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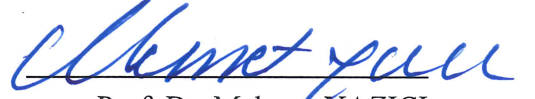MONEY SUPPLY, INFLATION AND ECONOMIC GROWTH IN LIBYA

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Title of the Thesis: **MONEY SUPPLY, INFLATION AND ECONOMIC GROWTH IN LIBYA**

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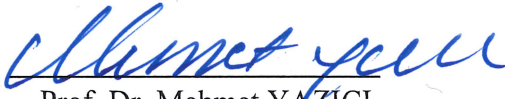
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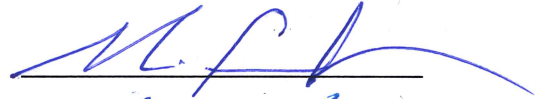Supervisor   Co- supervisor
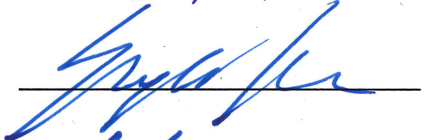
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ABSTRACT

MONEY SUPPLY, INFLATION AND ECONOMIC GROWTH IN LIBYA
AHMED IHMID OMAR KROUSO

M.Sc. Financial Economics
Supervisor: Prof. Dr. Mehmet YAZICI
Co- supervisor: Assoc. Prof. Dr. Dilek TEMIZ

The aim of this study is to exam the relationship between money supply, inflation and economic growth in Libya. Vector Auto-regression Model, Johansen co-integration test and Granger causality were used in the analysis for the sample period 1960-2016. The results shown that all the variables are co-integrated in long term. Furthermore, the increase in economic growth by 1% decreases Inflation by 1.55%. While the growth in money supply by 1 percent will increase the price level by 1.15 %. According to the results of causality test, there is no causality direction in short run between the study variables except unidirectional causality among economic growth and money supply running from RGDP to RM2 according to 5% significance level. In addition, the response of inflation on the economic growth is negative all throughout the ten periods, also the same applies to money supply and economic growth. Also besides, economic growth had an early and positive impact on money supply.

Key words: Money supply, Inflation, Economic Growth, Co-integration, Libya

ÖZET

PARA ARZI, ENFLASYON VE EKONOMİK BÜYÜME: LİBYA ÖRNEĞİ

AHMED IHMID OMAR KROUSO

Finansal Ekonomi Yüksek Lisans Programı (M.Sc.)

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Bu çalışmanın amacı Libya için enflasyon, para arzı ve ekonomik büyüme arasındaki ilişkiyi incelemektir. Analiz 1960-2016 dönemi yıllık verileri ile Vektör Otoregresyon modeli, Johanson Eşbütünleşme Testi ve Granger nedensellik methodu kullanılarak yapılmıştır. Değişkenler arasında eşbütünleşme belirlenmiş ve buna göre %1 ekonomik büyüme enflasyonu %1.55 düşürmekte, diğer taraftan %1 para arzında artış enflasyonu %1.15 artırmaktadır. Nedensellik testi sonuçlarına göre, milli gelirden para arzı yönünde nedensellik dışında, model değşkenleri arasında kısa dönemde bir nedensellik ilişkisine rastlanmamıştır. Ek olarak, enflasyonun ekonomik büyümeye tepkisi on dönem boyunca negatiftir ve ekonomik büyümenin ilk dönemlerde para arzı üzerinde pozitif bir etkisi bulunmaktadır.

Anahtar Kelimeler: Para Arzı, Enflasyon, Ekonomik Büyüme, Eşbütünleşme, Libya

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I would like to express my deepest gratitude to my supervisor, Prof. Dr. Mehmet Yazici, who has provided full support and guidance with patience. He kept his eye on the progress of my work and was available for help whenever I needed it during the course of my study. His door was always open for me.

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I would like to share this moment of happiness with my father, mother, brothers and other family members.

I express gratitude from deep in my heart to my wife for her inspiration. She made the real sacrifices when I was busy writing my thesis. Also to my little children, Fatma and Mohamed, who inspire me whenever I see them.

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Finally, my thanks go to my friends who are from different nationalities, for their belief in me: always saying, 'You will do it'.

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller
CPI	Consumer Price Index
ECM	Error Correction Mechanism
GDP	Gross Domestic Product
IMF	International Monetary Fund
J&J	Johansen-Juselius
KPSS	Kwiatkowski Phillips Schmidt and Shin's test
AIC	Akaike Information Criterion
PP	Phillips And Perron
INF	Inflation Rate
UN	United Nations
QTM	Quantity theory of money
IMF	International Monetary Fund
SME	Small Or medium Enterprise
AEC	Asian Economic Community
CBL	Central Bank Of Libya
VAR	Vector Auto-regression Model
IRF	Impulse Response Analysis
H_0	Null hypothesis
H_1	Alternative Hypothesis
QTM	Quantitative Theory Of Money
AD	Aggregate Demand
AS	Aggregate Supply
VEC	Vector Error Correction
OLS	Ordinary Least Squares
ARDL	Autoregressive Distributed Lag

OPEC   Organization of the Petroleum Exporting Countries

LYD   Libyan Dinar

VECM   Vector Error Correction Model

INTRODUCTION

Money supply has a considerable influence on economic activities in both developing and industrialized countries. Not surprisingly, these countries always seek to achieve a sustainable economic growth and development with a very low inflation rate (stable prices), which is considered the primary goal of monetary policy makers and Monetary authorities. Some economists discussed these core issues related with macroeconomics. Keynesians argue that inflation has a positive impact on economic growth. Also they say that the positive changes in income can lead to increasing of demand of money, and then rising of the general price level. However, the Classical economistsassume that inflation associated with an increase in the supply of money leads to a decrease in the value of money that causes inflation. If the economic growth rate is less than the growth in the money supply, inflation will result, as Monetarism suggest.

The processes that lead to increases in money supply in an economy ultimately result into inflation within that country. Money supply in an economy comes from direct government spending, foreign trade among other sources. While demand pressures as well as constraints of supply are critical elements of inflation, central planned economies pose a unique challenge in analyzing the forces of demand and supply as sole contributors to inflation. This is because such economies introduce other factors that affect inflation such as subsidies and price control. Ultimately, these additional factors greatly detach inflation from forces of demand and supply. Libya presents such a case scenario in which the forces of demand and supply are greatly impaired as sole contributors of inflation and overall economic growth of Libya,like other developing countries.

Libya has a memorable position in the global energy market, and has the largest oil reserves in Africa among the tenth largest globally with 46.4 billion barrels. Further, the Oil sector has long dominated the Libyan economy which is about $80 billion, accounting for more than 70 percent of gross domestic product (GDP), more than 95 percent of exports, and approximately 90 percent of government revenue. But The Libyan economy witnessed several international and domestic crises, beginning with economic sanctions in the 1980s. The sanctions included a comprehensive ban on imports and exports, which negatively affected the economic situation of the state and the citizens, where the cost of sanctions amounted to 33 billion in 1991 due to the loss of oil revenues.

As a consequence of the popular revolution that erupted in 2011, crude oil production dropped to 335 thousand barrels per day (a fifth of potential) compared with the natural rate 1.77 million barrels per day pre-revolution. As a result, the economy has remained in recession since 2011 and this led to the deterioration of living conditions and a rise in the level of prices. Thus, this period became the most difficult period for the Libyan economy.

This study aims to examine the relationship between money supply (M2), inflation, and economic growth in Libyafor the period of 190-2016with application from EVIEWS 9.1Econometrics software to find out if these variables are negatively or positively related by using several tests of time series macroeconomic variables and regression models. To ascertain or prove the validity of Empirical evidence, we have to use annual time series data and time series methods of unit root test, co-integration test and Vector Auto-Regression (VAR) model.

After this brief introduction, this work is organized as follows: section I presents the theoretical framework. Section II a brief review of the literature an overview of Libya economy is given in section III. Section IV presents the data and methodology used. While section V shows interpretation of results and discussion. Final section draws conclusion and recommendation.

CHAPTER I

THEORETICAL FRAMEWORK

Macro-economic variables are important indicators of the economic trends in any economy. The relationship that exists between different macroeconomic variables has been subject to debate among economists. The differing opinion among economists on this topic has led to the emergency of numerous economic theories (Kacemi, 2012). This chapter discusses the various economic theories that attempt to explain the relationship between various macro-economic variables.

1.1 Classical Theory

The classical economic theorists formed the foundation over which other theories were developed later. Adam Smith was the first who set the foundation for the classical growth model that would later be used to develop other economic theories. In Smith's classical growth model, he pointed out that three factors of production are correlated directly with the economic output (Sahu, 2016). Also, he identified the three factors of production as land, labour and capital. So, Smith proposed that the three factor of production relate to economic output in the below equation:

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

In equation 1, L represents labor; K is capital while T represents land.

From this equation, Smith said that factors that increase the three main factors of production ultimately lead to increasing in productivity. For instance, he pointed that the savings as a factor that increases one's ability to invest and increases his capital. Furthermore, the income distribution is significant factor that push the economic growth in different countries. He also noted that an increase in the demand for workers increases their bargaining power and increases the cost of labour. The major weakness of this classical theory is that it does not show clearly the relationship between the effects of inflation and the tax on profit margin and the final economic output. However, we can infer from the last discussion of Smith's classical theory that the two factors has a negative connection with each other. Eventually,high wages reduces profit level as discussed in this theory, hence one can conclude that increase in the taxes and inflation equally has a negative effect on the profit margin. The main critics of this theory argued that it does not account for the causes of inflation and the effect of the tax on profit level and total output (Diebolt and Kyrtsou, 2005).

1.2 Keynesian Theory

This an economic theory which introduced a new school of thought to the discussion on the relationship between the macroeconomic factors. In his book entitled "The General Theory of employment, interest and money" John Maynard suggested that the Keynesians believe in this interrelationship. From the Keynesian view, that government interventions in the economic affairs of the country are significant for the economic growth of that country. This theory suggested that the government intervenes by both contractionary and expansionary economic policies which aim to encourage the investments and increasing the production capacity in the economy.

The traditional Keynesian theory is based on an attempt to attain a point of equilibrium between the aggregate supply curve and the aggregate demand curve. The relationship between the two curves is a demonstration of the relationship between inflation and growth. The theory suggested that the supply curve appears as

sloping straight upward and not a straight vertical line (Dornbusch and Fischer, 2001). The implication of this that any change in aggregate demand has effect on both the prices of products and output. If the supply curve was vertical, it implies that any change in aggregate demand has effect only on the prices but has zero effect on the output (Dornbusch and Fischer, 2001). This position is derived that several other factors come into play in determining the inflation rate in the short term apart from the aggregate demand. Inflation is equally influenced by other factors like the monetary policy, labour force and the cost of other factors of production.

1.3 The Quantity Theory of Money

This theory is mainly related to the changes in demand for money and how such changes affect the price of products in an economy. The Fisherian or "neo-quantity" version of this theory suggests that changes in the supply of money have fixed and mechanical relationship with general price levels in that economy. The economic equation presented by Irving Fisher was the basic version of the quantity theory of money formulated as follows:

$$MV = PT \qquad (2)$$

In this equation, M represents the supply of money, V represents velocity of money, and P represents Average levels of price in the economy while T represents the Transaction volumes in the economy.

The quantity theory of Money made the assumption that the only fixed factor in the short run is the velocity of money. Going by this assumption, the equation 2 can be rewritten as $\%\Delta M = \%\Delta P + \%\Delta T$. This means that a change in the supply of money has an effect on the overall GDP of the economy. The main argument for this theory is that the controlling of money supply in an economy is a key strategy to achieve the stability in the economy.

The second assumption of this theory is that both; the velocity of money and the volume of transaction will remain fairly constant when viewed in the long-run. The implication of this assumption on equation two is that it can equally be written as $\%\Delta M=\%\Delta P$. This means that an increase in the quantity of money supplied in an economy will lead to an equal increase in the price levels (Hasan, 2013). Consequently, this assumption led to the conclusion that a change in the supply of money only results into a change in the levels of prices in an economy. Therefore, this theory suggests that inflation is only dependent on the supply of money and not any other variable in the long run. This phenomenon is referred to as the neutrality of money.

Critics of this theory like Keynes say that the velocity of money cannot remain constant in the long run. Moreover, the theory was inconsistent and cannot be demonstrated in the short run in cases where price is sticky.

1.4 Neo-Classical and Endogenous Growth Theories

The Neo-classical theory was articulated by Tobin (1965) and Mundell (1963). Mundell explained how inflation in an economy relates to the growth of output without consideration of the excesses in the demand for products. He suggested that an increase in inflation or a mere expectation of its increase lead to an immediate decrease in the level of people's wealth. He attributed this decrease in wealth of people to the balancing off on the people's rate of return on real money (Hasan, 2013). In response, people resort to saving in assets and increasing price levels of their assets and products. Consequently, this lowers the interest rates. An increase in savings as translates into accumulation of capital and increases the rate of capital growth. Tobin developed on Mundell's assertions by suggesting that inflation causes people to transform their money to assets that can generate more interest. Thus, inflation results to a positive economic growth.

The two economists "Tobin and Mundell" made the assumption that investment is a substitute of the balance of real money. This assumption leads to the

conclusion that an increase in inflation and decrease on real money balance returns will force people to substitute their real money with interest generating assets. Since such assets constitute capital, this switching results to an accumulation capital which consequently leads to economic growth. Therefore, there is a positive relationship between inflation and economic growth in an economy.

Stockman (1981) presented another approach that leads to a conclusion that disagrees with that concluded from Mundell and Tobin. In Stockman's opinion, the two variables are complemented each other in a way that leads to a negative relationship between inflation rate and the level of output in the steady state. He argued that decrease in purchasing power of money balances leads to a decrease in the people's purchase of both capital goods and cash goods. Consequently, inflation leads to a decrease of output at a steady level. Therefore, Stockman concludes that there is a negative relationship between inflation and economic growth in an economy.

1.5 Demand-pull & Cost-push Theory

The Keynesian Theory discussed that the increase in the Aggregate demand is the main contributor to demand-pull inflation. Therefore, the aggregate demand includes the net exports, government expenditure, consumption and investment. An inflationary gap occurs in case if the aggregate supply does not meet the aggregate demand and hence creates a surplus of the aggregate demand. Therefore, the rate of inflation is the difference between the aggregate supply and the aggregate demand.

Keynes and his followers made the assumption that price will remain fixed. However, they did not deny that price can only remain fixed in the short run, since other non-monetary factors play a role in determining the prices. Moreover, output is a variable factor since it is influenced by levels of investment expenditure. From this theory, changes in price are affected by nominal money income through the effect of the interest rates. For instance, an increase in the amount of money would consequently cause a decrease in interest rates (Hasan, 2013). The decrease in

interest rates will cause an increase in aggregate demand which in turn will serve as a motivation for the increase of investments. Also, the increased aggregate demand will have the impact on output first rather than price assuming unemployed resources are available.

In simple terms this theory proposes that the main cause of inflation occurs when both increased demand of products and high level of production of the same products. Therefore, increased aggregate for demand goods and services increased prices and the overall increase in GDP. This conclusion leads to the demand pull theory. Under the demand pull theory, demand pull inflation occurs when there is "too much money chasing too few goods" (Tobin, 1965).

On the other hand, the cost push theory presents a opposite story to the demand pull theory. According to the cost push theory, inflation occurs when the factors affecting prices leads to a more rapid increase in the prices compared to the rate of increase in productivity resulting from changes in the factors affecting productivity (Hasan 2013). These Factors such as increase in the cost of labor or raw material will lead to an increase in the overall cost of production. This in turn, leads to an increase in prices and hence inflation. Therefore, inflation that arises from an increase in the cost of production is referred to as the cost push inflation.

1.6 Phillips Curve

The Philips growth curve shows that the inflation rates have an inverse relationship with the unemployment rate. This curve remains very controversial among economists. The centre of this controversy is in the very existence of the tradeoffs that this curve suggests (the prices and unemployment) based on data that used to develop this curve which obtained from the United Kingdom during the period between 1861 and 1913. The Philips curve suggests a tradeoff between unemployment, inflation and wages (Diebolt and Kyrtsou, 2005). For instance, an increase in inflation and consequently wages leads to a decrease in unemployment. Moreover, a reduced unemployment rate results in an increase in the cost of labour.

The Philip's curve below shows the impact of the shift in prices from equilibrium (U*) and the subsequent effect on inflation.
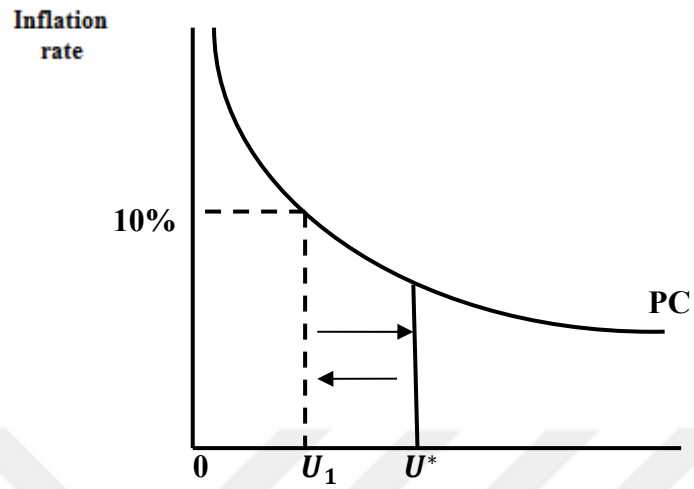
Figure2: Phillips curve

CHAPTER II

LITERATURE REVIEW[*]

It is important and relevant to notice that; most early studies in the past, investigated theoretical and empirical aspects of the relationship among various variables, especially money supply, inflation rate and economic growth. Different authors have different conclusions about the relationship that exists between these variables. it is useful to briefly review some of their related works below.

Rosemary (2015) Empirically, examines of the impact of inflation on Nigeria's economic growth and shown that it has had an influence on the real gross domestic product in Nigeria over the past decades. The time series of data collected annually indicated the significances of the variables from the time period between (1970-2013). Research has shown that both the high rate of inflation and the high rate of unemployment have had a negative impact on the economic growth and real gross domestic growth (GDP) which has although been less responsive to inflation as compared to unemployment. Although in most cases the results have also shown that the real GDP is more responsive to inflation and less responsive to unemployment. Granger's study shows that long-run causality did not find between inflation and real GDP.The results showed that at lag1; both inflation rateand unemployment have had a negative effect on the economic growth a meanwhile at lag 2; it showed that RGDP is more responsive to inflation but not like responsive to unemployment. This study applied the Augmented Dickey-Fuller (ADF), Phillips Peron (PP),

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[*]See the a summary of related literature in a table in Appendix 2

Kwiatkowski Phillips Schmidt and Shin's test (KPSS) unit root tests and the Johansen co-integration test.

