level of significance. This meant that there was no casual link from GDP growth, inflation, money supply growth and inflation targeting to the dollar exchange rates.

Previous studies did not consider causality testing in their analysis. Compared to the works of Dagher and Kovanen (2011), Nduka (2014) and Osei (2015), the study makes a significant contribution to the literature by including a causality analysis.

5.6 Conclusion

The chapter presented the results from estimating the long-run demand for money function for Ghana, determining the stability of the long run function and the causality between the demand for broad money and the inflation-targeting regime of the country. The ADF and PP unit roots procedures were used to establish the stationary properties of the variables. Both ADF and PP tests established the existence of the stationary characteristics of the variables after first differencing. This meant that the variables were found to be stationary, implying that they were integrated of order one. The ARDL model was estimated to determine the long run relationships after the Bounds test provided evidence of cointegration. The study found that the variables were cointegrated. This meant that the variables moved together in the long run.

The results of the CUSUM and CUSUMSQ tests also showed that the long run money demand function was largely stable, and converged to equilibrium in the event of disturbances, following the results of the error correction model estimated. The study concluded by examining the direction of causality between the variables used in the study. The findings were that there existed unidirectional causality between the dollar exchange rates, inflation, GDP growth and the inflation targeting regime and money supply and unidirectional causality between the dollar exchange rates, money supply growth, the inflation targeting regime and GDP growth and inflation.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

This chapter presents a general summary and conclusion for the study, as well as policy implications of the study.

6.1 Summary of the Study

Monetary policy, in earlier times, failed to keep inflation in line. Money supply growth was mostly above 20%, around the 1980s, due to excessive government spending. With the help of programs of economic recovery and structural adjustment, monetary policies changed to better achieve macroeconomic targets, especially low and stable price levels. With the adoption of the inflation-targeting regime in 2007, the economy initially benefitted from low and stable prices (between 8% and 10%). The economy grew to a maximum of 15%, with inflation expectations well anchored and some additional revenue from the exploration of oil resources. This period of boom seemed short-lived and recent trends in inflation, dollar exchange rates and pressures from external commodity markets brought monetary policy conduction under pressure, despite calls for fiscal discipline. Following a recent program of extended credit by the IMF, monetary policy was referred back to monetary aggregated targeting, by the incorporation of quantative benchmarks, while pursuing usual practices of inflation targeting.

Following this, it was necessary to empirically estimate the money demand function for Ghana and determine whether the function was stable. This is because a stable money

demand function implies constancy of the velocity of money and suggests that the central bank can successfully use money supply to target inflation.

There have only been few studies on money demand for Ghana since 1998 and majority of studies on money demand in African countries are on Nigeria. However, most of the studies used cointegration approaches and made inferences on the need to continue or disregard the conduction of existing monetary policies. Specifically, the studies on Ghana failed to provide causality analysis as to how the elements of the money demand functions fared with existing monetary policy regimes. Hence, the study aimed to fill the gap in the literature by estimating the causality between the variables in the money demand function and the inflation-targeting regime.

The study therefore sought to estimate a long run demand for money function, determine the stability of the long run demand for money function and determine the causality between demand for broad money and the inflation-targeting regime for Ghana. The study used time series data over the period 1979 to 2014. In order to achieve dynamic econometric models, multi-variate VAR and ARDL models were specified.

Also, two econometric techniques – the cointegration approach by Pesaran et al. (2001) and the causality test by Toda and Yamamoto (1995) were employed in estimating the models. The Bounds test to cointegration revealed that all the variables – inflation, dollar exchange rates, GDP growth, money supply growth and the inflation targeting regime converged to long run equilibrium once there were deviations in the short run. While inflation and money supply were found to negatively impact demand for broad money in the long run, the dollar exchange rates and inflation were found to positively impact

demand for broad money in the short run. These relationships were statistically significant at 5%.