Komain Jiranyakul (2001), using the series quarterly collected data that ranged from the first quarter of (1990 to 2000), showed that there is no causal relationship between money growth and the inflation rate. The test results reject the notion that money growth is the main cause of inflation in Thailand during the period under study. Through a clearer observation, it was imperative to pinpoint a list of other determinants of inflation in Thailand such as: the oil shock, an increase in the production costs, and stimulus fiscal policy variables. Empirically, the paramount goal of this paper was set to investigate the correlations and connection between: real money supply, inflation rate, and real gross domestic product. Methodologically, this study used the Augmented Dickey Fuller (ADF), ECM and Phillips Peron (PP) test

Chan Wun (2016), based on series of quarterly collected data from (1999 to 2015) using Vector Error Correction Model (VECM), error correction model (ECM), Johansen co-integration, and Granger causality test, found that both of the money supply growth and economic growth are positively related and connected to the inflation rate. These results can be explained by Quantity theory of money (QTM) model which states that the velocity of money and real output are fixed in the long run. Therefore, the increase in money supply directly causes an increase in the inflation rate. In an AD-AS model, a rise in money supply causes a fall in the interest rate, which stimulates the aggregate demand; it causes a rise in the price level in a long run. It is important to notice that when it comes to the issue of the short run, through an empirical study one can find out that money supply negatively causes inflation rate. It is unlikely to have a long run relationship. Inflation rates are affected by the price of imported goods, raw material, and agricultural produce. Therefore, money supply is not the only source and factor that influences inflation rate. Moreover, the impact of inflation rate on money supply growth fluctuates in the short run. Now based on observation, money supply proves negatively, in relation to economic growth in the short run. One of the reasons behind economic growth is the more direct influence on the growth of the consumption, investment, government

expenditure and net export. Therefore, money supply is not the only factor that affects the economic growth of a country.

Faraji Kasidi (2013), examines the impact of inflation on the economic growth in Tanzania. Through an annual time-series of economic data collection for the period of time between 1990 to 2011 which obtained from the CBN Statistical Bulletin (2010). The findings from a regression analysis discovered that inflation had a negative impact on the economic growth in Tanzania. The results of the co integration test showed that there was no co-integrating relationship between inflation and economic growth through the period of (1990-2011). A statistically significant long-term relationship between inflation and economic growth was found. However, there was a negative and statistically significant relationship in short term. The study proved that the degree of responsiveness of the change in GDP because of the change in the price levels was inelastic.

For Cameroon, Henri Ngoa Tabi, Henri Atangana Ondoa (2011), examined three macroeconomic variables (Inflation, Money and Economic Growth) based on the data from the Central Bank between the period of 1960 to 2007.They suggested that an increase in money supply can boost growth and that inflation is not a major determinant of economic growth. Also, the results from these estimations showed that an expansionary monetary policy did not necessarily lead to an increase in the general price level in Cameroon. Moreover, The results showed that money in circulation caused growth and growth caused inflation. However, it was realized that an increase of money in circulation does not necessarily induce an increase in the general price level. Furthermore, The study showed that money supply was positively related to inflation. Exchange rate, interest rate, and government expenditure were inversely related to inflation. With these findings, it became clear to infer and assert that money supply, exchange rate and interest rate determined inflation in Cameroon. The study used Granger causality test, Augmented Dickey-Fulley (ADF) test, and the VAR model.

Cuma Bozkurt (2014), examined money, inflation and growth relationship a Turkish case, which was derived and taken from a quarterly data time collection from 1999 to 2012. The increase in money supply and speed of money can lead to inflation in a long run. In other words, there is a high relationship between money supply and inflation. a raise in the growth of money causes an equal boost in the inflation rate. Co integration tests indicated that there was a unique long-term or equilibrium relationship between variables. This study was conducted through the use of ADF unit root test and Co- integration tests.

Fekadu Dereje Girma (2012), analyzes the short run and long run relationship between economic growth and the inflation in Ethiopia by using the yearly data obtained from the world economic outlook database of IMF for the period between (1980 to 2011). The research showed and revealed that inflation does not have any forecasting power on the economic growth in the short run. Co-integration test showed that there was a long run relationship between the economic growth and the inflation rate in Ethiopia. The Vector Error Correction (VEC) estimated some results that showed that increase in output growth decreased inflation in the short run during the sample period of 1980-2011. However, the second equation showed that inflation does not have a significant effect on the economic growth in the short run.The error correction terms were classified to be statistically significant which showed that if both inflation and economic growth were out of equilibrium, inflation will adjust to reduce the equilibrium error in the long run. This was also an indication that economic growth significantly reduced inflation in a short run while the inflation did not have any significant effect on the economic growth. If inflation had previously been larger than the normal share, then economic growth could have caused the inflation to be lower in the long run. The VAR model showed and proved that inflation does not have significant effects on economic growth in a short run. On the other hand, the Granger Causality test showed that economic growth causes inflation which means that economic growth can predict movements in inflation.

Fitsum, et al (2016), examines the relationship between inflation, money supply and economic growth in Ethiopiaand analyzed by a co integration and causality analysis. The causal relation between inflation rate and money supply and

between inflation rate and economic growth in Ethiopia between the period of 1970 to 1971 and between the years 2010 to 2011 in Ethiopia through a secondary data source this study employs a tri-variant Granger causality test with Vector Error Correction Model (VECM) and Johansen Co integration Test, Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test statistic which showed: that money supply, aggregate price, and real GDP were co-integrated. It implied that the variables had a long run equilibrium relationship. Furthermore, VECM test indicated that there is a bi-directional causal relationship between inflation rate and supply of money as well as unidirectional causal relationship from economic growth to the inflation rate in the long run. In the short run, the model indicated that there was the presence of unidirectional causality from money supply to inflation. The model also revealed that economic growth has had a negative effect on inflation in the short run.

Iwedi Marshal (2016) The Link between money supply and economic growth in Nigeria through an econometric investigation reveals that the data collection between the time period of 1970 to 2014 with regards to money supply had a short and long run positive and significant linkage on the Real Gross Domestic Product in Nigeria. There were co- integration between M2 and RGDP and so there was an equilibrium relationship between the two variables in the long run. On causality, there was a causality running from M2 to RGDP and not vice versa. This showed that there was unidirectional causality from money supply (M2) to Real GDP in Nigeria during the period of study. These findings were concluded from theVAR testing the short run relationship between the variables, from; co-integration testing the long run relationship between the variables, and from; Granger causality test for testing the direction of the causality linkage.

A.S Bakare (2011) An empirical study of the determinants of money supply growth and its effects on the inflation rate in Nigeria were covered during the periods between 1981 and 2006.The results showed that changes in money supply determined the inflation rate in Nigeria. It showed that a 1% rise in money supply can lead to increase in inflation by 5.6 percent. And also, a rising in exchange rate had a positive impact on inflation. Similarly, the interest rate determined the inflation by the highest level. It showed that a 15% increase in the interest rate leads to 102.9

percent rise in the inflation in Nigeria. These findings were derived from and concluded through the VAR for testing the short run relationship between the variables, co-integration for testing the long run relationship between the variables, and Granger causality test for testing the direction of the causality linkage.

Evans Ovamba Kiganda (2014) The relationship between inflation and money supply in Kenya was examined based on the annual time series data spanning from 29 years between the time periods of 1984 to 2012. In general, the findings of this study indicated that inflation and money supply in Kenya had a positive relationship. Also, unidirectional Granger causality was established through the running out of money supply to inflation in Kenya. In conclusion, there is a significant positive long-run relationship between inflation and money supply in Kenya. That is, the source of inflation is mainly derived from the growth rate of the money supply and that a quick increase in money supply leads to a rapid rise in inflation rate. This study employed the: Augmented Dickey Fuller (ADF) test, Vector Error Correction Model (VECM) and Granger causality test.

Obaid (2007) has examined the causality connection between the actual GDP and money supply (M3) in Egypt from 1970 to 2006 by utilizing Granger test. This author has found that causality does not exist between the nominal GDP and the nominal money supply during the research period. For instance, when he applied the real GDP and definite money supply, he realized that there is a collective causality connection between the real GDP and the actual distribution of money in Egypt. As a result, Obaid considers an economic policy as a suitable strategy to be used as far as Egypt's real GDP is concerned. However, the mutual causality connection could aid the researcher to predict the GDP's performance in a given volume of money distribution by the Egyptian economic policymakers.

Moreover, Hossain (2005) has examined the casual link amid economic growth, currency devaluation, inflation and money growth in Indonesia in between 1954 to 2002. This inscriber has realized that there is a short-term bi-directional causality occurring among currency inflation and devaluation as well as between the

rise in prices and money supply growth. In consideration of the entire sample period, the causality succeeding inflation to the growth of narrow distribution of money was strong while compared to tapered capital supply expansion to inflation.

Furthermore, Vector and Stephen (2000) have studied if there is a momentous long-run connection between the nominal GDP and money as well as the price level and money in the Venezuelan financial system. These authors have employed time-based econometric methods to get annual data of the above nation from 1950 to 1996. One of the crucial aspects of their analysis is the application of co-integration and unit roots test in combination with structural ruptures. Indeed, the structural breaks are suggested to be important by some elements of the Venezuelan. Because economy relies greatly on oil gains, the shocks concerning oil price are believed to have a great impact on various macroeconomic variables. Since the economy also has large far-off debt, the global liability crisis that occurred in 1982 had persistent implications on Venezuela's financial system. The radical alterations concerning political instability and economic policy might also lead to a significant effect on the macroeconomic changes. However, these writers have concluded that there exists a long-term interaction amid nominal GDP and narrow money (M1), the CPI and the GDP deflator particularly when one made grants for one or more structural breaks.

Tan and Baharumshah (1999) have explored the informal link between prices, output, and money in Malaysia. These authors have recognized that in short-term cash is non-neutral, thus an indication that there is a unidirectional connection between output and money though the opposite is not true.

Al-Sawai'e, Al-Fawwaz (2012) investigated Output, Money, and Prices for Jordan. The empirical analysis was based on VAR model with annual data for the period 1976-2009. The findings of this study showed that, a non-presence of a long-term link between the study variables. They conclude that the changes in money do not have any influences on the output in Jordan in the short run. In addison to, this results discovered that money supply as a dependent variable will cause inflation

movement and not in the economic activity. The authors concluded that the monetary policy will not be effective in Jordan in a short run.

Daniela and Mihail (2010) have also researched about the relationship between GDP and money supply in Romania. This study used ADF method and relied heavily on the data harnessed from GDP and money supply (M3) over ten years. The analysis showed that both sequences are non-stationary, but when the Engle-Granger co-integration technique was employed it indicated a conjoining between M3 and GDP in long term, also M3 can cause GDP. In the view of developing nations, Abbas (1991) has explored the casual connection amid output and money in Asian countries and found that there exists a collective interaction between income and money in Thailand, Pakistan, and Malaysia. On the other hand, Kalumia and Yourogou (1997) have spotted a causal interaction between income and money in West Africa thus indicating the existence of non-neutrality aspect of money.

Sims (1972) has applied Granger causality method to research about the connection between the output and amount of money in the United States. He discovered that the quantity of wealth helps the interpretation output though vice versa is not true. In other words, his results indicates that there is a causality course from the volume of money to GDP, an aspect which is unswerving to the views of monetarists and Friedman.

Ogunmuyiwa and Francis (2010) have employed the VAR model, causality test and econometric method OLS to study the explication of money distribution on economic growth in Nigeria in between 1980 - 2006. These authors have found that despite money distribution being positively linked to growth, there is a connection between expansionary and contractionary money supply. Also, Ahmed and Suliman (2011) explored that three macroeconomic variables such as price level (CPI), money supply and real gross domestic product of yearly data of Sudan in between 1960 to 2005 are co-integrated in long run. Through the application of Granger causality, they revealed that the causal direction between GDP and CPI is uni-directional

without any feedback. While, CPI does not cause money supply, but the causation runs from money supply to price level.

Nevertheless, Babatunde, Shuaibu (2001) checked the relationship among Money supply, inflation and economy growth in Nigeria.In thisanalysis, they employed ARDL model, based on 33 observations and an annual datawas used.The results presented that real income, money supply, inflation, gross fixed, capital formation are cointegrated. Moreover, they found that the real income is positively influenced by the gross fixed capital formation in the long run at 5% level. While a 1 percent price increase in money supply will lead to boost real income by 0. 144%.Also, the increase in inflation rate will cause to increase by 0.128% in real income.

Wang Yan-liang (2012) his study proved that there exist co-integration relationship between supply of money and inflation rate. But the cointegration among economic growth and money supply is completely absent.

Additionally, Yuan (2007) has used variance decomposition and co-integration methods to investigate the relationship between economic growth, inflation, and money supply. The author noted that capital distribution was non-neutral and exogenous to the output in the long run view. Moreover, Yao realized that economic growth and inflation have a devastating connection in both long run and short run, though they would get back to usual level. However, the writer has rowed that money supply has a lag impact on economic expansion and inflation velocity.

Prasert Chaitipa, Kanchana Chokethaworna, Chukiat Chaiboonsrib, Monekeo Khounkhalaxc, (2015) looked at Money Supply Influencing on Economic Growth-wide Phenomena of AEC Open Region; which are Singapore, Indonesia, Thailand, and Malaysia. The analysis was based on the yearly period from 1995 to 2013. Unit root, co-integration, Hausman Test and ARDL approach were used. The most appropriate way to investigate the relationship between money supply and economic

growth was Pooled Mean Group estimator. The conclusion of this study that there is a long run relationship between supply of money and gross domestic product. Money supply (M1) has a positive relationship with GDP growth, however, demand deposits were a negative relationship with GDP.

CHAPTER III

OVERVIEW OF THE LIBYAN ECONOMY

3.1 Background

Libya is among the developing nations having a large relatively populated land. This country has identical idiosyncrasies of other developing regions for it relies on agriculture as the basic source of revenue, that is, contributing to about 30%of the Gross Domestic Product (GDP) and the rest proceeds are obtained from grants and aid from the United Kingdom and the USA. Prior to the discovery of oil, Libya was amid the poorest nations in the global view since most of its citizens lived an underprivileged life with an average per capita of less than $40 in every year; and there were no mineral and power resources.

Despite the Libyan country being among the poorest nations in the entire universe, this nation had equilibrium between aggregate demand and aggregate supply. The above balance had not resulted from the efficiency of production, though it emanated from the equilibrium between the factors influencing poverty and economic backwardness. However, Libyan's economy was in the dire urge of a big push of pernicious equilibrium that overwhelmed it.

In the end of 1950s, oil was invented in this nation and it started to be exported at the start of 1960s hence bringing about great changes in the economy of Libya. For instance, the discovery of this mineral made various foreign companies to enter Libya and commenced to export products hence making the economic structure to prevailing leading to a radical transformation of the financial system. Oil has made

this nation to capture prominent rank in the global energy market. In 1962, Libya subscribed to the Organization of Petroleum Exporting Countries (OPEC), two years subsequent to the creation of the above institution. In 1962, this nation had managed to produce about 67.1 million barrels of oil though in 1965 this volume hiked to 445.4 million barrels. As a result, Libya has positioned fourth biggest oil manufacturer in non-communists and it was followed by Venezuela, Iran, and Saudi Arabia. Similarly, this nation produces an average of 1.6 million barrels daily (that is, 2.09% worldwide oil production) thus being ranked 17th amid the global largest oil makers whereas Africa is the third largest producer. Otherwise, the oil reserves of Libya are the biggest in Africa hence getting positioned 9th among ten nations with largest confirmed oil resources in the world; this is an estimation of about 48.12 billion barrels, roughly 3.04% of the international reserves (Waddams, 1980).

Because of oil, Libyan financial system primarily relies on the oil export revenue accounting to more than 70% of GDP (above 95% exports and 90% government revenue). In this country, the oil sector is controlled by the government since it acts as the core basis of distant trade earnings. Oil has also made Libya's GDP to rise hence this country is amid the nations having highest per capita earning in Africa because of low population and lots of wealth. Libya's financial system has transformed from primitive farming economy to petroleum-based cutback hence leading to improvement of living standards and making this country to have unbalanced expansion economy. Eventually, Libya's situation has subjected the administration to great pressure of trying to satisfy the entire requirement of community and catering for their needs. Indeed, the above aspect has enabled Libya to be responsible for getting the best mean of attaining its targets.

Since the 1970s, the government has put notable efforts on achieving economic diversification due to uncertainties concerning oil prices and issues regarding global warming which can lead to serious unenthusiastic implications in the economic view.The above trials aimed at reforming the economy. For instance, the Libyan administration has invented three strategies geared at the instigation of economic diversification. For example, there were started annual investment programs for handling oil-based activities, that is, a three-year strategy (1973-1975);

five-year program (1976 to 1980); and a five-year project (1981 to 1985). The core purpose of thee programs and strategies was to attain a measured reduction of the governance of the oil subdivision on the entire economy as well as ensuring diversification of production, particularly manufacturing and agriculture sectors. The above activities have been positively echoed by the financial system. Table 1 denotes that the GDP had risen drastically from 9.5 Billion to 26.0 Billion, that is, an increase of 17% during 1970 to 1985. The Libyan plenty financial reserves are enhanced by the rise in oil earning by 20%. The above improvement was accompanied by a significant augmentation in per capita income that rose by 104% as well as a population increase by 37%.

Table 1: Overview of Some Libyan Data

	1970-1977	1978-1985	1986-1993	1994-2001	2002-2009	2010-2016
Population*	2.11	2.9	3.8	4.5	5.3	6.2
Oil Revenues**	3,722	9,554	4,779.	5,950	21,084	25,564
GDP**	9,587	26,027	25,404	26,173	54,986	40,316
Per Capita Income***	4.4	9.1	7.16	6.17	10.16	8.04

Author's calculation taken as an average of 8 years. Sources of data are International Monetary Fund (IMF) and Libyan Statistics and Census Bureau.
In thousand dollars***, billion dollars** and in millions of people*.

In 1986, the UN and the US obliged economic endorsement on Libya, a thing that coincided with the decline in the global oil price hence hindering the entire success of the above three plans. The sanctions entailed restriction of US firms from transacting with Libya; freezing the assets owned by Libya; prevention of global flights to Libya; stopping the selling of aircraft, oil equipment, and arms. These actions basically affected the oil firm operating in Libya though the rest activities were going on. The regime was also pressured to cut subsidies for monetary diversification programs, thus failing to boost its economy. As a result, the economic status started to worsen and the earnings from oil severely dropped by almost half at the begging of sanctions. However, this rise was meek by 24% in the 1980s and 1990s as contrasted with pre-sanctions shown in the above table. Irrespective of these

sanctions, the GDP did not attain any progress but it remained volatile, that is, rising to 26.1 and falling to 25.4 again. On the other hand, the population poll did not vary notably since the population density rose by 4% because of fall in per capita income.

For United Nations (UN/SU) sanctions got picked up in 2003 and the sympathetic developments in the international oil market; this nation had maintained an upward economic growth. Moreover, various measures had also occurred thus boosting the role of the private sector in the financial system. Eventually, the gains from foreign investors rose, particularly in the infrastructure and hydrocarbon field. Nonetheless, the Libyan's economy was still relying on hydrocarbon reserves. Evidently, the sanctions lifting were the core watershed in the history of Libya. Conversely, various macroeconomic variables including GDP encountered an extremely spiky bounce back by 110% due to heightening oil revenues by about 254%. Because of these increases, the per capita income faced drastic growth of 65% and the population rose by 16.8%.

Libya has made a momentous progress on economic reformations and has potentially gotten closer to the developed nation in different regions such as Saudi Arabia, Qatar, Jordan, and United Arab Emirates. However, the violent resistance that emerged in Libya on 17th February 2017 has made the UN Security Council compel sanctions on Libya hence leading to freezing of Libyan international assets. As a result, the Libyan economy suffered for six lean years before encountering a labyrinth of political complexity and the distinctions that emanated from February Revolution that unswervingly impacted oil production. Eventually, the volume of crude oil dropped to the lowest point on record to about 0.4 million barrels daily (bad); a number that represents a quarter of possible production. This country also encountered a historic economic depression where its revenue reduced by 60%. As a result, GDP went to 40.3$ billion, a figure that was lower compared to the flourishing period. Moreover, a per capita income fell by 20% because of the high population growth rate of approximate 17%. Furthermore, the Libyan upheaval also led to drastic international and regional spillover. Before the conflict, Libya was accounted for 2% international production of crude oil, and the decline of Libyan oil exports encountered a temporary shortfall in the global market.