The error correction model estimated showed that the long-run money demand function converged to equilibrium in the event that there were shocks to the long-run system. The speed of convergence was 84.9% and was significant at 5% significance level. Following this, stability tests (CUSUM and CUSUMSQ) revealed that the recursive residuals of the long-run demand for money function was largely stable. The CUSUM and CUSUMSQ charts showed that the residuals of the long-run money demand function largely remained within the area of the critical bounds. The stability of the money demand function suggested that the velocity of the money was constant and the central bank could use money supply as an operational instrument to target inflation.

Lastly, the Toda and Yamamoto causality test found that there existed unidirectional causality between the dollar exchange rates, inflation, GDP growth and the inflation targeting regime and money supply and unidirectional causality between the dollar exchange rates, money supply growth, the inflation targeting regime and GDP growth and inflation.

6.2 Conclusions of the Study

The first and second objectives of the study were to estimate a long-run money demand function for Ghana and determine the stability of the function over the period 1979-2014. The results showed that money supply growth, inflation, dollar exchange rates, GDP growth and the inflation-targeting regime moved together in the long run. This meant that the variables were cointegrated. The results also showed that inflation and money supply

growth were significant predictors of demand for broad money balances in the long run. The short run components of the estimated demand function showed that dollar exchange rates and inflation had significant positive influences on demand for broad money. Furthermore, the results of the recursive residuals tests showed that the long run relationship was stable and converged back to equilibrium, with a speed of adjustment of 84.9%. The recursive residual charts further established the stability of the money demand function. Both the CUSUM and CUSUMSQ charts showed that the residuals of the money demand function largely remained within the critical bounds at 5% significance level. These findings meant that the velocity of money was constant and implied that the central bank could use money supply as an instrument to target inflation successfully.

The third objective was to examine the casual links between the demand for money and the inflation-targeting regime. The results showed that there existed unidirectional causality between the dollar exchange rates, inflation, GDP growth, the inflation targeting regime and money supply and unidirectional causality between the dollar exchange rates, money supply growth, the inflation targeting regime, GDP growth and inflation. Exchange rates, inflation, the policy regime and money supply were found not to cause GDP growth. Also, GDP growth, inflation, the policy regime and money supply growth were found not to cause dollar exchange rates.

6.3 Recommendations

Based on the above conclusions, the following policy recommendations are outlined:

First, the negative and significant effects of money supply growth and inflation in the long run money demand function present negative effects for Ghana's growth, if steps are not taken to ensure that these are controlled. Evidence of a long run relationship between money supply growth, inflation, GDP growth, dollar exchange rates and the inflation targeting regime speak well to the recommendations made for monetary policy in the recent IMF program and suggest that the new direction of targeting monetary aggregates in an inflation targeting regime is favorable. This is anchored on the evidence of the stability of the long-run money demand function. The stability of the function means that the velocity of money is constant and implies that the central bank can use money supply as an instrument to target inflation successfully. The recommendation is that the central bank must ensure the monetary aggregate targets are infused in the current regime. The enforcement of these quantitative benchmarks in the policy regime must be strong enough to ensure that monetary policy wins the fight against inflation and exchange rates in Ghana. This must be done noting that some disciplinary measures would be needed to reduce the risks of not ensuring that monetary targets are achieved to keep inflation under control. This may also mean getting the cooperation of fiscal policy actors to ensure that they are aware of these quantitative benchmarks and are well equipped to stay within these quantitative limits. This will ensure the successful performance of the inflation-targeting regime in Ghana and specifically, ensure that the regime is more resilient to control inflation and reduce the effects of the dollar exchange rate on the demand for money.