3.2 Money Supply

Libya encountered a great revenue boom from oversea currencies in between the 1970s and 1980s resulting from higher charges of oil during 1970 to 2010. These rises were accompanied by both positive and negative implications on all fields of the Libyan national economy and money distribution. The surplus distribution of money was applied to fund regime expenditure as well as for changing the Libyan financial system from aid beneficiary to a donor. Furthermore, Libya also attained an economic transformation from capital scarcity to abundance.

The analysis of the indicators and statistics of Libyan money supply[1], it is clear that in 1970 this country had approximate 668000$ million and was about to attain 3,453$ Billion by 1976. The anticipated improvement was due to the continued increase of money supply the nation sometimes experienced some declines, particularly during the sanction period. The Libyan monetary advancements were viewed in terms of steady money growth following embargo lifting of 2003 to 2004. These developments also denote economic re-monetizing which aligns with the progressed domestic economic status and heightened public assurance as well as the sharp rise in public crediting at an interest rate of 23%. According to Figure 3, during the completion of the study (2016) Libya had approximate 60.639$ Billion. This development in money distribution emanated from a rise in the narrow money supply[2] or balanced heightening supply of quasi-money[3]. The above condition indicates that expansionist policy implemented by the CBL is enabling Libya to open up international market.

Otherwise, Broad Money (M3)[4]distributions are applied in some developed nations. For instance, the expansion of money markets and the instigation of the fiscal organization as well as liaison between the central bank and commercial plays

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[1]   In this study we use M2 as money supply

[*2]; Includes currency traded outside commercial banks plus demand deposits (known as current deposits) M1= CS + CD.

[3]; Includes Time deposits and savings deposits (DM).

[4]; M3 = M1 + Time Deposits at Banks.

vital role in boosting economic growth. The other factor attracting lots of revues include banks dealings involving securities from purchase and sale of securities always carried out by organizations such as lending and saving banks (AL Dujaili A, 2001).

However, the categorization of M3 is not practiced in Libya due to the absence of mechanisms of carrying out this activity. Prior to and after the rebellion, the financial condition of the community was not good hence the government could only finance the expenditures through borrowing money from CBL and through drawing down deposits from lending organizations. Otherwise, the money supply rose because of monetization of the budget shortfall; hence making the circulating currency to increase three times from 6.1$ Billion at end of 2010 to 18.8$ Billion at the finish of 2016. Apart from this rise in circulating currency, demand for money heightened, even more, leading to deficiency of liquidity in the banking system addressed by the CBL.

Undoubtedly, the financial policies used by Libya have affected the exchange rate of Libyan dinar alongside the dollar, that is, the higher the level of dinars, the lower the value of dinar as compared to the dollar. Indeed, the amount more than the dinar is supposed to be exchanged with a dollar to increase the commodity prices or to lessen the level of personal real income. For this reason, we assumed that the amount of money supply positively affects the level of prices.
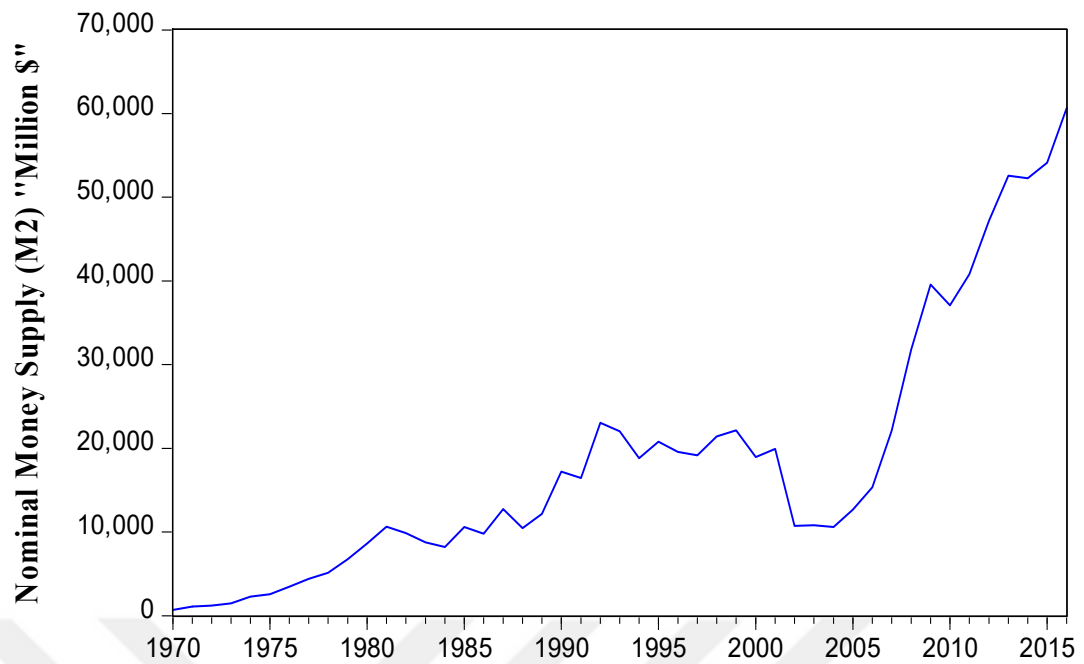
Figure 2: M2

Source: This data is sourced from Central Bank of Libya and the Libyan Statistics and Census Bureau.

3.3 Inflation in Libya

By 1970s and during early 1980s, Libya has encountered a severe rise in oil revenues because of the advancing nature of its economy and restricted availability of endogenous resources instead of oil. Moreover, the Libyan financial system experienced a rapid rise in almost entire macroeconomic variables as indicated previously, particularly, the consumer price level(Alkoum & Agil, 2013). For instance, Figure 4 denotes that the inflation went to the highest level (29%) because of the heightened level of reserves and liquidity emanating from oil revenues. However, the administration was forced to trail a contractionary strategy to minimize inflationary pressure through reducing public spending, lessening budget deficits and increasing taxes (Alshami, 2014).

On the other hand, inflation became moderate but has also denoted a considerable volatility concerning exogenous shocks and policy changes accompanied by instances of stable and stable inflation. This condition was followed by sudden bursts as shown in Figure 4. However, consumer price inflation and

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supply growth exhibited a high level of contemporaneous correlation that occurred in the middle of 1980s and 2000. Figure 3 and 4 indicates that the route of development of money distribution and the inflation rate is moving in a single direction. The above condition confirms that the QTM theory, which found that the level of money supply impacts the entire intensity of prices. Since in both year, 2000 and 2004 Libya had encountered a deflation in consumer prices index at a yearly rate of 7.2%. In between, 2004-2010 was a period of rising in oil prices accompanied by an increase in civic disbursement (investment and consumption), with the intensification rate of public spending that reached 16.5% hence leading to rising in money distribution to 20.28%. Moreover, the GDP heightening led to pushing up of inflation (ShenbischA, 2013).

The Central Bank of Libya (CBL) did non have foreign assets hence faced hardship in foreign exchange selling because of UN sanctions. The above condition was worsened by the corresponding market value of Libyan dinar (LYD) that fall drastically in 2010. In 2016, the LYD also depreciated by about 620 percent because of restriction concerning foreign exchange restrictions that were applied by the UN. Furthermore, in late 2016, there also emerged a shortage in food distribution and prospering of black markets which led to an increase in food prices by 71% (Bank, 2016). As a result, the inflation hiked to 25.9% at the same period. Nonetheless, the Central Bank failed to deal with the crisis in a professional way and did not undertake suitable measures irrespective of the aspect that it had tools and time.
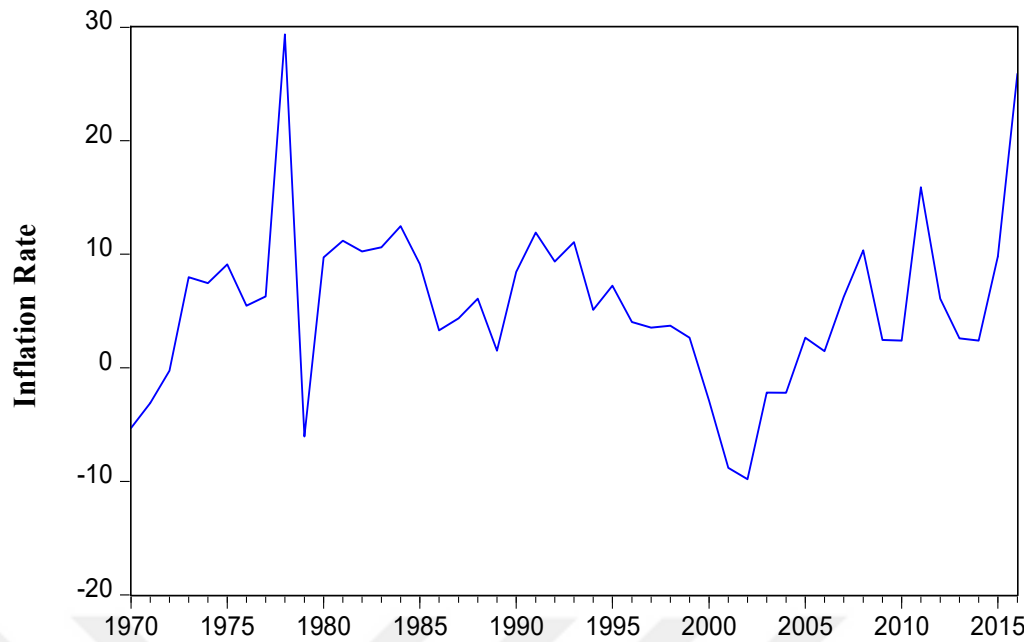
Figure 3: INF

3.4 Economic Growth

Though Libya was enjoying abundant resources, this amid the least diversified financial systems in the north Africa among different oil-producing nations. The weakening of economic situations started in the mid-1980s with the global fall of oil prices and the condition exacerbated by the imposition of intercontinental sanctions (Alhaj, 2006). Eventually, Libya suffered from a structural private investment gap, since most economic growth has relied more on public investment, and less on private investment and human capital. The above condition made Libyan financial authorities to come up with growth and transformation plans. In particular, there was started a three program that was to be implemented in three phases, that is, 1973-1975, 1976-1980, and 1981-1985.

Additionally, there were yearly investment programs that were formulated in between 1986 and 2000. Apart from the above programs, Libya was getting revenues from different sources such as agriculture contributing to about 20%, the manufacturing sector had 26% whereas the oil product donated about 54% of the gross product. All the above sectors led to an approximate 171% rise in GDP.

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Moreover, the US/UN sanctions, as well as the weakening of oil prices, subjected Libya to most influential situations hence leading to disturbance in economic growth thereby making the annual growth to drop to 3%. Furthermore, the state intervention also led to a reduction of imports' spending which caused recession aggravation and fall in the development rate of the entire local production in various sectors in 1985-2001 (Secretary of Planning, 1998). Additionally, the yearly investment policies applied during the embargo time (1986 to 2003) had not attained any noteworthy developed as indicated in Figure 5 below.
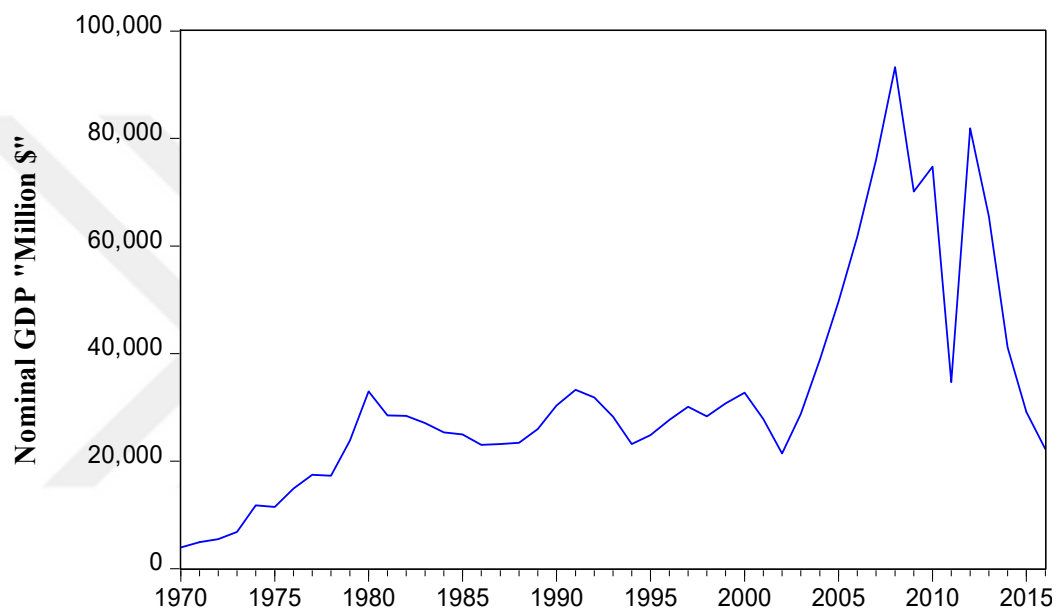
Figure 4:GDP

From the lifting of global sanctions in 2003, Libya has attained high levels of economic developments by taking advantage of the increase in international oil prices. Subsequently, state revenues have risen and spending on expansion projects has heightened too. This time also denotes the return of growth strategy, following planning that had halted in between 1980s-1990s (Mhannam, 2014). Furthermore, interest emanating from overseas investors also augmented, particularly in the hydrocarbon field. The Libyan GDP has piercingly risen by 52 percent for seven years. Based on the IMF's data, the GDP of this nation was 74.7$ Billion in 2010 as contrasted to 2003 when it was28.5$ Billion. The revenue collected from oil was more than 68% of GDP, that is, 95% of the entire GDP. Gross domestic product

(GDP) growth has been highly volatile since a civil war in 2011. The hydrocarbon sector was negatively impacted by the turmoil which led to an over 70% reduction in oil production. This fall off in production had a debilitating effect on the economy evidenced by the significant decline in GDP growth by -53%. In 2012 GDP growth was restored recording an increase of 135%. However, since 2013, Libya has been in a recession with growth contracting every year through 2015. In 2016 economic growth is declined by 24%.

CHAPTER IV

MEHTODOLOGY AND DATA

This chapter focuses on explaining the data, theoretical model as well as empirical methodology applied in the study.

4.1 Data

In this study, the causality interaction between economic growth, money supply, and inflation was analyzed through application of annual data retrieved from the Census Libya, the International Monetary Fund (IMF) and the Bureau of Statistics Central Bank of Libya in between 1960 to 2016. However, some of the information from 1960 was implemented since the previous studies didn't have a connection with the preceding years.

4.2 Method of Analysis

The Vector Auto-regression Model (VAR) is amongst tool designed to analyze the available data series. This research has also applied various developed time series approaches such as Error Correction Model Test, Unit Root Test, Diagnostic Test, Granger Causality Tests, Eviews9.1 program and Co-integration Analysis. However, the series is transformed to logarithmic form to obtain LNCPI, LNGDP and LNM2 and respectively over the period.

4.2.1 Specification of the Model

The regression framework for this research was founded on the monetarist theory, a model that shows a link between different variables. During this study, the used function or model should have variables indicating their connections. The link between inflation and pertinent economic variables can be explained in functional form as follows:-

$$lnCPI = f(lnRM2, lnRGDP)(3)$$

Where:-

$lnCPI$ = (the natural log of Consumer price index) is applied to indicate the rate of inflation.

$lnRM2$ = (the natural log of Real Money Supply) represents the supply of money.

$lnRGDP$ = (natural log of Real gross domestic product) is considered as a tool for determining economic growth in Libya.

To ensure that the regression function is in an estimation formality, the function should be restructured to a Vector Auto-regression Model and it should entail a lag period and an error term.

4.2.2 The Vector Auto-Regression Model (VAR)

The VAR model is commonly applied to investigate the connection among macroeconomic variables applicable in this study. Indeed, VAR is an econometric model that helps in capturing the progression and relationships between different times series through generalizing AR sculpts. However, all the variables in a VAR are considered to be methodological since it includes every variable in an equation as

well as explaining its evolution with regard to its lags and the wraps of the remaining variables in each mock-up. Because of this feature, Christopher Sims advice people to apply VAR sculpt for they are theory-free tactics of guesstimating economic links. As a result, this model is viewed as a substitute of the "incredible identification limitations" available in structural approaches. The VAR model calls for the application of suitable integration order from I (1) to ensure that the entire variables are stationary at the leading difference.

The *Vector Auto-regression Model* (VAR) used for determining the relationships between these variables are as follows:

$$\ln CPI_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \ln CPI_{t-i} + \sum_{i=1}^{p} \beta_2 \ln RM2_{t-i} + \sum_{i=1}^{p} \beta_3 \ln RGDP_{t-i} + \mu_t (4)$$

$$\ln RGDP = \beta_0 + \sum_{i=1}^{p} \beta_1 \ln RGDP_{t-i} + \sum_{i=1}^{p} \beta_2 \ln RM2_{t-i} + \sum_{i=1}^{p} \beta_3 \ln CPI_{t-i} + \mu_t (5)$$

$$\ln RM2_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \ln RM2_{t-i} + \sum_{i=1}^{p} \beta_2 \ln CPI_{t-i} + \sum_{i=1}^{p} \beta_3 \ln RGDP_{t-i} + \mu_t (6)$$

At this point, β stand for coefficients that are about to be estimated, **μ** represents error term, **t** is time 1, 2… 56 (that is different periods in between 1960 to 2016); "**p**" denotes the most favorable lag length of every variable.

The functional part of the above equation demonstrates the interaction between the independent and dependent variables; the error term stands for all elements that influence monetary growth and price rate that is about to be explored in this research based on the main equation (4). Moreover, the study's parameters are applied to approximate the variation concerning inflation rate and also the changes revolving around economic growth and distribution of money. As a result, the leading priority of this research is to check the availability of stationary in the series of LNRGDP, LNRM2, and LNCPI.

4.2.3 Unit Root Test

The Unit Root analysis is applied to determine the stability of three macroeconomic variables within this study. The above test is preferred because of two cogent purposes. First, this tool is used to hinder spurious regression issues. On the other hand, a common assumption underlying the use of causality analysis is that the time series in the query must be stationary. During the implementation of the above test, Phillips-Perron (PP) and Augmented Dickey-Fuller (1981) analysis are used to denote the stability of the existing variables.

4.2.3.1 Augmented Dickey-Fuller (ADF) Test and Philips Perron (PP) Test

ADF was conducted to determine the level of incorporation among the used variables. Which is based on the t-proportion of a regression to test for the non-stationary or stationary properties of the time series. In order to eliminate autocorrelation ADF test is included lagged term of the dependent variable. So a set of hypotheses is carried out by the test:

H_0: series is non-stationary

H_1: Series is stationary

$$\Delta Y_t = \alpha_1 + \gamma Y_{t-1} + \sum_{i=1}^{k} \theta \, \Delta Y_t + \varepsilon_t (7)$$

The estimation of γ considered as the most important concern of the ADF test.

Where:

k indicates to the number of lags included into the model to ensure the error terms ε_t are white noise, i.e., error terms have zero mean and constant variance through different time t.

The rejection of the null hypothesis that $H_0: \gamma = 0$ implies that the series is stationary " does not has a unit root", and the non-rejection of the null hypothesis $H_0: \gamma = 0$ mentions that the time series is non-stationary " has unit root " .

Otherwise, Phillips and Perron (1988) have on the other hand simplified the Dickey-Fuller analyses to the circumstances where commotion processes are serially linked. The PP assessment focuses on appending a 'Correction Factor' to the DF analysis statistic. Alternatively, Phillips-Perron was applied to check the availability of unit root since it also considers the serial relationship in the error terms through the application of non-parametric arithmetical technique without the inclusion of lagged distinction terms (Hussain 2011).

The Phillip-Perron analysis focuses on the below model:-

$$\Delta y_t = \vartheta + \beta \left(t - \frac{T}{2}\right) + (p-1)y_{t-1} + \chi \Delta y_{t-1} + \varepsilon_t (8)$$

For the asymptotic specialization of the Phillips and Perron (1988) analysis looks similar to that of Dickey-Fuller assessment, then the identical critical values are applied for both Phillips Perron and ADF tests. Indeed, the Phillips Perron evaluation is considered to be more powerful as compared to the ADF analysis.

4.2.3.2 The KPSS

The KPSS test is used to analyze the stochastic constituents of a series as well as evaluating stillness of the hypothesis through assessing the problem beneath null stability against the substitute of the non-stationary variable. As a result, the differential yt is considered stationary beneath the null hence the analysis is derived under the void and it is suggested that it will make it more probable than when viewed under the ADF test. The above argument is based on the aspect that the ADF analysis does not reject the proposition that the provided series are stationary. The above outcome will rely on the sample chosen and the nature of the obtained information. Afar from ADF analysis having a null proposition of a unit root, the

KPSS assessment holds that under null hypothesis there is always a stationary process. Trailed by KPSS (1992), the suggestion behind the conjoining is that despite the integration of multivariate time series, some linear transformations in a given time series can emerge stationary.

4.2.4 Determination of Lag Length

With regard to Tsay (2005), there exist various means of establishing the order p of a VAR procedure which is based on suggestions. Our research has engrossed the Akaike Information Criterion (AIC) to determine the lag length of an autoregressive model (VAR) for the information procedure is well known as it is said by Tsay (2005). The above method was utilized in selecting the lags having minimum AIC values.

4.2.5 Diagnostic Tests

In the process of testing dependability and ensuring the statistical soundness of the used sculpt, the researchers are confirmed to have used various diagnostic analyses such as Inverse Roots of AR Characteristics Polynomial, Serial Correlation LM.

4.2.6 Co-Integration Test

The co-integration refers to a statistical method which explores the subsistence of connection and long-run balance interactions on different variables which are incorporated into a single order. However, the co-integration analysis is therefore conducted to determine if the chosen system is applicable. When the time-series becomes co-joined as indicated by Granger (1988), the conventional checks would lose out some of the "prediction constancy" and therefore accomplish erroneous winding ups.

4.2.7 Error Correction Model Test (ECM)

An ECM fits into a category of multiple time series sculpts that are normally applied to data where the underlying variables have a long-term statistic inclination which is also recognized as a con-integration. The ECMs are hypothetically-driven methods for determining both long-term and short-term impacts of on-time series. On the other hand, the phrase error-correction links to the aspect that the last-periods divergence emanating from long-run balance and the error has the capability of affecting its short-run courses. As a result, the ECMs tend to directly estimate the rate at which a dependent variable gets back to equilibrium following an alteration in other variables.

4.2.8 Pair-wise Granger Causality Tests

For researchers to study causality between economic growth, money supply, and inflation, the causality aspect caused by Granger is applied to assess the prediction of three variables. To determine the causality occurring between the money supply, inflation and economic growth, below models were applied:

$$lnCPI_t = \beta_0 + \beta_1 lnRM2_{t-1} + \beta_2 lnRGDP_{t-1} + u1_t \quad (9)$$

$$lnRM2_t = \beta_3 + \beta_4 lnCPI_{t-1} + \beta_5 lnGDP_{t-1} + u2_t \quad (10)$$

$$lnRGDP_t = \beta_6 + \beta_7 lnRM2_{t-1} + \beta_8 lnCPI_{t-1} + u3_t \quad (11)$$

Where

$lnCPI_t$ -is the Consumer Price Index (proxy price increases) at "t" time.

$lnRM2_t$ – is a function ofReal Money supply at"t" time.

$lnRGDP_t$ – stands for Real Gross Domestic Product at "t" time.

u_t – represents the Random error terms.

Granger causality denotes that when lnRM2t and lnRGDP Granger lead to lnCPI, subsequently lnRM2 and lnRGDP are helpful forecasters of lnCPI in function (9), It moreover happens with changeable in equations (10) and (11).

As a result, three sequences of causality are anticipated to occur in between different variables, that is,

i. There may emerge a unidirectional pattern, a causality emanating from the first to the second variable,

ii. Furthermore, the may occur a bi-directional outline, a causality from the first to second variable and there verse is true.

iii. Both bi-directional and unidirectional course may fail to emerge.

4.2.9 Impulse Response Analysis (IRF)

IRF of a dynamic system is recognized as an impulse when presented with a concise input indicator. More commonly, an impulse reaction stands for the response of any dynamic system in comeback to some peripheral modification. With regard to equations 9, 10, and 11 where $u1_t$ to $u3_t$ stands for error term, then we can refer the above terms as the sock or impulses or innovation.

Where:

The alteration in $u1, u2\ and\ u3$ will lead to changes on $LnCPI_t, LRM2_t$ and also $LRGDP_t$ at the subsequent time. On the other hand, in an instance where there exist variations or distresses in $u1, u2\ and u3$ this transformation shall impact the $LCPI_t, LRM2_t$ as well as $LRGDP_t$.

CHAPTER V

EMPIRICAL RESULTS

In this chapter, we present the findings of the analyses that were done using the dataset and the methods described in the above-mentioned chapter.

Below are the definitions of the variables used in research:

LNRM2 =Real logarithmic real money supply

LNCPI = Logarithmic Consumer Price Index (define inflation)

LNRGDP = Real logarithmic GDP (define economic growth)

The empirical models which are estimated in this study are as following:-

Empirical Model (1960-2016)Without Dummy.

Empirical Model (1960-2016)With Dummy.

Empirical Model (1960-2010)With Dummy.

5.1 Empirical Model (1960-2016)Without Dummy

In the research, the time trace graphics were studied at first in order to gain more information about the structure of the variables to be used in the model, then they were assessed through unit root tests in order to check whether they met the stationary condition or not.

Figure 5 presents the time related progress of the series used in the research.
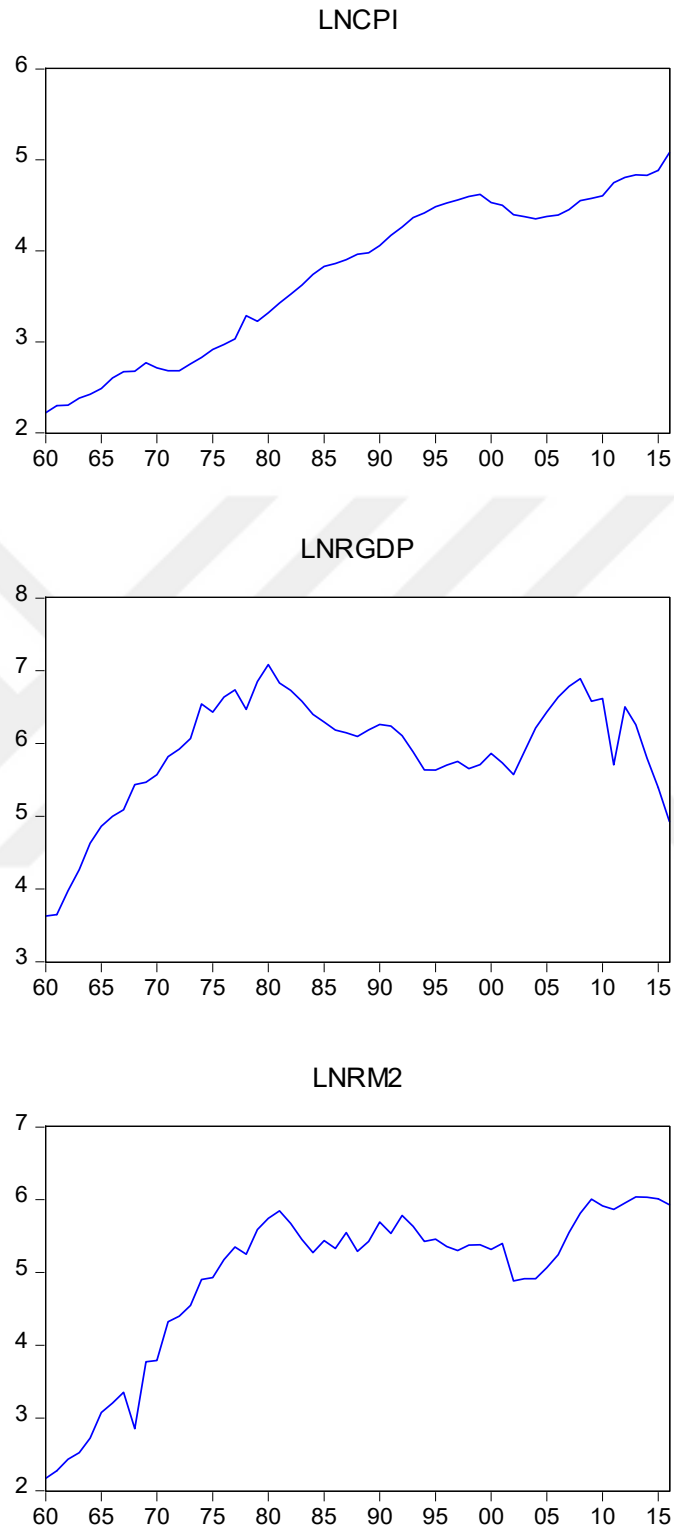
Figure 5: Time Trace Graphics of LNRM2, LNCPI, LNRGDP Series

Figure 5shows that the series has a trend structure. Though the series have a rather fluctuating structure, they have an upward trend in general.

Once the time trace graphics of the series used in the research are studied, time series are needed to be tested as the second step in order to check whether they are stationary or not. Augmented Dickey-Fuller (ADF) (1981), Phillips-Perron (PP) (1980) and Kwiatkowski, Phillips, Schmidt, Shin (KPSS) (1992) unit root tests are used in determining whether the series included in this research have unit roots or not. The reason for giving place to all the three tests at the same time is to support the results of the stationary test.

Table 2presents the ADF and PP unit root test results belonging to the variables used in this research. The values given in brackets show the length of lag. Schwarz (SIC) information criterion is used in determining how many period lags of the dependent variable will take place on the right side of the regression equation in unit root tests.

Table 2:ADF and PP Unit Root Test Results

Variable	ADF test statistics		Fixed, Trend	Phillips-Perron test statistics		Fixed, Trend	Result
LNRM2	-1,99363(0)	P=0.5920	Fixed	-1,99363(0)*	P=0.5920	Fixed	Has unit root
LNCPI	-1,043174 (0)	P=0.7317	Fixed	-0,949933 (4)*	P=0.7648	Fixed	Has unit root
LNRGDP	-1,622722 (0)	P=0.7713	Fixed, Trend	-1,478929(2)*	P=0.8252	Fixed, Trend	Has unit root
DLNRM2	-8,978036 (0)	P=0.0000	Fixed, Trend	-8,853175(4)*	P=0.0000	Fixed	Doesn't have unit root
DLNCPI	-5,709538 (0)	P=0.0000	Fixed	-5,878357(3)*	P=0.0000	Fixed	Doesn't have unit root
DLNRGDP	-7,816042 (0)	P=0.0000	Fixed, Trend	-7,817674(3)*	P=0.0000	Fixed	Doesn't have unit root

Note: If p-value is higher than 0.05 at the end of the tests, it means unit root is detected; otherwise, it means there is no unit root. *Bandwidth (Newey-West using Barlett kernel) Phillips-Perron.

The results of the ADF and PP unit root tests applied on the levels of the variables showed that the variables were not stationary. The results obtained when the same tests were applied on the first degree difference of the variables show that the difference of the variables is stationary I(1). Furthermore; KPSS trend stationary test was performed in order to support that the difference of series was stationary. KPSS test results are presented in Table 3.

Table 3: KPSS Test Results

Variable`	LM-Stat	Fixed, Trend	Asymptotic Critical Value (%5)	Result
LNCPI	0.172079	fixed, trend	0.146000	not stationary (has unit root)
LNRM2	0.189810	fixed, trend	0.146000	not stationary (has unit root)
LNRGDP	0.176301	fixed, trend	0.146000	not stationary (has unit root)
DLNCPI	0.142463	fixed	0.463000	Stationary (doesn't have unit root)
DLNRM2	0.105710	fixed, trend	0.146000	stationary (doesn't have unit root)
DLNRGDP	0.103059	fixed, trend	0.146000	Stationary (doesn't have unit root)

In Table 3, LM test statistics belonging to the levels of the variables show that there is %5 significance level; they are not stationary as KPSS test is absolutely higher than the critical values and they have unit roots. The results obtained when the variables of the same test are applied on the first degree difference show that the difference of variables is stationary I(1).

Considering the variables to be included in the model, all of them are observed to be stationary at the same degree, that is, at the first degree. This also enables the performance of co-integration analysis together with the VAR analysis.

The most significant condition in establishing VAR model is the accurate estimation of VAR lag length determined by the information criteria. As the

variables to be included in the model are stationary at the same degree, the levels of these variables are used in VAR analysis. Table 4 presents the VAR lag length.

Table 4: Determination of VAR Lag Length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-119.7174	NA	0.022512	4.719899	4.832471	4.763056
1	90.13959	387.4282*	9.95e-06*	-3.005369*	-2.555082*	-2.832740*
2	94.59441	7.710267	1.19e-05	-2.830554	-2.042552	-2.528453
3	96.92928	3.771702	1.55e-05	-2.574203	-1.448485	-2.142629
4	105.0656	12.20443	1.63e-05	-2.540983	-1.077550	-1.979938
5	116.6452	16.03339	1.52e-05	-2.640201	-0.839053	-1.949684

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

As seen in Table 4; LR, FPE, AIC, SC and HQ information criteria indicate 1 lag. So, VAR lag length is determined as one because the criterion involved selecting lags with minimum AIC values (**-3.005369**). Stability of the 1 lagged VAR model is tested through the following tests.

Table 5: Inverse Roots of AR Characteristic Polynomial

Root	Modulus
0.937265	0.937265
0.919689 - 0.113568i	0.926674
0.919689 + 0.113568i	0.926674
-0.321457	0.321457
-0.256604	0.256604
0.137972	0.137972

Eviews 9.1 Output

As can be seen in table 5, no modulus value is outside reference range. This shows that the established VAR model is stable. Inverse Roots of AR characteristic

polynomial in FIGURE 6, which enables the interpretation of the same analysis through graphic, must be assessed in unit circle analysis.

Inverse Roots of AR Characteristic Polynomial
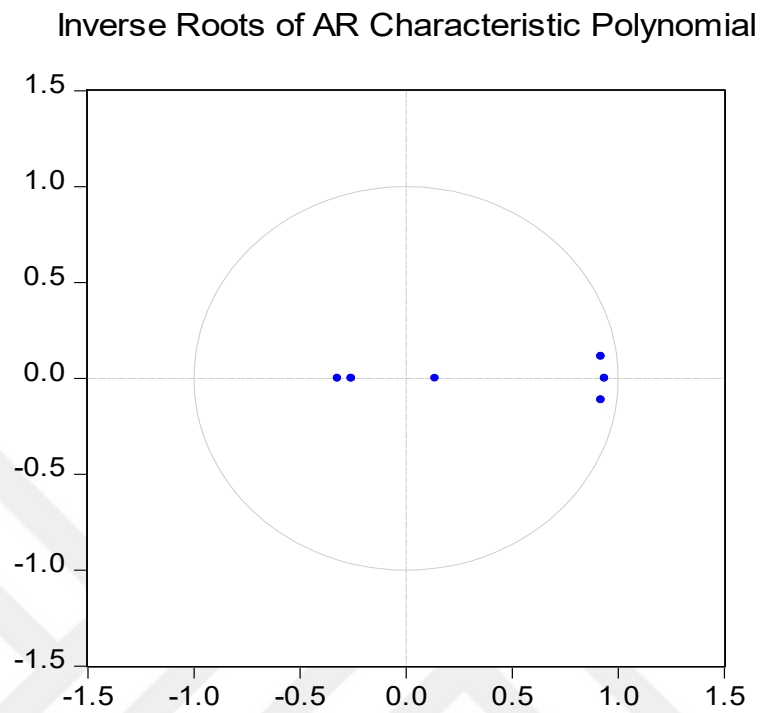
Figure6: Inverse Roots of AR Characteristic Polynomial

No AR root is outside the unit circle according to FIGURE 6, which most obviously supports that the established VAR model is stationary.

According to the Table 5 and FIGURE 6,All (inverse) roots have modulus less than one.

Table 6: Serial Correlation LM Test

Lags	LM-Stat	Prob
1	4.222105	0.8962
2	4.060985	0.9074
3	13.06690	0.1596
4	15.62255	0.0752
5	7.185119	0.6179
6	5.465061	0.7920
7	3.113695	0.9596
8	2.779211	0.9724
9	2.240445	0.9871

When the probability values in LM test given in Table 6 are studied, the null hypothesis claiming that there is no serial correlation in the series, cannot be rejected, because Prob-values are greater than 5%.

After completing the analysis which claims that the VAR model is structurally consistent, co-integration analysis was performed. JJ co-integration test results are given in Table 7.

Table 7: Co-integration Analysis

UnrestrictedCointegrationRank Test (Trace)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.**
None *	**0.353762**	**37.65485**	**29.79707**	**0.0051**
At most 1	0.140353	13.64256	1549471	0.0933
At most 2	0.092275	5.324743	3.841466	0.0210

Trace test indicates 1 cointegratingeqn(s) at the 0.05 level.

* denotes rejection of thehypothesis at the 0.05 level.

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

UnrestrictedCointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob.**
None *	**0.353762**	**24.01229**	**21.13162**	**0.0191**
At most 1	0.140353	8.317820	14.26460	0.3473
At most 2	0.092275	5.324743	3.841466	0.02110

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

* denotes rejection of thehypothesis at the 0.05 level

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

Normalizedcointegratingcoefficients (standarderror in parentheses)		
LNCPI	**LNRGDP**	**LNRM2**
1.000000	2.398412	-3.394327
	(0.69021)	(0.52513)

Table 7; shows that T.statistic value (37.64585) according to Trace test is greater than Critical Value (29.79707). Also, Max-Eigen Statistic value (24.01229) is higher than Critical Value (21.13162).Based on this result, the null hypothesis, which claims the absence of no co-integration, was rejected by trace and maximum

eigenvalue test statistics and one co-integration relation was found in the model. So it can be said that there is a long term relation among LNCPI (price level), LNRM2 (money supply) and LNRGDP variables. Therefore, that these two variables (LNRM2 and LNRGDP) are individually cointegrated with the aggregate consumer price index. Thus, there is long-run equilibrium relationship between aggregate price, money supply and economic growth.

The normalized coefficients of long run relationship in table (7) show that the coefficient can be interpreted as the long run elasticities setting lag=1 both money supply and economic growth have an impact on inflation. With inflation showing relatively more degree of responsiveness to changing the Money supply as compared to economic growth.