Secondly, the causality between dollar exchange rates, inflation, GDP growth and the targeting regime and money supply growth as well as those between money supply growth, GDP growth, dollar exchange rates, the targeting regime and inflation show the pressures that the economy stands to suffer. The causality speaks more for the use of money supply by the central bank. The causality means that abrupt changes in the dollar exchange rates, inflation, and GDP growth can cause changes in money supply through the demand for money channel whiles abrupt changes in money supply, GDP growth, the dollar exchange rates can cause changes in inflation. This suggests that the regulation of money supply and its use in controlling macroeconomic variables such as the dollar exchange rate and inflation should be handled well.

Future research in this area should analyze the effects of fiscal dominance on the demand for money in Ghana and the inflation-targeting regime in order to account for the estimated effects of indiscipline in public sector spending on the inflation and growth under the inflation-targeting regime.

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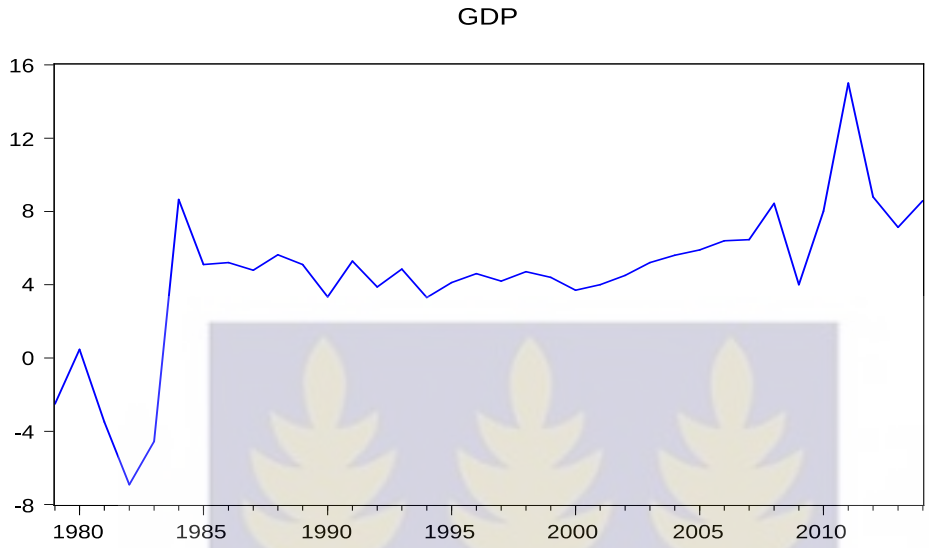
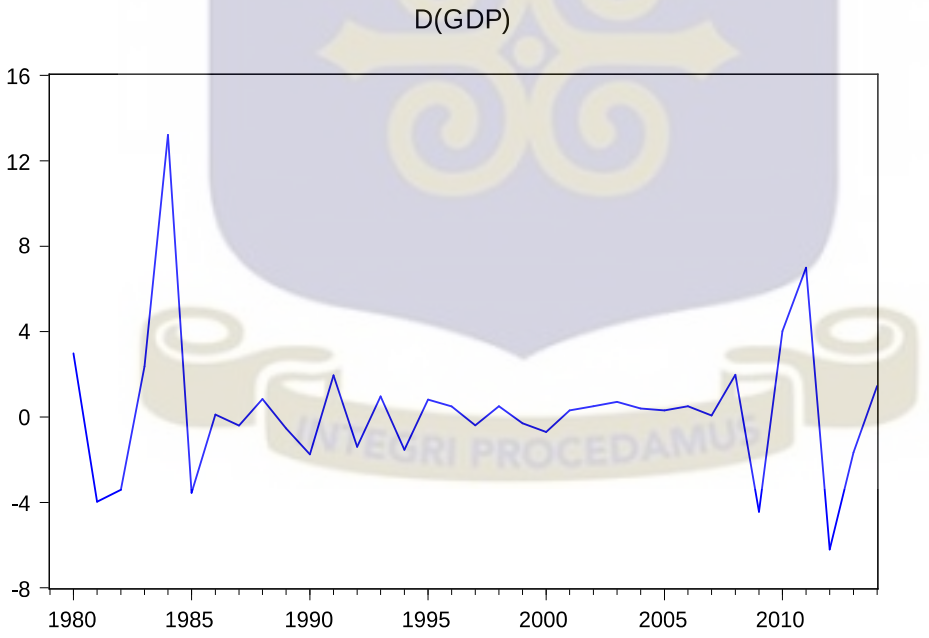
APPENDICES

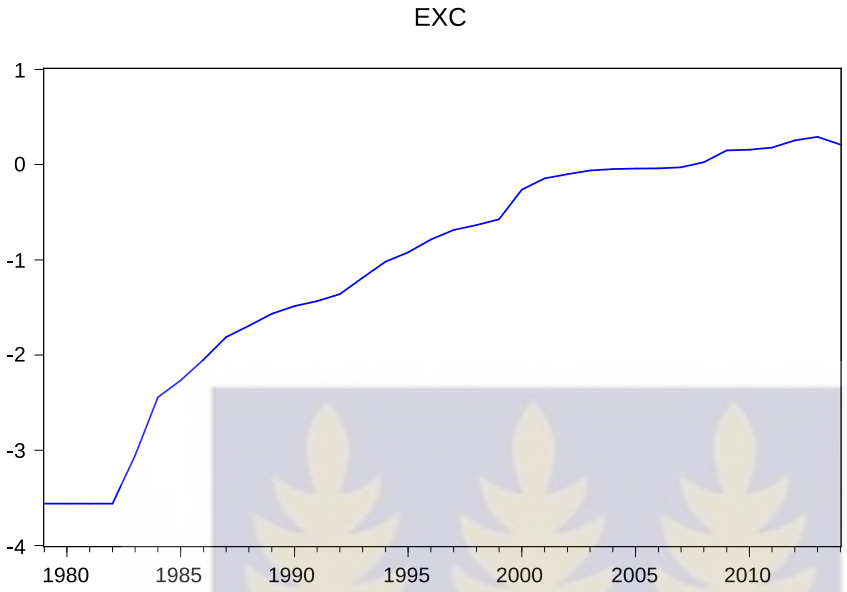
APPENDIX I: THESIS DATA

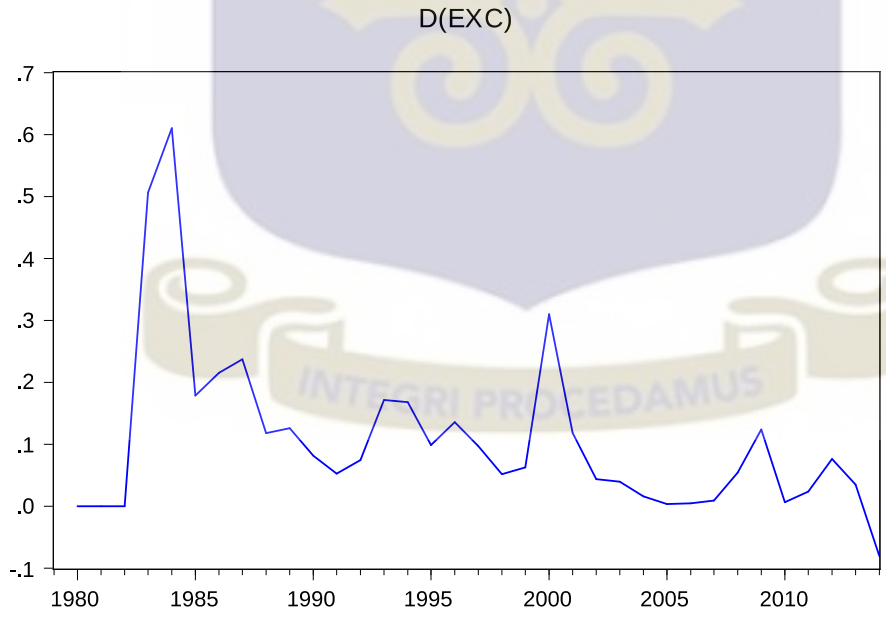
YEARS	Official exchange rate (LCU per US$, period average)	Money and Quasi money growth (Annual %)	GDP growth (Annual %)	Policy Regime	Inflation, [consumer prices] (Annual %)
1979	0.000275	15.8	-2.51	0	54.4
1980	0.000275	33.8	0.472	0	50.1
1981	0.000275	51.3	-3.5	0	117
1982	0.000275	23.3	-6.92	0	22.3
1983	0.000883	40.2	-4.56	0	123
1984	0.0036	53.6	8.65	0	39.7
1985	0.00543	46.2	5.09	0	10.3
1986	0.00892	47.9	5.2	0	24.6
1987	0.0154	53.3	4.79	0	39.8
1988	0.0202	46.3	5.63	0	31.4
1989	0.027	54.7	5.09	0	25.2
1990	0.0326	13.3	3.33	0	37.3
1991	0.0368	39.1	5.28	0	18
1992	0.0437	52.3	3.88	0	10.1