The long-run equilibrium relationship among the tested variables is based on the following cointegrating vector:

$$(1.000, 2.398412, -3.394327)$$

the coefficient for LNCPI, LNRM2 and LNRGDP are represented by the above values. Hence, the long-run equilibrium relationship can be expressed as:

$$LNCPI = -2.398412LNRGDP + 3.394327LNRM2$$

The long run effect of GDP on aggregate price is negative and statistically significant at 5 percent level. When RGDP increases by 1 % the price level will decrease by 2.4 percent, hence the direction of relation is negative. On the other hand, aggregate price is positively related to money supply in the long run and it is statistically significant at 5 percent level. The general price level increases by 3.394327% when real money supply increases by 1%.Clearly, this finding is consistent with the monetarist view that in the long run, the changes in the money supply will lead to price change.

The long term relation among the variables makes possible the establishment of a vector error correction model (VECM) that obviously includes the error correction term obtained though co-integration regressions and thus, it was aimed to find the source of causality. Test results belonging to vector error correction model are given in Table 8.

Table 8: Vector Error Correction Model Test Results

Error Correction:	D(LNCPI,2)	D(LNRGDP,2)	D(LNRM2,2)
CointEq1	-0.063322	-0.180022	1.052791
	(0.07329)	(0.32766)	(0.22714)
	[-0.86402]	[-0.54942]	[4.63497]
D(LNCPI(-1),2)	-0.425159	0.086979	-0.574428
	(0.14370)	(0.64246)	(0.44537)
	[-2.95868]	[0.13539]	[-1.28979]
D(LNRGDP(-1),2)	0.046151	-0.529272	-0.294253
	(0.04072)	(0.18203)	(0.12619)
	[1.13349]	[-2.90755]	[-2.33183]
D(LNRM2(-1),2)	-0.045512	-0.078065	-0.252449
	(0.04226)	(0.18894)	(0.13098)
	[-1.07695]	[-0.41318]	[-1.92745]
C	0.003616	-0.018964	-0.007505
	(0.00942)	(0.04211)	(0.02919)
	[0.38392]	[-0.45030]	[-0.25706]
R-squared	0.273653	0.369382	0.655141
Adj. R-squared	0.214360	0.317903	0.626989
Sum sq. resids	0.234551	4.688362	2.253031
S.E. equation	0.069186	0.309323	0.214430
F-statistic	4.615222	7.175389	23.27177
Log likelihood	70.23212	-10.63736	9.148427
Akaike AIC	-2.416004	0.579162	-0.153645
Schwarz SC	-2.231839	0.763327	0.030520
Mean dependent	0.003515	-0.014664	-0.004401
S.D. dependent	0.078056	0.374532	0.351095
Determinant resid covariance (dof adj.)	1.58E-05		
Determinant resid covariance	1.18E-05		
Log likelihood	76.55704		
Akaike information criterion	-2.168779		
Schwarz criterion	-1.505785		

Values in () shows Standard Error
Values in [] shows T.Statistic

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ECT (-1) is the error correction term obtained through long term co-integrated relation and it shows the size of the past imbalance. In practice, error correction coefficient is expected to be negative and statistically significant. According to the test results of the error correction model, the mark of error correction coefficient is negative but statistically insignificant at 5 percent level for equations (1) and (2). On the other hand; in equation (1), the mark of error correction has a positive sign. For this reason, VECM model is useless for this model.

Table 9: Pairwise Granger Causality Tests

NullHypothesis:	Obs	F-Statistic	Prob.
DLNGDP does not GrangerCause DLNCPI	55	0.23144	0.6325
DLNCPI does not GrangerCause DLNGDP		0.0558	0.8145
DLNM2 does not GrangerCause DLNCPI	55	0.08694	0.7693
DLNCPI does not GrangerCause DLNM2		0.11067	0.7407
DLNM2 does not GrangerCause DLNGDP	55	0.16947	0.6823
DLNGDP does not GrangerCause DLNM2		**8.30258**	**0.0057**

Eviews 9.1 Output

Pairwise Granger Causality Test was also performed. The results obtained through this test are presented in Table 9. Results show that there is no short term causality relation among the variables according to 5% and 10% significance level. But, there is short term causality relation between economic growth and money supply (uni-directional) according to 5% significance level.

In another word, Null hypothesis is not rejected at 5% and 10% significance level. While, Null hypothesis of the economic growth can not cause the money supply is rejected at 5% significance level, based on the empirical results that showed that uni-directional causality exists between economic growth and money supply running from RGDP to RM2in short run.

Following causality tests, impulse-response analysis are given place in this section. The dashed lines in graphics indicate the confidence limits of "one" standard error whereas the straight lines indicate the point estimations.

Response to Cholesky One S.D. Innovations ± 2 S.E.
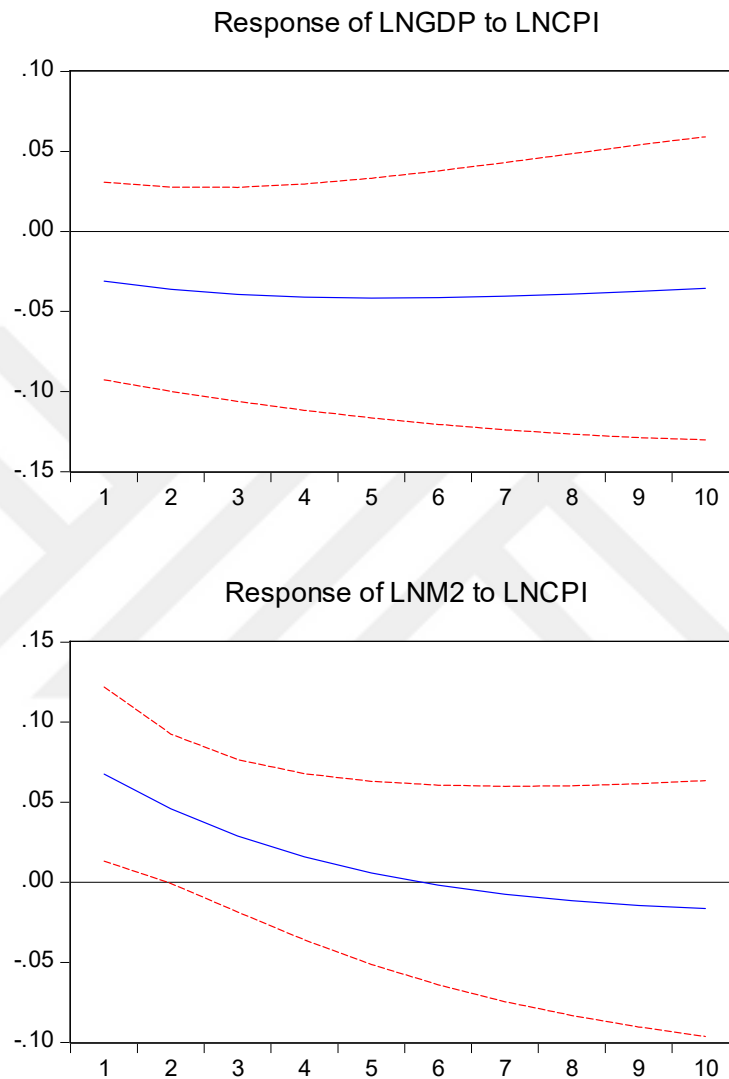
Figure 7: Impulse Response Analysis (Response of LNRGDP and LNRM2 to LNCPI)

As can be seen in graphic, the effect of inflation on the economic growth is negative all throughout the ten periods, whereas the effect of inflation on money supply is positive up to 6 period and then negative.

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of LNCPI to LNGDP

Response of LNM2 to LNGDP
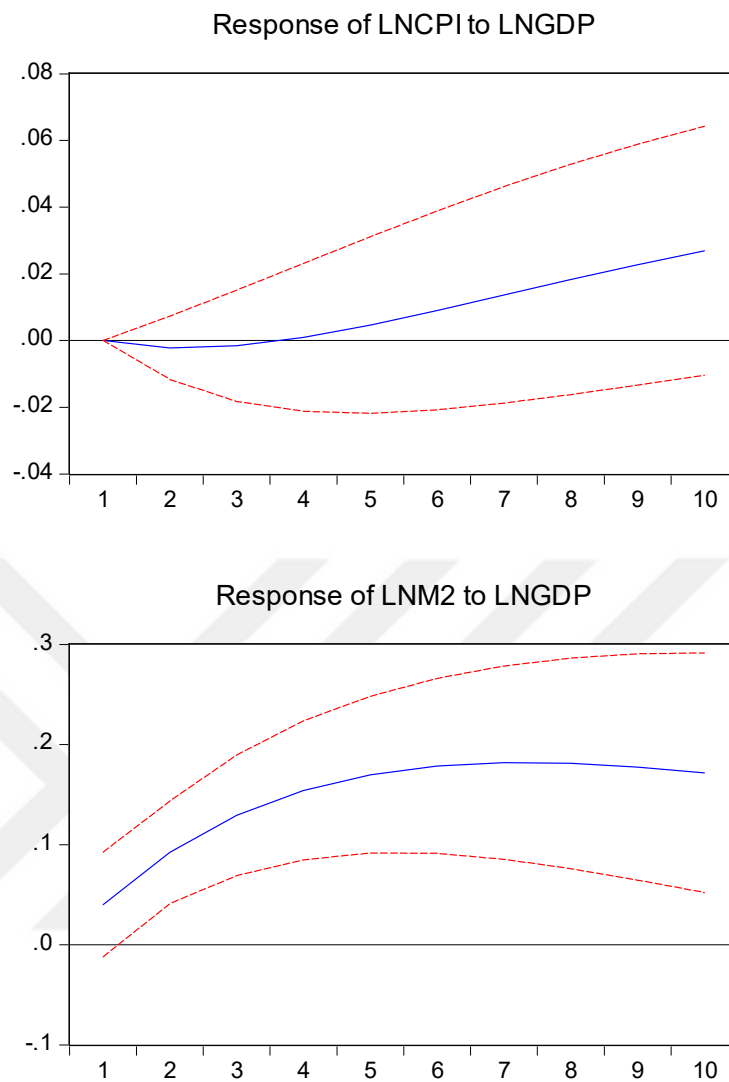
Figure8: Impulse-Response Analyses (Response of LNCPI and LNRM2 to LNRGDP)

FIGURE8represents IRF of economic growth to other variables in the VAR model.

As can be seen in graphic, the effect of economic growth on inflation is negative up to 4th period and then positive. The effect of economic growth on money supply is positive.

Also we can say the economic growth had a negative impact on inflation for the first 4 years and later became a long run positive influence in all the periods. While economic growth had an early and positive impact on money supply for 6 years, then became steady.

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of LNCPI to LNM2

Response of LNGDP to LNM2
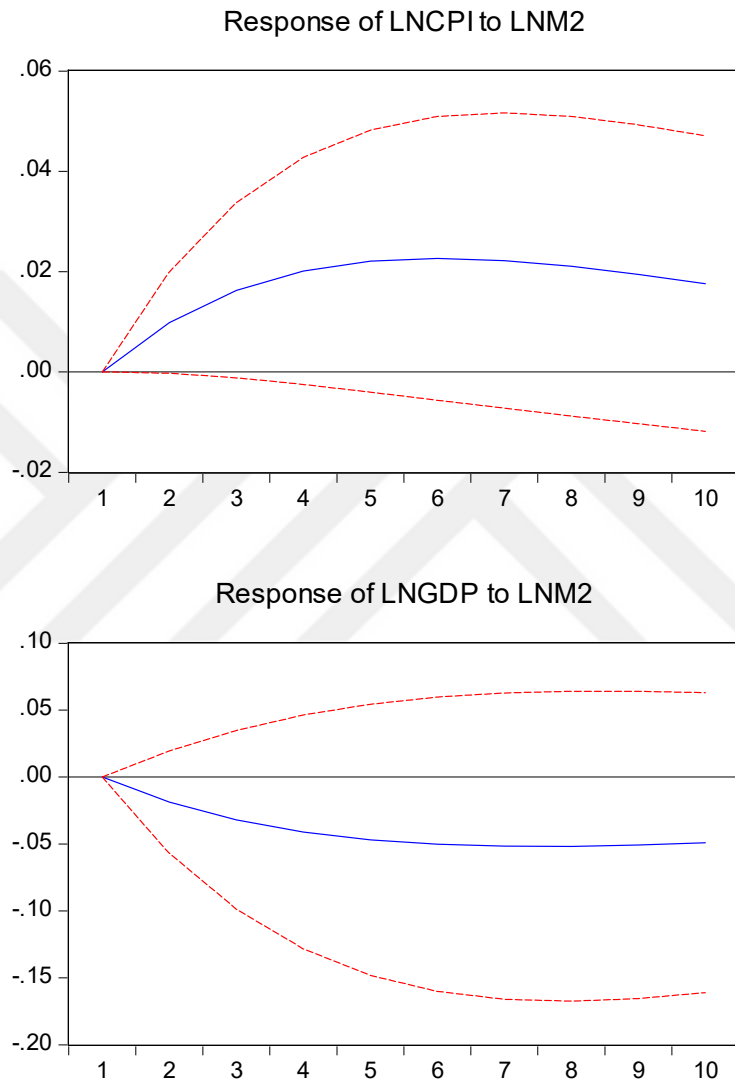
Figure9: Impulse-Response Analyses (Response of LNCPI and LNRGDP to LNRM2)

As can be seen in graphic, the effect of money supply on inflation is positive but the effect of money supply on economic growth is negative.

More clearly, the inflation responds positively and significantly with the changes in money supply in line with the quantity of money theory that the price level directly changes with the change in money supply. On the other hand we find that money supply has a negative, seemingly permanent effect on economic growth.

5.2 Empirical Model (1960-2016)With Dummy "1970 & 1986"   *

According to this model, the dummy variables are constructed for two periods 1970 and 1986 because of The significant rise in the price level, and the imposed sanctions from UN/US.

Comparison with the results of Johansen test in the first model that showed similar results, is that the three variables are co-integrated in long-term as trace and maximum eigenvalue tests presented. However, maximum eigenvalue test indicates 1 co-integrating among the variables. The normalized coefficients of long run relationship also show that the money supply plays the main role in causing inflation in long run. while the economic growth has a negative impact on the price level.

The long-run equilibrium relationship among the tested variables is based on the following cointegrating vector:

$$(1.000, 0.725785, -0.930790)$$

When rewriting the equation can be obtained the long-run equilibrium equation:-

$$LNCPI= -0.725785LNRGDP + 0.930790LNRM2$$

It can be said that the growth in money by 1 percent causes the rise in aggregate price by 0.93 percent. Furthermore, when the real output grows up by 1 %, it will decrease the price level 0.725785 percent in long term.

---

*   All the results are attached in the Appendix 3

Consequently, Vector Error Correction Model Test is useless for this model. In addition to, the Granger Causality Tests Impulse Response Analysis show the same previous results

Furthermore, Impulse Response Analysis shows that the effect of inflation on the economic growth is negative through the first period, and then positive as well as near to the zero line. Whereas the effect of inflation on money supply is positive and close to the zero line as can be seen in graphic.

As can be seen in graphic, the effect of economic growth on inflation is positive. The effect of economic growth on money supply is positive except in the third period is negative, then positive again.

As can be seen in graphic, the effect of money supply on inflation is positive and near to the zero line, but the effect of money supply on economic growth is positive for the three periods then Fluctuating between a positive and negative response (see Appendix).

5.3 Empirical Model (1960-2010) with dummy "1970&1986"
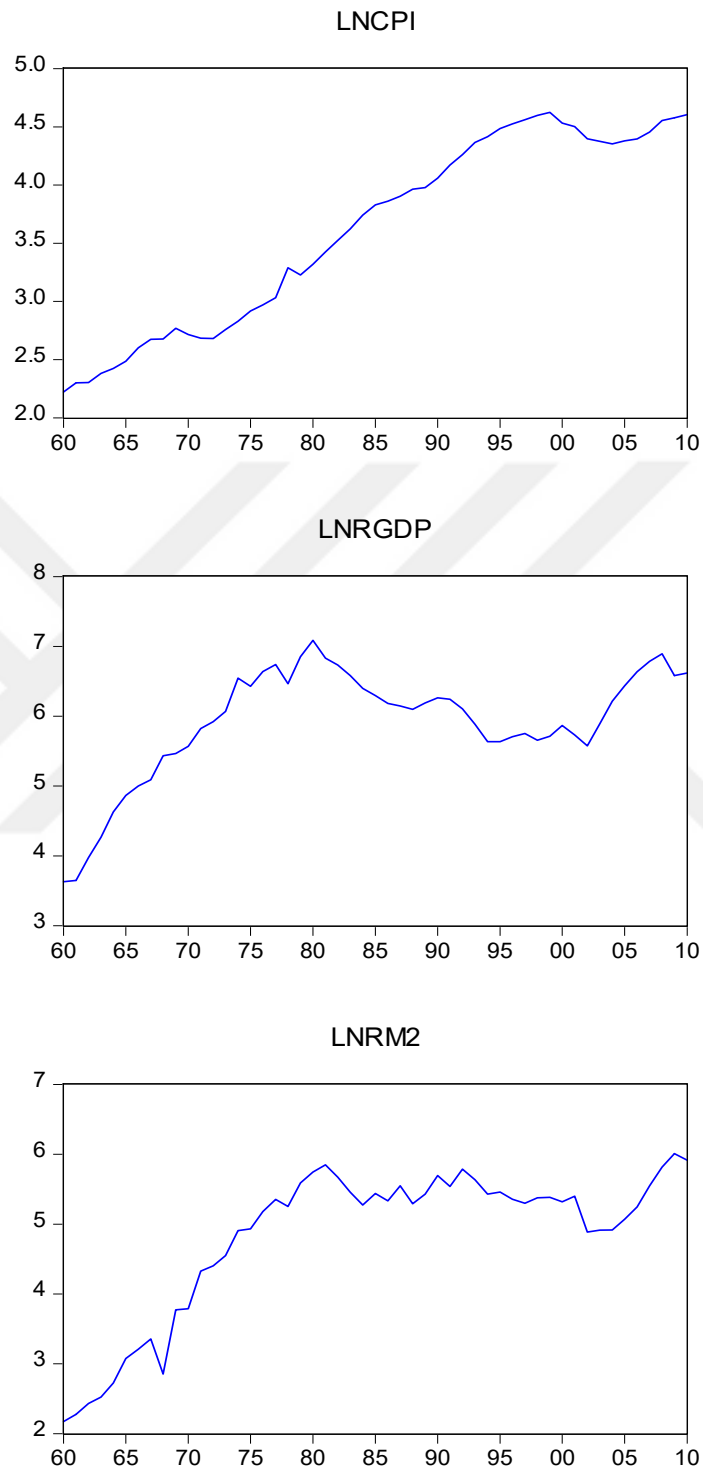
LNCPI

LNRGDP

LNRM2

Figure 10: Time Trace Graphics of LNCPI, LNRGDP,LNRM2 Series

Also the series has a trend structure. Though the series have a rather fluctuating structure, they have an upward trend in general.