1993	0.0649	33.5	4.85	0	25
1994	0.0956	52.6	3.3	0	24.9
1995	0.12	43.2	4.11	0	59.5
1996	0.164	39.2	4.6	0	46.6
1997	0.205	44.1	4.2	0	27.9
1998	0.231	17.5	4.7	0	14.6
1999	0.267	25.4	4.4	0	12.4
2000	0.545	54.2	3.7	0	25.2
2001	0.716	56.5	4	1	32.9
2002	0.792	39.2	4.5	1	14.8
2003	0.867	23.2	5.2	1	26.7
2004	0.899	27.3	5.6	1	12.6
2005	0.906	19.5	5.9	1	15.1
2006	0.916	39.3	6.4	1	10.9
2007	0.935	36.8	6.46	1	10.7
2008	1.06	39.2	8.43	1	16.5
2009	1.41	24.7	3.99	1	19.3
2010	1.43	31.9	8.01	1	10.7
2011	1.51	34	15	1	8.73
2012	1.8	25.1	8.79	1	9.16
2013	1.95	19.08	7.13	1	11.6
2014	1.62	26.956	8.584	1	15.31

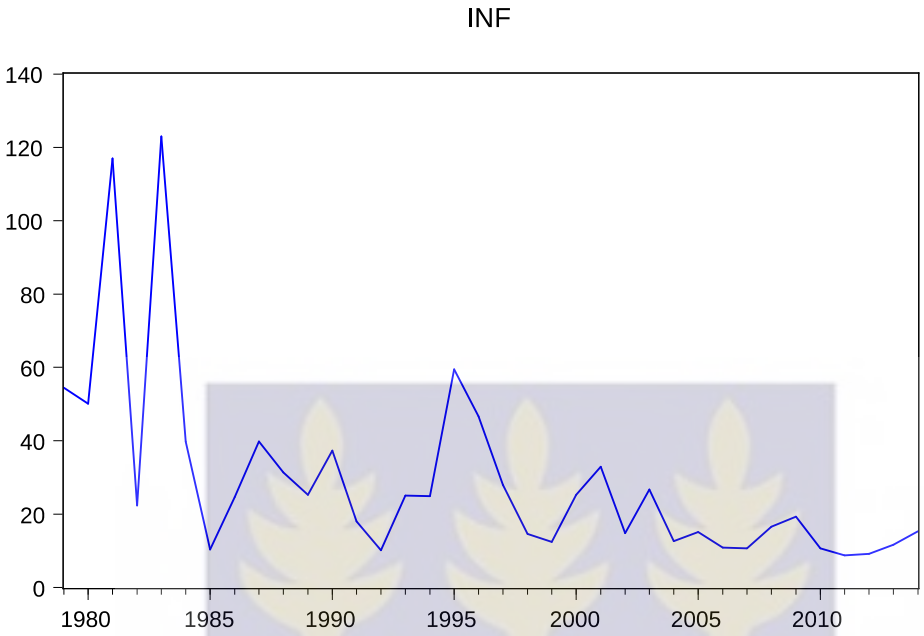
Appendix II: Selected Series in Levels and First Differences

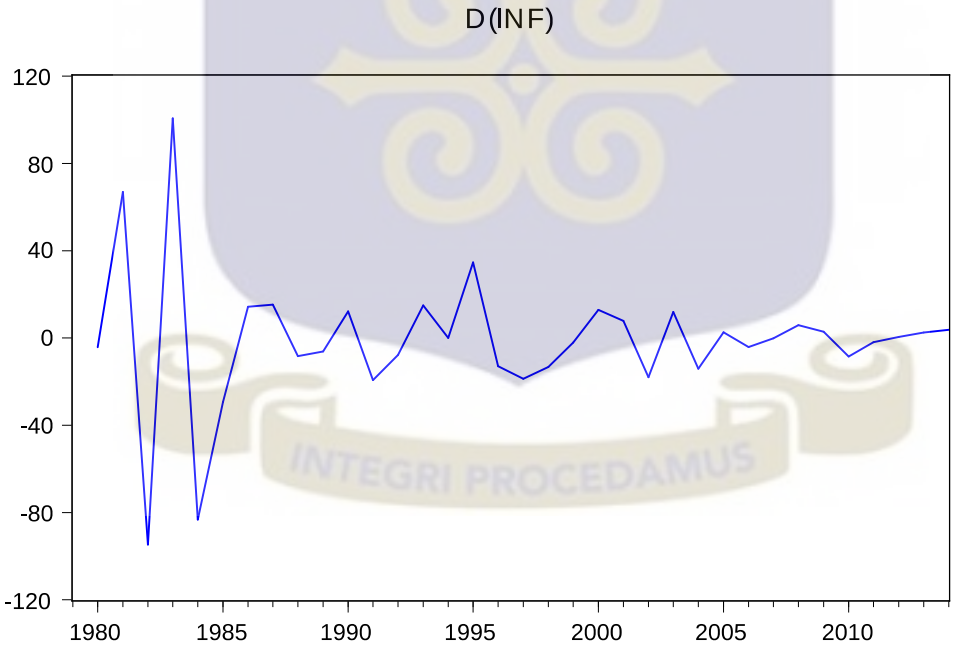


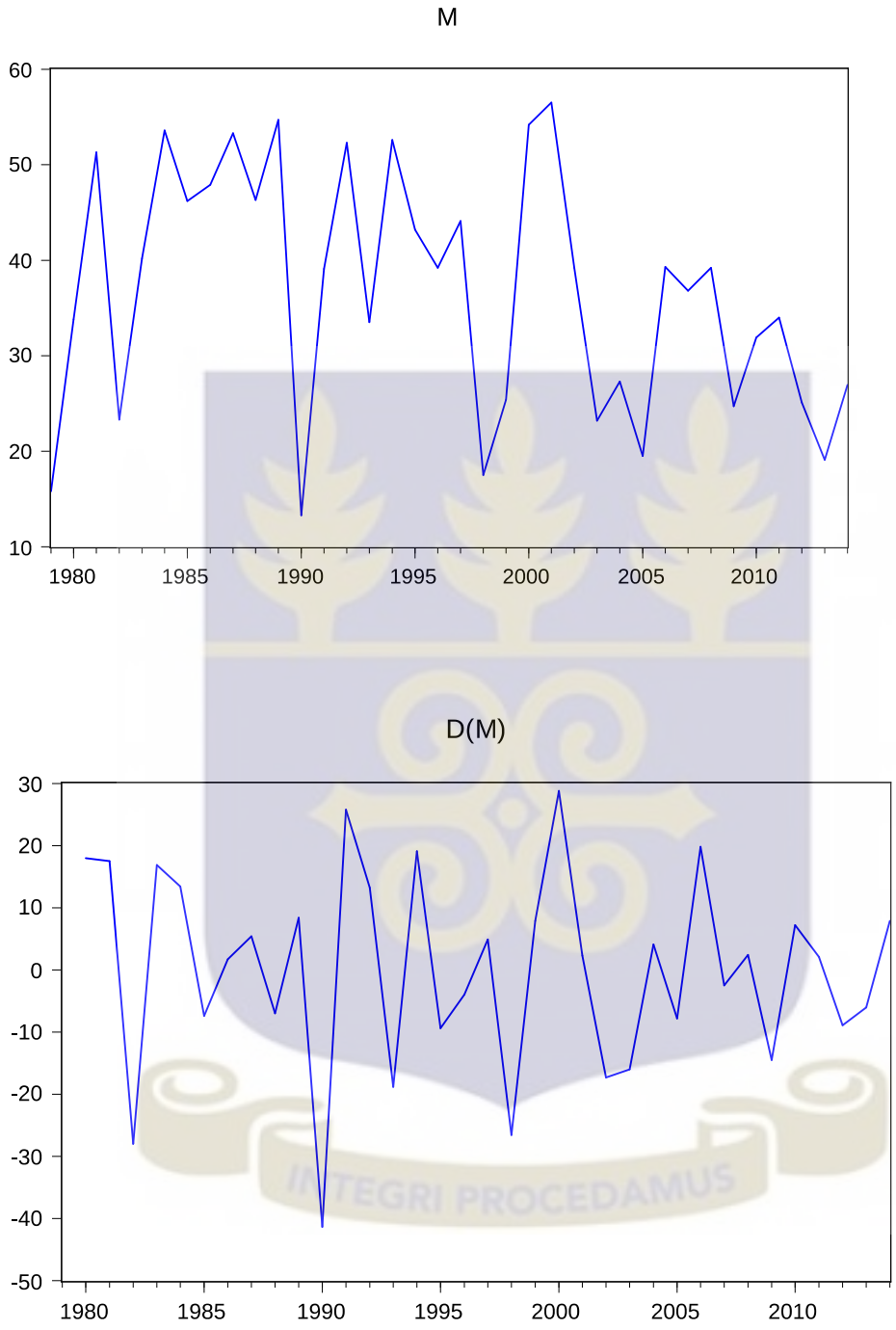












Appendix III: Estimates from Causality Analysis

Dependent variable: EXC			
Excluded	Chi-sq	df	Prob.
GDP	1.474388	3	0.6882
INF	0.596072	3	0.8973
M	0.628802	3	0.8898
PR	0.135628	3	0.9872
All	5.090738	12	0.9549
Dependent variable: GDP			
Excluded	Chi-sq	df	Prob.
EXC	5.279764	3	0.1524
INF	4.637274	3	0.2004
M	0.094266	3	0.9925
PR	0.656138	3	0.8835
All	17.55231	12	0.13
Dependent variable: INF			
Excluded	Chi-sq	df	Prob.
EXC	4.087577	3	0.2522
GDP	3.340935	3	0.342
M	0.62344	3	0.891
PR	0.780217	3	0.8542
All	22.7145	12	0.0302
Dependent variable: M			
Excluded	Chi-sq	df	Prob.
EXC	9.598263	3	0.0223
GDP	5.995027	3	0.1119
INF	18.10765	3	0.0004
PR	4.541334	3	0.2086
All	32.13809	12	0.0013
Dependent variable: PR			
Excluded	Chi-sq	df	Prob.
EXC	11.32785	3	0.0101
GDP	2.889619	3	0.409
INF	6.659013	3	0.0836
M	3.745977	3	0.2902
All	24.99619	12	0.0148