Table 10:ADF and PP Unit Root Test Results

Variable	ADF test statistics		Fixed, Trend	Phillips-Perron test statistics		Fixed, Trend	Result
LN RM2	-1,865513(0)	P=0.6573	Fixed	-1,834150(0)*	P=0.6731	Fixed	Has unit root
LNCPI	-0.282845 (0)	P=0.9891	Fixed	-0,865024 (4)*	P=0.9519	Fixed	Has unit root
LNRGDP	-2.663531 (0)	P=0.2558	Fixed, Trend	-2.383800(2)*	P=0.3832	Fixed, Trend	Has unit root
DLNRM2	-8,502640 (0)	P=0.0000	Fixed, Trend	-8,378130(4)*	P=0.0000	Fixed	Duesn't have Unit root
DLNCPI	-5.591153 (0)	P=0.0002	Fixed	-5,829423(3)*	P=0.0001	Fixed	Doesn't have Unit root
DLNRGDP	-5.398105 (0)	P=0.0003	Fixed, Trend	-5.557512(3)*	P=0.0002	Fixed	Doesn't have Unit root

Table 11:KPSS Test Results

Variable`	LM-Stat	Fixed, Trend	Asymptotic Critical Value (%5)	Result
LNCPI	0.163336	fixed, trend	0.146000	not stationary (has unit root)
LNM2	0.217269	fixed, trend	0.146000	not stationary (has unit root)
LNGDP	0.176182	fixed, trend	0.146000	not stationary (has unit root)
DLNCPI	0.110601	fixed	0.146000	Stationary (doesn't have unit root)
DLNM2	0.134684	fixed, trend	0.146000	stationary (doesn't have unit root)
DLNGDP	0.173825	fixed, trend	0.146000	Stationary (doesn't have unit root)

The results of the ADF, PP and KPSS unit root tests applied on the levels of the variables showed that the variables were not stationary. The results obtained when the same tests were applied on the first degree difference of the variables show that the difference of the variables is stationary. This means that all the variables are I(1).

Table 12: Determination of VAR Lag Length

VAR Lag Order Selection Criteria
Endogenous variables: LNCPI LNRGDP LNRM2
Exogenous variables: C
Date: 02/23/18   Time: 19:28
Sample: 1960 2010
Included observations: 46

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-96.49393	NA	0.015180	4.325823	4.445082	4.370498
1	101.9443	362.3654*	4.03e-06*	-3.910621*	-3.433584*	-3.731920*
2	107.6216	9.626783	4.68e-06	-3.766157	-2.931342	-3.453430
3	111.9700	6.806187	5.81e-06	-3.563913	-2.371321	-3.117161
4	119.2750	10.48100	6.42e-06	-3.490215	-1.939845	-2.909437
5	131.4598	15.89328	5.84e-06	-3.628687	-1.720539	-2.913883

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR lag length is determined as one also because the criterion involved selecting lags with minimum AIC values (**-3.910621**).

Table 13: Inverse Roots of AR Characteristic Polynomial

Roots of Characteristic Polynomial
Endogenous variables: LNCPI LNRGDP LNRM2
Exogenous variables: C
Lag specification: 1 2
Date: 02/23/18   Time: 19:29

Root	Modulus
0.952780	0.952780
0.874478 - 0.120500i	0.882741
0.874478 + 0.120500i	0.882741
-0.334180	0.334180
0.065825 - 0.171138i	0.183361
0.065825 + 0.171138i	0.183361

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial
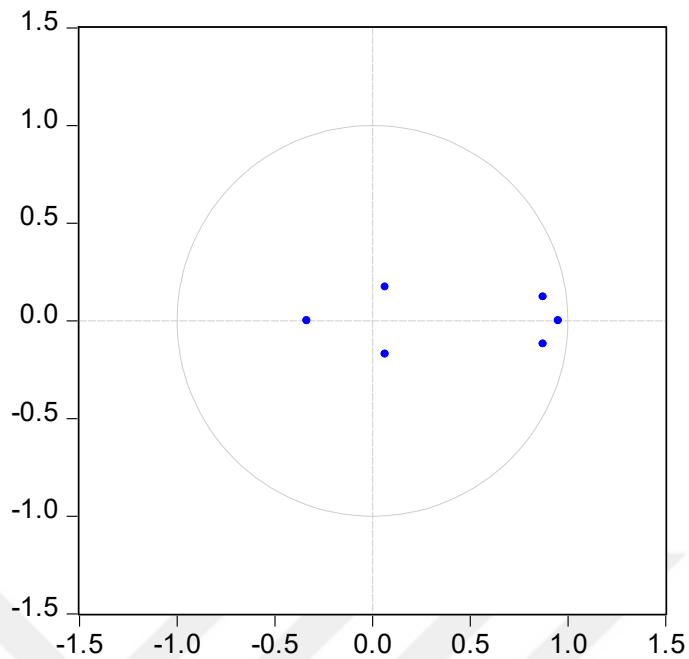
According to the Table 13 and FIGURE, All (inverse) roots have modulus less than one. So, VAR model is stationary.

Table 14: Serial Correlation LM Test

Lags	LM-Stat	Prob
1	5.762379	0.7634
2	7.922100	0.5420
3	10.41899	0.3176
4	14.61420	0.1021
5	5.204443	0.8161
6	8.241502	0.5100
7	3.584995	0.9365
8	3.807799	0.9236
9	3.812572	0.9233

Probs from chi-square with 9 df.

LM Test showed that there is no serial correlation in the series. Thus, the results proved VAR model is structurally consistent.

Table 15: Co-integration Analysis

Date: 02/19/18   Time: 16:41
Sample (adjusted): 1963 2010
Included observations: 48 after adjustments
Trend assumption: Linear deterministic trend
Series: D(LNCPI) D(LNRM2) D(LNRGDP)
Exogenous series: DUMMEY
Warning: Critical values assume no exogenous series
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.428951	47.71721	29.79707	0.0002
At most 1 *	0.230711	20.82378	15.49471	0.0071
At most 2 *	0.157633	8.233922	3.841466	0.0041

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.428951	26.89343	21.13162	0.0069
At most 1	0.230711	12.58986	14.26460	0.0904
At most 2 *	0.157633	8.233922	3.841466	0.0041

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

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

D(LNCPI)	D(LNRM2)	D(LNRGDP)
5.069810	-7.681963	7.877257
2.820460	-3.482127	-3.733822
22.03938	0.145221	2.139593

Unrestricted Adjustment Coefficients (alpha):

D(LNCPI,2)	0.010830	-0.018974	-0.016130
D(LNRM2,2)	0.145713	0.047602	-0.002038
D(LNRGDP,2)	-0.030052	0.091295	-0.024374

(Continued)

Unrestricted Adjustment Coefficients (alpha):			
D(LNCPI,2)	0.010830	-0.018974	-0.016130
D(LNRM2,2)	0.145713	0.047602	-0.002038
D(LNRGDP,2)	-0.030052	0.091295	-0.024374

1 Cointegrating Equation(s):	Log likelihood	96.02318

Normalized cointegrating coefficients (standard error in parentheses)

D(LNCPI)	D(LNRM2)	D(LNRGDP)
1.000000	-1.515237	1.553758
	(0.28779)	(0.29231)

Adjustment coefficients (standard error in parentheses)

D(LNCPI,2)	0.054905
	(0.04539)
D(LNRM2,2)	0.738736
	(0.15272)
D(LNRGDP,2)	-0.152360
	(0.15859)

2 Cointegrating Equation(s):	Log likelihood	102.3181

Normalized cointegrating coefficients (standard error in parentheses)

D(LNCPI)	D(LNRM2)	D(LNRGDP)
1.000000	0.000000	-13.98291
		(3.75883)
0.000000	1.000000	-10.25363
		(2.52785)

Adjustment coefficients (standard error in parentheses)

D(LNCPI,2)	0.001388	-0.017123
	(0.04909)	(0.07137)
D(LNRM2,2)	0.872995	-1.285116
	(0.16949)	(0.24641)
D(LNRGDP,2)	0.105135	-0.087041
	(0.16204)	(0.23557)

Table 15; shows that T.statistic value (47.711721) according to Trace test is greater than Critical Value (29.79707). Also, Max-Eigen Statistic value (26.89343) is higher than Critical Value (21.13162). So it can be said that there is a long term relation among LNCPI (inflation), LNRM2 (money supply) and LNRGDP (economic growth) variables. Based on the result of maximum eigenvalue test statistics one co-integration relation was found in the model.

The normalized coefficients of long run relationship in table 15 show that the coefficient can be interpreted as the long run elasticities setting lag=1 both money supply and economic growth have an impact on inflation.

The long-run equilibrium relationship among the tested variables is based on the following cointegrating vector:

$$(1.0000, -1.515237, 1.553758)$$

Hence, the long-run equilibrium relationship can be expressed as:

$$LNCPI = -1.553758LNRGDP + 1.515237LNRM2$$

Consequently, there is a positive relationship between the money growth and price level. When the real money supply rises by 1 % the aggregate price increases by 1.15 percent. However, a negative directional was found among economic growth and aggregate price. Economic growth by 1 percent will reduce the price level by 1.55 in long run.

The long term relation among the variables makes possible the establishment of a vector error correction model (VECM) that obviously includes the error correction term obtained though co-integration regressions and thus, it was aimed to find the source of causality.

Table 16: Vector Error Correction Model Test Results

Vector Error Correction Estimates
Date: 02/25/18   Time: 13:32
Sample (adjusted): 1963 2010
Included observations: 48 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
D(LNCPI(-1))	1.000000
D(LNRGDP(-1))	1.553758
	(0.29231)
	[5.31553]
D(LNRM2(-1))	-1.515237
	(0.28779)
	[-5.26507]
C	-0.024558

Error Correction:	D(LNCPI,2)	D(LNRGDP,2)	D(LNRM2,2)
CointEq1	0.054905	-0.152360	0.738736
	(0.04539)	(0.15859)	(0.15272)
	[1.20952]	[-0.96071]	[4.83706]
D(LNCPI(-1),2)	-0.565850	-0.123343	-0.571292
	(0.14940)	(0.52195)	(0.50265)
	[-3.78746]	[-0.23631]	[-1.13656]
D(LNRGDP(-1),2)	-0.021293	-0.258019	-0.350004
	(0.07053)	(0.24641)	(0.23730)
	[-0.30190]	[-1.04711]	[-1.47497]
D(LNRM2(-1),2)	0.055630	-0.175800	-0.295273
	(0.04396)	(0.15357)	(0.14789)
	[1.26559]	[-1.14477]	[-1.99661]
C	0.003577	-0.009534	-0.018833
	(0.00923)	(0.03226)	(0.03106)
	[0.38747]	[-0.29556]	[-0.60627]
DUMMY	-0.095590	0.046213	0.267932
	(0.05348)	(0.18685)	(0.17994)
	[-1.78732]	[0.24733]	[1.48902]
R-squared	0.418357	0.199664	0.718619
Adj. R-squared	0.349114	0.104386	0.685121
Sum sq. resids	0.161622	1.972697	1.829457
S.E. equation	0.062033	0.216723	0.208707
F-statistic	6.041848	2.095597	21.45274
Log likelihood	68.53971	8.494134	10.30331
Akaike AIC	-2.605821	-0.103922	-0.179304
Schwarz SC	-2.371921	0.129978	0.054596
Mean dependent	0.000470	-0.006027	-0.005187
S.D. dependent	0.076890	0.229005	0.371933

|	
Determinant resid covariance (dof adj.)	5.48E-06
Determinant resid covariance	3.67E-06
Log likelihood	96.02318
Akaike information criterion	-3.125966
Schwarz criterion	-2.307315

According to the test results of the error correction model, the mark of error correction coefficient is positive for equations (1) and (2). On the other hand; in equation (1), the mark of error correction has a negative sign but insignificant. For this reason, VECM model is useless for this model.

Table 17: Pairwise Granger Causality Tests

Pairwise Granger Causality Tests
Date: 02/25/18   Time: 13:41
Sample: 1960 2010
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
D(LNRGDP) does not Granger Cause D(LNCPI)	49	2.94809	0.0927
D(LNCPI) does not Granger Cause D(LNRGDP)		0.32407	0.5719
D(LNRM2) does not Granger Cause D(LNCPI)	49	3.1E-05	0.9956
D(LNCPI) does not Granger Cause D(LNRM2)		0.16158	0.6896
D(LNRM2) does not Granger Cause D(LNRGDP)	49	0.18992	0.6650
D(LNRGDP) does not Granger Cause D(LNRM2)		14.0947	0.0005

Results show that there is no short term causality relation among the variables according to 5% and 10% significance level. But, there is short-term causality relation between economic growth and inflation (uni-directional) running from RGDP to RM2 according to 5% significance level.

Response of D(LNRGDP) to D(LNCPI)

Response to Cholesky One S.D. Innovations ± 2 S.E.
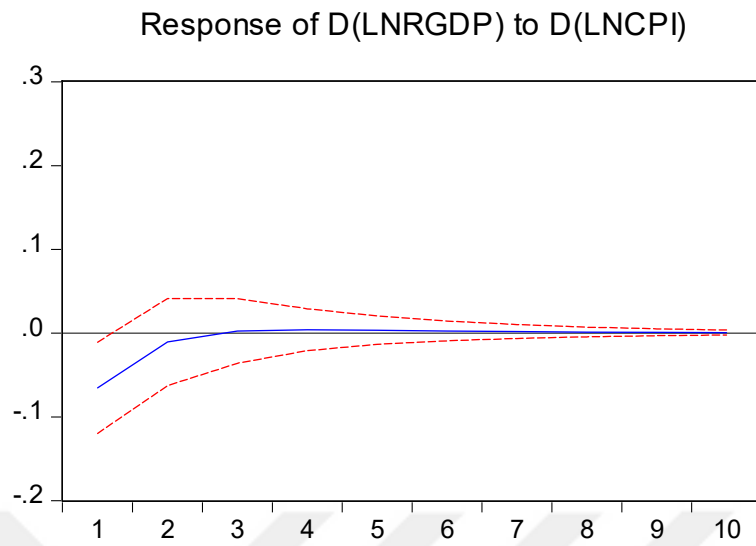
Response of D(LNRM2) to D(LNCPI)
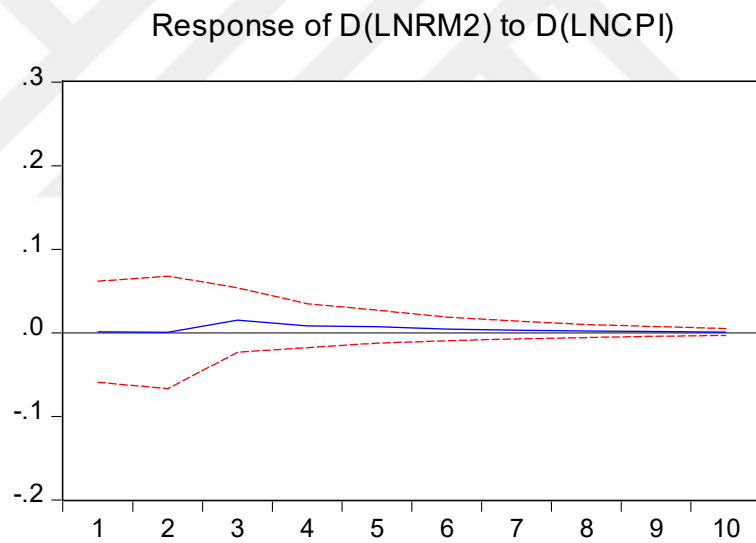
Figure 11: Impulse Response Analysis (Response of LNRGDP and LNRM2 to LNCPI)

As can be seen in graphic, the effect of inflation on the economic growth is negative during the first year then becomes almost zero throughout the ten periods, whereas the effect of inflation on money supply does not respond well.

Response of D(LNCPI) to D(LNRGDP)

Response to Cholesky One S.D. Innovations ± 2 S.E.
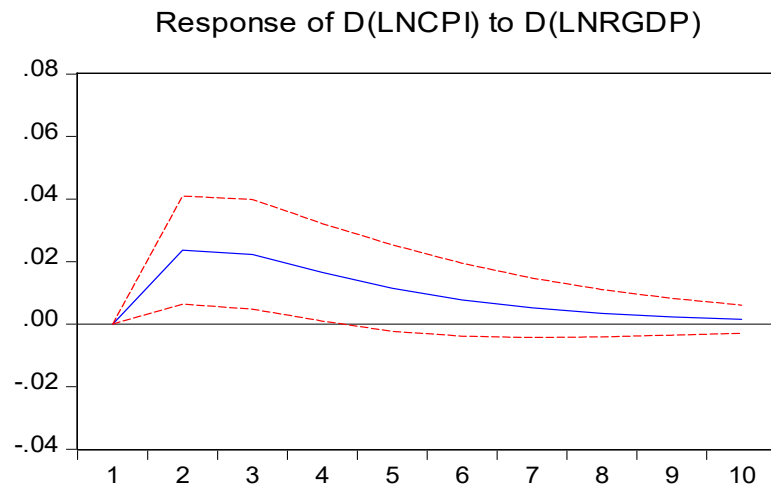
Response of D(LNRM2) to D(LNRGDP)
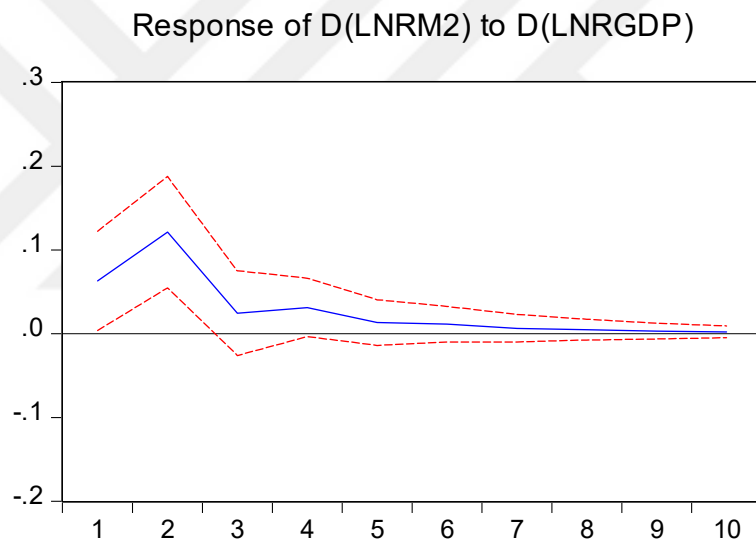
Figure12: Impulse-Response Analyses (Response of LNCPI and LNRM2 to LNRGDP)

The effect of economic growth on inflation and money supply are positive up to 2th period, then approaching the zero line gradually.

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of D(LNCPI) to D(LNRM2)

Response to Cholesky One S.D. Innovations ± 2 S.E.
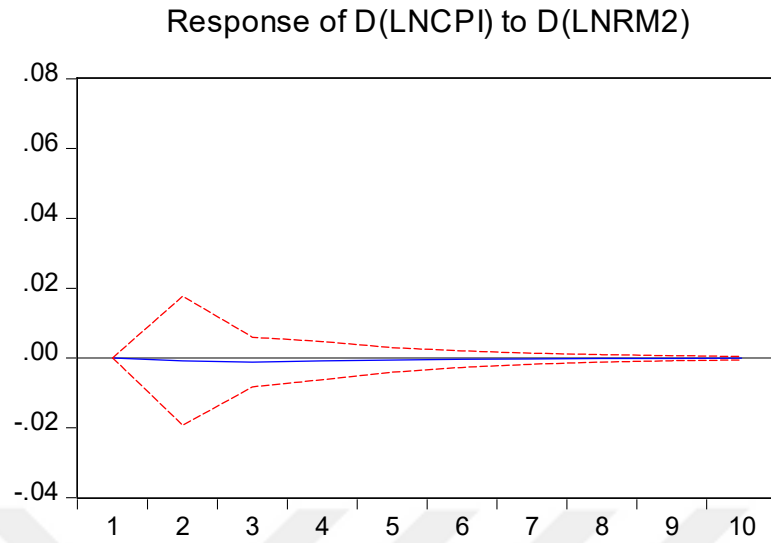
Response of D(LNRGDP) to D(LNRM2)
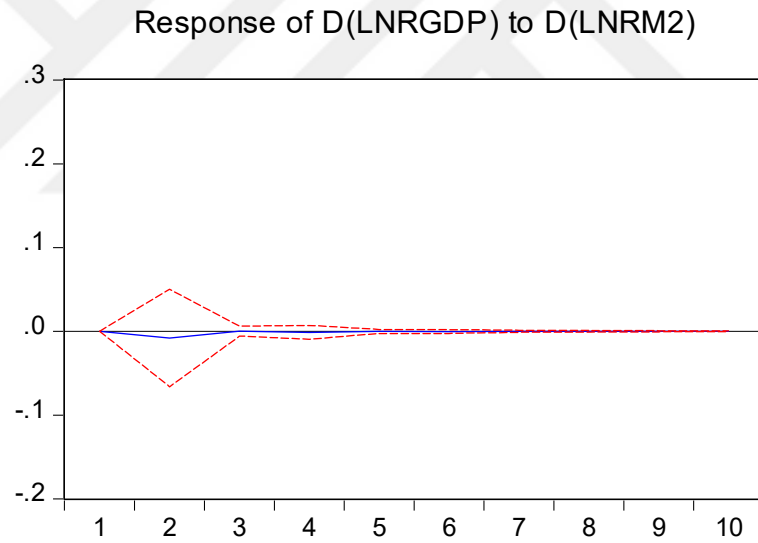
Figure 13: Impulse-Response Analyses (Response of LNCPI and LNRGDP to LNRM2)

The inflation and economic growth respond negatively and modestly to changes in money supply during the first years and then The response is almost none.

According to the findings which found from **the first "full period without dummy" and the third empirical models** can make comparison because the Civil

war effects our results, is that all the variables are I(1). Also, Johansen Cointegration Test displayed that there is a long run relationship between CPI, RGDP and RM2 according to trace and maximum eigenvalue tests. Moreover, the results of the three empirical models showed that there is one co integration between the study variables in long run. In addition to, the long-run equilibrium relationship among the tested variables are consistent with the monetarist view. There are positive relationships among the growth of money and aggregate price, further, negative relationships between the economic growth and aggregate price in long run. But the degrees of responsiveness differ from model to model.

All of those results, in turn, show the empirical model "1960-1910" with dummy variables is the best model for our study.

Test results belonging to vector error correction model indicated that there is no short run relationship between the study variables, and VECM model is useless for these two empirical models. Otherwise, the Granger Causality Tests only appeared that there is uni-directional causality running from the economic growth to the money supply in short-term at 5% significance level.

CHAPTER VI

CONCLUSION AND RECOMMENDATIONS

The main objective of this study is to examine the relationship between money supply, inflation and economic growth in Libya. Annual time series data for the period of 1960-2016 are employed in the study. In the present study, co-integration, error correction, Granger Causality models and Impulse Response Analysis are used to find the long-run and short-run relationship as well as the causality occurring and responding between study variables for Libya. The diagnostic tests provided that all variables are all satisfied, that is, no serial correlation and the model is stable.

The three empirical models proved that the third empirical model is the best, which can be relied upon to interpret the findings.

On ADF, PP Unit Root Test and KPSS test results, they show that the three series were non-stationary at their levels, but they were stationary at first difference. This means the series CPI, RM2 and RGDP were integrated at order one I(1).

The Co-integration test revealed that there exists a long-run relationship between inflation, money supply and economic growth. We found that when the money supply raises the price level will increase significantly. The same results have been found by Cuma Bozkurt (2014), Olorunfemi, Adeleke (2013) and Bakare (2011).The evidence shows that the inflation rate in Libya is largely

driven by the expansion of money which generated by increasing in oil revenues "following the lifting of sanctions". Due to this reason, aggregate demand rose more rapidly than the productive capacity of the economy, driving prices to higher. Furthermore, the Central Bank did not deal with the crisis professionally especially in last 7 year, where it followed the traditional methods by the printing of currency and withdrawal from the reserves of its assets from abroad to compensate for the shortfall in funds as a result of recent sanctions.

Whereas, economic growth has a negative relationship with the general level of prices. This is because of an improvement of economic growth by following a development-oriented policy in form of boosted government investment in various sectors of the economy, in particular, oil sector. This means that the growth of economic does not have any role in causing inflationary pressures in Libya .

It is known that if there is no inflation an economy may slip into deflation, so The Granger causality test shows there is no causality direction in short run between the study variables except unidirectional causality among economic growth and money supply running from RGDP to RM2 according to 5% significance level. The test result accepts the notion that money growth is the main cause of inflation in Libya during the study period. Also, the results of our estimation show that an expansionary monetary policy plays the key role which leads to increase in the general price level in Libya .

Furthermore, Impulse-Response Analyses shows that the response of inflation to economic growth is negative during all the ten years. However, to supply of money was positive for the first five years then turned to the negative response. The response of economic growth to Inflation is positive after 4th period. While economic growth is positively affected on money supply. Finally, the effect of money supply on inflation is positive over the long run but the effect of money supply on economic growth is negative.

In addition to the above, the deep interference of the state in economic affairs is an effective factor in limiting the adoption of appropriate monetary and financial policies. Further, the macroeconomic stability for Libya is eroded by the absence of an integrated fiscal policy, as well as Invade of administrative and financial Corruption most of the government's institution, particularly in recent years.

It would be unrealistic to imagine that Inflationary pressures can be eliminated in the near future. So Libya needs a comprehensive long-term strategy to reform its economy and enhance its economic and financial potential .

Based on the results, some suggestion of the recommendations are applied which could help to repair the situation of Libya economy

- Create a productive and diversified economy starting from encouraging private sector development, especially small or medium enterprise (SME) support to the reduction of government budget dependence on oil resources.
- The exit of the state from the economic sectors "economic dominance", and leave them to individuals and private sector institutions, to the interest of the homeland and the citizen.
- For ensuring an appropriate balance between money growth and price stability, monetary policy and fiscal policy must be coordinated.
- For dealing with inflation, government's principal aims should be to restrain excessive demands for private consumption by directing a substantial proportion of the increased incomes produced by the oil boom to the public treasury and by taking procedures to encourage private saving.
- It should be the special responsibility of the National Bank to keep a watch on evolutions and to advise the responsible bodies on appropriate action.
- By establishing appropriate mechanisms to sterilize foreign exchange injections into the Libyan economy can be controlled in inflation.

- The monetary policy objective of price stability should be maintained while allowing sufficient expansion of documentary credits granted to the investors at competitive interest rates to strike a balance between demand and supply.

- Improve the monetary policy framework by strengthening the database and enhancing the Bank's ability to control economic activities and improve its daily management of monetary affairs.

- Demand management policies should be adopted such as a reduction in real broad money supply to reduce inflation in the long-run.

- A development-oriented policy should be pursued in form of boosted government investment and encouraging private sector development, in various sectors of the economy results in an improvement of economic growth which in turn will reduce to the inflation rate. In other words, the imports should be reduced over the long term through aggressive export promotion to achieve long-run economic growth.

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APPENDIX 1.

Data Used For The Study

Year	CPI (1)	M2 (2)	RM2 $(\frac{2}{1})$	GDP (3)	RGDP $(\frac{3}{1})$
1960	9.22	81	8.785249	347	37.63557
1961	9.96	97	9.738956	383	38.45382
1962	10.01	114	11.38861	533	53.24675
1963	10.81	134.5	12.44218	769	71.13784
1964	11.29	172	15.23472	1,155	102.3029
1965	12.01	260	21.64863	1,555	129.4754
1966	13.48	333	24.70326	1,997	148.1454
1967	14.47	414	28.61092	2,347	162.1977
1968	14.53	252	17.34343	3,325	228.8369
1969	15.95	693	43.44828	3,772	236.489
1970	15.10	668	44.23841	3,961	262.3179
1971	14.63	1,104.50	75.49556	4,930.30	336.9993
1972	14.60	1,190	81.50685	5,448.48	373.1836
1973	15.76	1,487.50	94.38452	6,806.06	431.8566
1974	16.94	2,284	134.8288	11,766.66	694.608
1975	18.48	2,559	138.474	11,454.50	619.8323
1976	19.49	3,453	177.1678	14,869.69	762.9395
1977	20.72	4,372	211.0039	17,463.63	842.8393
1978	26.80	5,114.50	190.8396	17,236.36	643.1478
1979	25.18	6,738	267.5933	23,775.75	944.2315
1980	27.64	8,627	312.1201	32,974.54	1193.001
1981	30.73	10,643	346.3391	28,488.18	927.0478
1982	33.88	9,854	290.8501	28,402.42	838.3241
1983	37.48	8,771	234.0181	27,066.36	722.1547
1984	42.15	8,216	194.9229	25,345.15	601.3084

1985	46.01	10,582	229.9935	24,928.78	541.8122
1986	47.52	9,810	206.4394	23,004.83	484.1084
1987	49.59	12,735	256.8058	23,145.25	466.7322
1988	52.61	10,457	198.7645	23,417.24	445.1101
1989	53.40	12,143	227.397	25,989.65	486.6976
1990	57.92	17,205	297.0477	30,314.80	523.3909
1991	64.81	16,454	253.8806	33,262.96	513.2381
1992	70.87	23,044	325.1587	31,803.33	448.7559
1993	78.72	22,027.00	279.8145	28,278.78	359.2325
1994	82.74	18,822	227.4837	23,179.07	280.1435
1995	88.73	20,797	234.3852	24,837.21	279.919
1996	92.31	19,571	212.0139	27,681.80	299.8787
1997	95.59	19,146.50	200.2981	30,104.25	314.931
1998	99.13	21,420	216.0799	28,315.55	285.6406
1999	101.76	22,133	217.502	30,736.95	302.0534
2000	92.90	18,950	203.9828	32,719	352.1985
2001	90.10	19,905	220.9212	27,814.15	308.7031
2002	81.27	10,747	132.2382	21,416.53	263.5232
2003	79.49	10,809	135.9794	28,739	361.5423
2004	77.74	10,593	136.2619	38,837.90	499.5871
2005	79.80	12,664	158.6967	49,715.37	622.9996
2006	80.97	15,356	189.6505	61,742.11	762.5307
2007	86.03	22,116	257.0731	75,978.36	883.1612
2008	94.94	31,796	334.9063	93,311.68	982.849
2009	97.28	39,567	406.7331	70,153.57	721.151
2010	100.00	37,080.50	370.805	74,773.33	747.7333
2011	115.52	40,795	353.1423	34,711.01	300.4762
2012	122.52	47,206	385.2922	81,910.32	668.5465
2013	125.71	52,581	418.2722	65,513.03	521.1441
2014	125.09	52,261	417.7872	41,141.70	328.8968
2015	132.50	54,125	408.4906	29,154.42	220.0334
2016	161.00	60,639	376.6398	22,221.51	138.0218

Source:

GDP: International Monetary Fund (IMF)

CPI: Libyan Statistics and Census Bureau.

Money supply: Central Bank Of Libya.

APPENDIX 2:

Summary of Related Literature

SUMMARY OF RELATED LITERATURE				
Authors	**Title**	**period of studies,**	**Methodology**	**Conclusion/Results**
Chan wun 2016	Analysis on money supply, inflation rate and economic growth through Empirical study.	The series are quarterly data from 1999 to 2015.	Vector Error Correction Model (VECM), Error Correction Mode (ecm), Johansen co-integration test, Granger causality.	In the long run relationship, both of the money supply growth and economic growth are positively related to inflation rate. In AD-AS model, rise in money supply causes fall in the interest rate, which stimulus the aggregate demand, it causes rise in price level finally. On the other hand, increase in GDP also directly shifts the aggregate demand to the right, thus, the price level goes up and causes inflation. In shout run money supply negatively causes inflation rate.Finally, money supply was proved negatively related to economic growth in the short run. One of the reasons behind is economic growth is more directly influenced by the growth of the consumption (C), investment (I), government expenditure (G) and net export (NX). Therefore, money supply is not the only factor that affects the economic growth.

Fitsum Sharew Denbel, et al. 2016	The relationship between inflation, money supply and economic growth in Ethiopia. Their Co integration and Causality analysis	This study entirely used secondary data sources covering the year ranged from 1970/71 to 2010/11.	Granger causality test. Vector Error Correction Model. Johansen Co integration Test.	This study shows that aggregate price, money supply and real GDP are co integrated. This implies that the variables have long run equilibrium relationship. Following the co integration result, VECM is formed and the result indicates that there is bi-directional causal relationship between inflation and money supply and unidirectional granger causal relationship from economic growth to inflation in the long run. In the short run the model indicates the presence of uni-directional causality from money supply to inflation(The finding that money supply causes inflation). The model also reveals economic growth has negative effect on inflation in the short run. If the basic sources of economic growth are noninflationary like increase in production and productivity, economic growth reduces inflation.

Iwedi Marshal, 2016	The Link between Money Supply and Economic Growth in Nigeria: An Econometric Investigation	Data were collected for the period of 1970 – 2014.	VAR model. cointegration test. granger causality test.	Money supply has a short and long run positive and significant linkage on Real Gross Domestic Product in Nigeria. There are cointegration between M2 and RGDP and so there is an equilibrium relationship between the two variable in the long run. On causality, there is a causality running from M2 to RGDP and not vice versa. This shows that there is unidirectional causality from money supply (M2) to Real GDP in Nigeria during the period of study.
Rosemary Emike Idalu, 2015	Impact of Inflation on Economic Growth: Case Study of Nigeria (1970-2013)	Time series data were collected annually for the period of 1970-2013.	the Johansen co-integration test. Granger Causality Test.	The result showed that both inflation and unemployment have a negative impact on economic growth and real GDP is less responsive to inflation as compared to unemployment. Also, it shows that real GDP is more responsive to inflation and not as responsive to unemployment. Granger Causality shows that no long run causality test exists between inflation and real GDP. The impulse response of economic activities to a unit shock in inflation, the result showed that economic activities responds slowly initially and positively shocks in inflation but in the long run it is negative and has a permanent effect to real GDP. This thus shows us that inflation has a bad long run impact on real output.

Cuma BOZKURT 2014	Money, Inflation and Growth Relationship: The Turkish Case	Taken a quarterly data from 1999.2 to 2012.2.	Co integration tests. VAR model.	The increases in the money supply and velocity of money causes inflation in the long run. On other words, there is a high correlation between money supply and inflation. An increase in the growth rate of money causes an equal increase in the rate of inflation. That money supply is the main determinant of inflation. Although inflation, which increased up to the levels of 30% after 2001 crisis, was reduced to 6.2% in 2012, this decline couldn't be sustained, and increased to 7.4% in 2013. Co integration tests indicate that there is a unique long-term or equilibrium relationship between variables.

Evans Ovamba Kiganda. 2014	Relationship between Inflation and Money Supply in Kenya	annual time series data from 1984 to 2012 were used.	Vector Error Correction Model (VECM). Granger causality test.	money supply in Kenya have a positive correlation, integrated of order one, long run equilibrium relationship exists between the variables, inflation is error correcting at 68%. Also unidirectional Granger causality is established running from money supply to inflation in Kenya. In conclusion, there is a significant positive long run relationship between inflation and money supply in Kenya. Finds that inflation is always and everywhere a monetary phenomenon. That is, the source of inflation is fundamentally derivedfrom the growth rate of the money supply and that a rapid increase in money supply leads to a rapid increase in inflation.
Prasert Chaitipa, et al. 2014	Money Supply Influencing on Economic Growth-wide Phenomena of AEC Open Region	yearly period from 1995 to 2013.	cointegration, Hausman Test and ARDL approach	The findings from this study showed that there is a long run relationship between money supply and economic growth. Money supply (M1) was a positive correction with GDP growth, while demand deposits were a negative correction on GDP growth.
Tan, et al. 2014	Dynamic causal chain of money, output, interest rate and prices in Malaysia: Evidence-based on vector error-	Annual Data from 1970 to 2012.	VECM	The results show that M1 and M3 appear to have a significant effect on output and prices in the short run. However, we were unable to establish a causal relationship running from M2 to output in the short run. The

	correction modeling analysis.			results also indicate that M2 does not lead prices in the short run, but instead responses to changes in prices. This results, therefore, surpport the switching of Bank Negara from M2 to M3 as a monetary target. The absence of any significant Granger-causality from real output (or income) to price level suggests that the excess aggregate demand generated by the increase in income is readily absorbed by the expansion in the aggregate supply in the economy.
Faraji KASIDI, Kenani MWAKANEMELA. 2013	Impact of inflation on economic growth: a case study of Tanzania	Annual time-series data for the period of 1990-2011 were employed.	Johansen co-integration test.	The results from regression analysis revealed that inflation has the negative impact on economic growth of Tanzania. This indicated that inflation is harmful to economic growth of Tanzania. The results of co-integration test using Johansen co-integration test showed that over the period of 1990-2011 there was no co-integrating relationship between inflation and economic growth. That is, no any statistically significant long-run relationship between inflation and economic growth in Tanzania. Only a negative and statistically significant short term relationship was found. the study found that the degree of responsiveness of GDP to changes in the general price levels is

				large. The study concluded that the degree of responsiveness of change in GDP as a result of change in the general price levels is inelastic to the tune of -0.8.
Olorunfemi Sola, Adeleke Peter. 2013	Money Supply and Inflation in Nigeria	Secondary data that ranged between 1970-2008	((VAR) model. granger causality test.	The study reveals that the result from the causality test indicates that there exists a unidirectional causality between exchange rate and inflation rate, interest rate and inflation rate. The causality test runs from money supply to inflation, from exchange rate to inflation, and from interest rate to inflation rate. Unidirectional causality is also noticed between money supply and government expenditure, exchange rate and interest rate. Also, causality runs from money supply to government expenditure and exchange rate to interest rate. There is bi-directional relationship between oil revenue and money supply, oil revenue and government expenditure. The implication of this is that increase in money supply leads to government expenditure and which, in turn, leads to change in household income. The study also shows that there is a positive relationship between money supply and

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Al-Sawai'e, Al-Fawwaz 2012	Output, Money, and Prices: The Case of Jordan	annual data for the period 1976-2009	VAR Model.	inflation rate. inflation in Nigeria seems to find explanation in money supply.
				The results indicate a non-presence of a long-run relationship between the three variables. The money supply does not cause the growth of GDP, while causing the price. However, The price does not cause the growth of GDP and does not cause the money supply.

Fekadu Dereje Girma. 2012	Relationship between Inflation and Economic Growth in Ethiopia: An Empirical Analysis, 1980-2011	Using yearly data from 1980 to 2011.	The VAR model. Granger Causality test. Vector Error Correction (VEC).	The VAR model shows that inflation does not have significant effect on economic growth in the short run. Granger Causality test shows that economic growth Granger-causes inflation which means that economic growth can predict movements in inflation. It also shows that inflation does not have any forecasting power about economic growth in the short run. Cointegration test shows that there exist a long run relationship between economic growth and inflation in Ethiopia. Vector Error Correction (VEC) Estimation Results show thatincrease in output growth decreases inflation in the short run during the sample period of 1980-2011. However The second equation shows that inflation does not have significant effect on economic growth in short run. The error correction terms are statistically significant which shows that if both inflation and economic growth are out of equilibrium, inflation will adjust to reduce the equilibrium error in the long run. Also indicates that economic growth significantly reduces inflation in short run while inflation does not have any significant effect on economic growth. If inflation had previously been larger than normal share, then economic growth causes inflation to be lower in the long run.

A.S Bakare 2011	An empirical study of the determinants of money supply growth and its effects on inflation rate in Nigeria	The data series covered the periods between 1981 and 2006.	Cointegration test. VAR model.	The result show that changes in money supply determines inflation in Nigeria in the current period. It shows that a 1 percent rise in money supply in the current period leads to 5.6 percent rise in inflation. Also, a rise in real exchange rate has a positive effect on inflation as expected. It shows that a 1 percent rise in the real exchange rate will raise inflation by 19.5 percent in Nigeria. Similarly, the interest rate determines inflation by the highest magnitude. It shows that 15 increase in interest rate leads to 102.9 percent rise in inflation in Nigeria. The positive effect of government fiscal deficit was also expected but not significant.
Babatunde, Shuaibu. 2011	Money supply, inflation and economy growth in Nigeria	1975–2008, employing annual data	ARDL model	the results imply that real income, money supply, inflation, gross fixed, capital formation in Nigeria are cointegrated. Also, gross fixed capital formation also positively influence real income in the long run and also significant at the 5 per cent level. In the short run, a 1 per cent price increase in money supply will increase real income by 0. 144 per cent while a 1 per cent increase in inflation will increase real income by 0.128 per cent in Nigeriaz.
Henri Ngoa Tabi, Henri Atangana Ondoa. 2011	Inflation, Money and Economic Growth in Cameroon	Using the data of the Central Bank for the period 1960-2007	Granger causality test. Dynamic analysis of cointegration. VAR model,	That an increase in money supply can boost growth and that inflation is not a major determinant of economic growth. An increase in

				the rate of inflation by 1% can provoke economic cycles which in the long-term would reduce growth by 0, 025%. An increase in money in circulation induces certain fluctuations that increase the rate of growth of the GDP by 1% to 2%. The results of estimation show that an expansionary monetary policy does not necessarily lead to increase in the general price level in Cameroon. The results show that money in circulation causes growth and growth causes inflation. However, it was realized that an increase in money in circulation does not necessarily induce an increase in the general price level.
Daniela Zapodeanu, Mihail Ioan Cociuba. 2010	Linking money supply with the Gross Domestic product in Romania.	the period between 1999-2010, quarterly	Granger causality test, cointegration test, VAR model.	The results indicated a conjoining between M3 and GDP in long term, aslo M3 can cause GDP.
M. S. Ogunmuyiwa, A. Francis Ekone. 2010	Money Supply - Economic Growth Nexus in Nigeria	Annual data from 1980 to 2006.	Causality tests, VAR model.	The findings albeit support that aggregate money supply is positively related to economic growth and development. However, money supply does not have a significant predictive power in explaining the growth of real GDP. Also, the choice between contractionary and expansionary money supply are not significantly responsive to growth as evidenced in the case of GDP growthrate.

Wang Yan-liang 2010	Relationship Research on Money Supply, Economic Growth and Inflation	Annual data from 1998 to 2007	Granger Causality test, VAR, VECM	There is no cointegration relationship among money supply, inflation, and economic growth, but there is cointegration relationship between money supply and inflation while there is no co-integration relationship between money supply and economic growth. There is cointegration between the goal of economic growth and of price stability in China.
HOSSAIN, Akhtar 2005	The Granger causality between money growth, currency devaluation and economic growth in Indonesia: 1954-2001	Annual data for the period 1954-2002.	The Granger-Causality Test.	The empirical results suggest that there existed a short-run bi-directional causality between money supply growth and inflation and between currency devaluation and inflation. The causality running from inflation to narrow money supply growth was stronger than that from narrow money supply growth to inflation. The short-run bi-directional causality between currency devaluation and inflation was, however, weak or not so robust for the complete or any shorter sample period. On the relationship between inflation and economic growth, the results suggest that there was no short-run causality from inflation to economic growth.
Komain Jiranyakul, 2001	Causality between the money growth and inflation in Thailand.	The series are quarterly data and range from the first quarter of 1990 to 2000.	the Granger causility test.	The results shows that there is no causal relationship from money growth to inflation rate. The test results reject the notion that money growth is the main cause of inflation in Thailand during the period under

				study. For the most part there are other determinants of inflation in Thailand such as the oil shock, an increase in production costs, and stimulus fiscal policy variables.
Victor Olivo, Stephen M. Miller 2000	The Long-Run Relationship between Money, Nominal GDP, and the Price Level in Venezuela: 1950 to 1996	Annual data during 1950 - 1996.	VECM, Engle-Granger Cointegration Tests. Impulse Response Test	Their results showed that radical changes in economic policy and political instability may have also significantly affected the movement of the macroeconomy. They found that a long-run relationship exists between narrow money (M1) and nominal GDP, the GDP deflator, and the CPI when one makes allowances for one or two structural breaks. they did not find such long-run relationships when broad money (M2) is used.

Kalbe Abbas. 1991	Causality Test between Money and Income: A Case Study of Selected Developing Asian Countries	Annual data from 1960 to 1988.	Causality Test.	He found that M1dose not cause income (y). However, M2 and Y show bi-directional causality.
Sims, C. A. 1972	Money, Income, and Causality	The data used cover the period 1947-69, quarterly	Causality Test.	It indicates that there is a causality course from the volume of money to GDP, an aspect which is unswerving to the views of monetarists and Friedman.

APPENDIX 3:

Co-Integration Analysis

Date: 02/19/18   Time: 16:58
Sample (adjusted): 1963 2016
Included observations: 54 after adjustments
Trend assumption: Linear deterministic trend
Series: D(LNCPI) D(LNRGDP) D(LNRM2)
Exogenous series: DUMMEY
Warning: Critical values assume no exogenous series
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.414463	51.93260	29.79707	0.0000
At most 1 *	0.213843	23.03040	15.49471	0.0030
At most 2 *	0.169635	10.03808	3.841466	0.0015

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.414463	28.90220	21.13162	0.0033
At most 1	0.213843	12.99232	14.26460	0.0786
At most 2 *	0.169635	10.03808	3.841466	0.0015

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

(Continued)

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.414463	28.90220	21.13162	0.0033
At most 1	0.213843	12.99232	14.26460	0.0786
At most 2 *	0.169635	10.03808	3.841466	0.0015

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

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

D(LNCPI)	D(LNRGDP)	D(LNRM2)
-7.730130	-5.610412	7.195129
-5.464020	-3.355831	-3.548892
20.24464	-1.017870	0.289386

Unrestricted Adjustment Coefficients (alpha):

D(LNCPI,2)	0.008890	0.001097	-0.025831
D(LNRGDP,2)	0.028708	0.122942	0.049880
D(LNRM2,2)	-0.134627	0.056176	-0.015014

1 Cointegrating Equation(s):	Log likelihood	79.85430

Normalized cointegrating coefficients (standard error in parentheses)

D(LNCPI)	D(LNRGDP)	D(LNRM2)
1.000000	0.725785	-0.930790
	(0.14105)	(0.17560)

Adjustment coefficients (standard error in parentheses)

D(LNCPI,2)	-0.068724
	(0.07101)
D(LNRGDP,2)	-0.221914
	(0.32818)
D(LNRM2,2)	1.040682
	(0.22782)

2 Cointegrating Equation(s):   Log likelihood   86.35046

Normalized cointegrating coefficients (standard error in parentheses)

D(LNCPI)	D(LNRGDP)	D(LNRM2)
1.000000	0.000000	9.345086
		(2.37036)
0.000000	1.000000	-14.15829
		(3.34327)

Adjustment coefficients (standard error in parentheses)

D(LNCPI,2)	-0.074716	-0.053559
	(0.08695)	(0.06005)
D(LNRGDP,2)	-0.893671	-0.573634
	(0.36509)	(0.25213)
D(LNRM2,2)	0.733734	0.566793
	(0.26822)	(0.18523)

Vector Error Correction Model Test Results

Error Correction:	D(LNCPI,2)	D(LNRGDP,2)	D(LNRM2,2)
CointEq1	-0.068724	-0.221914	1.040682
	(0.07101)	(0.32818)	(0.22782)
	[-0.96778]	[-0.67621]	[4.56801]
D(LNCPI(-1),2)	-0.427343	0.110043	-0.561187
	(0.14012)	(0.64754)	(0.44952)
	[-3.04991]	[0.16994]	[-1.24841]
D(LNRGDP(-1),2)	0.042701	-0.511912	-0.293545
	(0.04020)	(0.18579)	(0.12897)
	[1.06217]	[-2.75536]	[-2.27600]
D(LNRM2(-1),2)	-0.017717	-0.084405	-0.302446
	(0.04304)	(0.19890)	(0.13808)
	[-0.41167]	[-0.42436]	[-2.19043]
C	0.007605	-0.017400	-0.012820
	(0.00943)	(0.04359)	(0.03026)
	[0.80621]	[-0.39914]	[-0.42364]
DUMMY	-0.106694	-0.038740	0.140661
	(0.05675)	(0.26226)	(0.18206)
	[-1.88013]	[-0.14772]	[0.77261]
R-squared	0.322626	0.371626	0.655399
Adj. R-squared	0.252066	0.306170	0.619503
Sum sq. resids	0.218737	4.671682	2.251347
S.E. equation	0.067506	0.311972	0.216571
F-statistic	4.572368	5.677515	18.25829
Log likelihood	72.11681	-10.54113	9.168614
Akaike AIC	-2.448771	0.612635	-0.117356
Schwarz SC	-2.227772	0.833633	0.103642
Mean dependent	0.003515	-0.014664	-0.004401
S.D. dependent	0.078056	0.374532	0.351095

Determinant resid covariance (dof adj.)	1.48E-05
Determinant resid covariance	1.04E-05
Log likelihood	79.85430
Akaike information criterion	-2.179789
Schwarz criterion	-1.406295

Pairwise Granger Causality Tests

Pairwise Granger Causality Tests
Date: 02/16/18   Time: 22:37
Sample: 1960 2016
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
D(LNRGDP) does not Granger Cause D(LNCPI)	55	0.23144	0.6325
D(LNCPI) does not Granger Cause D(LNRGDP)		0.05558	0.8145
D(LNRM2) does not Granger Cause D(LNCPI)	55	0.08694	0.7693
D(LNCPI) does not Granger Cause D(LNRM2)		0.11067	0.7407
D(LNRM2) does not Granger Cause D(LNRGDP)	55	0.16947	0.6823
D(LNRGDP) does not Granger Cause D(LNRM2)		8.30258	0.0057

Impulse-response analysis

Response to Cholesky One S.D. Innovations ± 2 S.E.
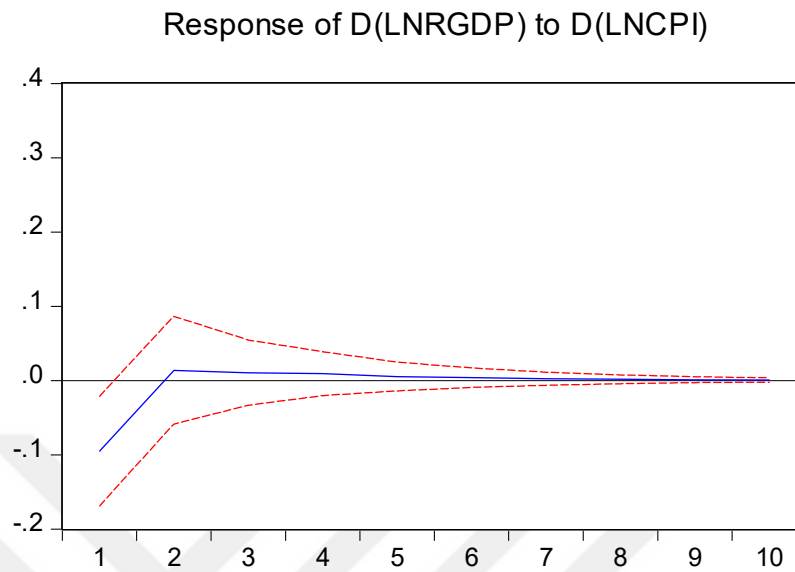
Response of D(LNRGDP) to D(LNCPI)

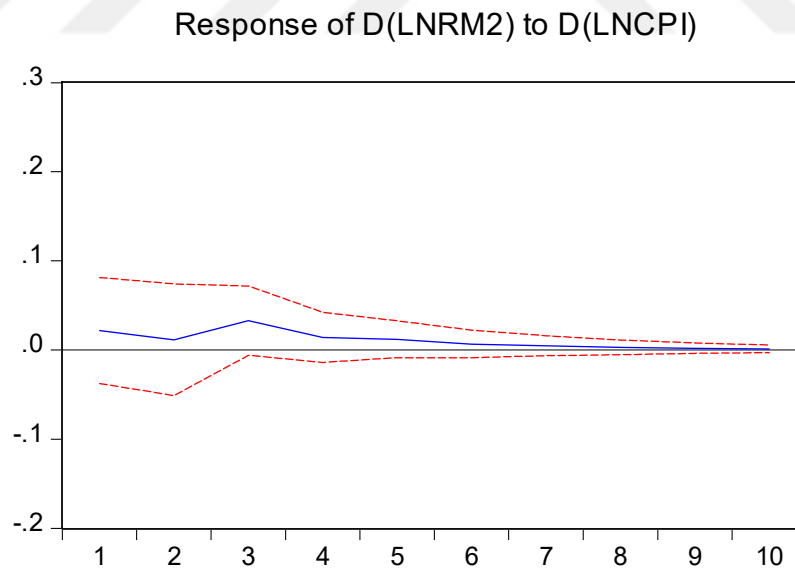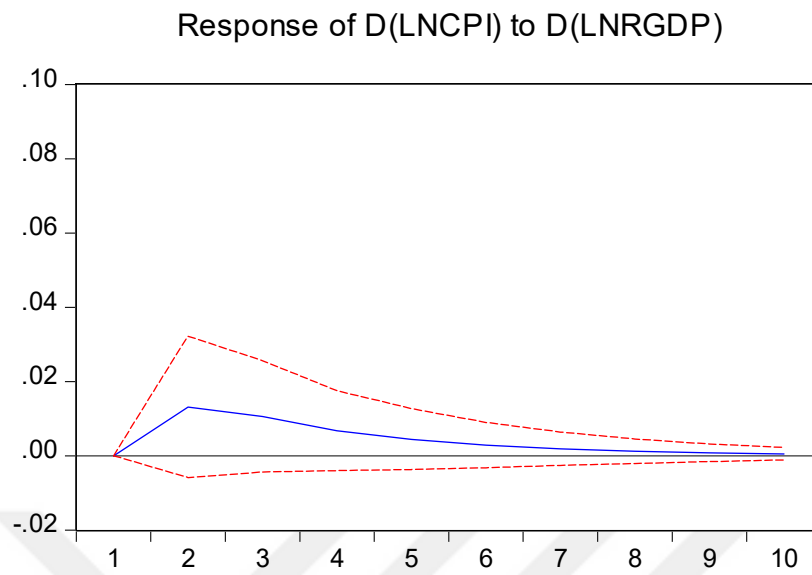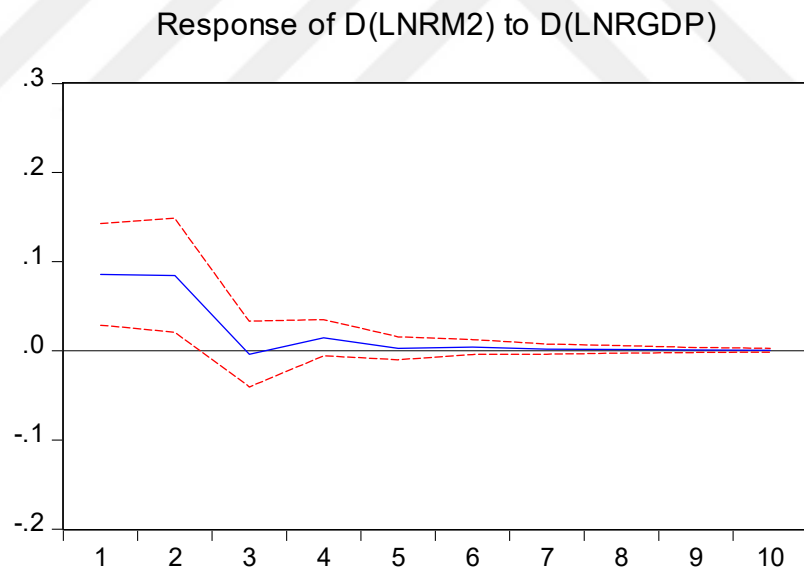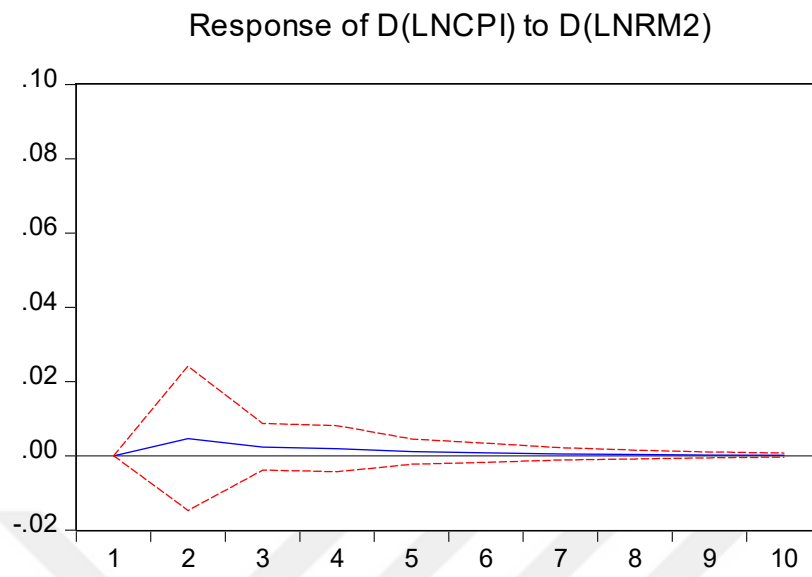Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of D(LNRM2) to D(LNCPI)

Figure: Impulse Response Analysis (Response of LNGDP and LNM2 to LNCPI)

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of D(LNCPI) to D(LNRGDP)

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of D(LNRM2) to D(LNRGDP)

Figure: Impulse-Response Analyses (Response of LNCPI and LNM2 to LNGDP)

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of D(LNCPI) to D(LNRM2)

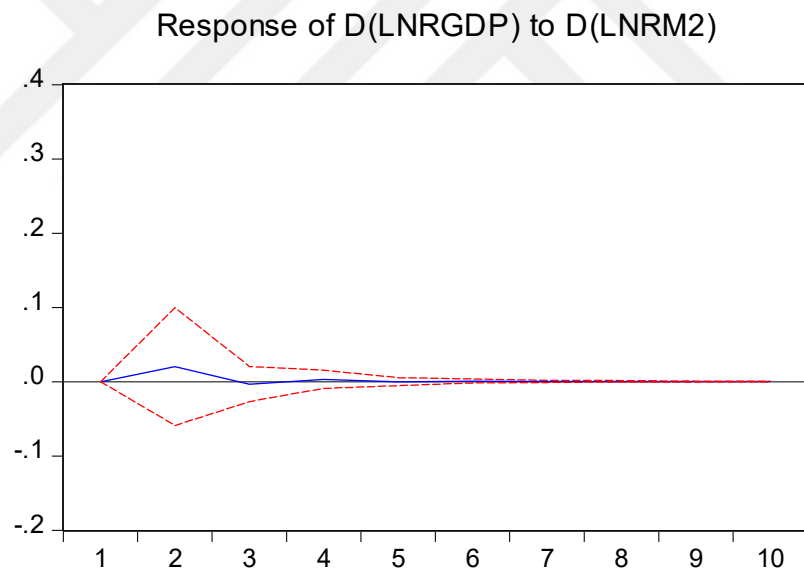Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of D(LNRGDP) to D(LNRM2)

Figure: Impulse-Response Analyses (Response of LNCPI and LNGDP to LNM2)