IDENTIFYING FACTORS AFFECTING INFLATION RATE IN U.S.A UNDER FOUR PERIODS

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Abstract

Inflation rate is a crucial variable on an economy. It is defined as a rise in an economy's general price level across variety of sectors. There have been many economical theories on inflation. This paper examines influence of selected seven economical variables on inflation rate in U.S.A economy during four defined periods from first quarter of 1981 to fourth quarter of 2016. The four periods consists of two republican periods of 1981-1992 and 2001-2008 and two democratic periods of 1993-2008 and 2009-2016. Four vector error correction models are estimated and granger causality is tested to identify the short – run and long-run relationships between seven economical indicators and inflation. Foreign direct investment which has a negative influence on inflation rate which is contradictory to the relationship described in inflation theory. Other variables of exchange rate, gross domestic product, trade of balance, money supply, and government expenditure and unemployment rate have mixed influence on inflation rate in U.S.A economy. The study recommends that there are effects of selected economical variables on inflation rate in U.S.A and some aspects of the theories of inflation are applicable in U.S.A economy. Further scrutiny should be done to clear the ambivalent results of influence of other variables on inflation rate.

Keywords: U.S.A Economy, Inflation, Economical Indicators of U.S.A, Vector Error Correction Model.

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DECLARATION OF THE CANDIDATE

"I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other university or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidate has carried out research for the Masters Dissertation under my supervision.

Signature: Date:

Prof. T.S.G Peiris

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CHAPTER 1

INTRODUCTION

1.1 Background to the Study

Inflation is considered as a chronic economical issue around the globe. Inflation simply described as the increase of average price level of goods and services. Identifying factors affecting inflation rate is essential for policy makers in order to maintain their targeted inflation rate. United States of America (U.S.A) is rated as the leading economy in the world with net worth of $20.4 Trillion in 2017 (Christine Lagarde, 2017). With such a reporting economy United States has been successful to maintain their inflation rate around 2% over past decades. Though United States of America has faced mini recessions in years of 1981 ,1998, 2001, 2008 which reduced the economic activities in a significant amount, the country has been able to continue the growth of the economy using several strategies like revising policies of money supply and government expenditure. During March 1991 to March 2001 and November 2001 to December 2007 there were two economic expansions in United States of America and during these periods inflation rate remained low compare with preceding decades.

Terrorist attack, on September 11, over U.S.A caused around $40 billion insurance loss and hindered the tourism, airlines and aviation field. Around $2 trillion of damage has been inflicted by the September attack (Byayuk, 2010). Despite the terrorist attack, United States of America was able to keep the control of the inflation rate due to the timely reactions of Federal Bank in St Louise.

Keynesian economy and monetarism are two leading economic theories explaining the cause of inflation and other economic indicators influencing it under different circumstances (Barone, 2019). In general, as U.S.A inflation is constant and stable; investors can invest with confidence. However, the slowing rate of inflation or the disinflation could be causing problems for the investors who involves with bonds commodities and currencies. It is indubitable that country's political condition affects the economy and its inflation rate.

1.2 Research Question

Macroeconomic performance of United States of America accelerated in a high volume from early 1980s. Two longest economical expansions in United States of America history has happened in 1980s and 1990s and two mild contractions during 1990 and 2001. 1981, 1998, 2001, 2008 are other crucial years in latest economy of United States as the economical activities dropped by a significant and notable amount due to mini recessions. This study tries to identify the behavior of the inflation if it is in accordance with the economical theories given or is the economy of United States of America special.

According to Keynesian economy (Keynes,1930) when aggregate demand exceeds the aggregate supply there will be a rise in price level. Employment will increase as a result of effort to meet the demand. Aggregate demand depends on the consumptions, investments, government expenditure and exports. Imports and tax rate should be decreased to lower the inflation rate. When government expenditure is increased it will create more employment and more individual consumption which will result in demand pull inflation. Multiplier Effect introduced by Keynes indicates that increasing government expenditure will increase business activities which will result in economic growth and increase of inflation rate. Monetarism (Friedman, 1968), on the other hand, suggests that monetary phenomenon is the only influence which can make inflation rate to fluctuate. In monetarism, Money supply takes a lead role in explaining inflation rate. Money supply will decrease interest rate of borrowing. When there is less borrowing interest rate individual consumption will go up and so does the inflation. Thus, it is important to find the influence of different economic indicators on the inflation rate under different scenarios. The different scenarios considered in this study are the political party of the president in power and the recessions the U.S.A economy faces during the identified periods.

1.3 Four Different Scenarios

In this study it is aimed to scrutiny the economical times data from 1981 to 2016 by dividing the time series data in to four periods. Data is divided in to four time periods as below.

- 1st Period – 1981 Q1 to 1992 Q4 is the period of twelve years when Republican Presidents Ronald Regan and George Bush were the presidents of United States of America.
- 2nd Period – 1993 Q1 to 2000 Q4 is the period of eight years when Democratic President Bill Clinton was in the presidency of United States of America.
- 3rd Period – 2001Q1 to 2008 Q4 is the period of eight years when Republican President George W Bush was in the presidency.
- 4th Period – 2009 Q1 to 2016 Q4 is the period of eight years when Democratic President Barak Obama was in the presidency.

1.4 Research Objective

On view of the above the objectives of this research are to

- examine the behavior of the inflation in United States of America under the above mentioned four time periods.
- examine the behavior of economical variables in United States of America under the above mentioned four time periods.
- examine the factors that affecting the inflation Rate in United States of America under the above mentioned four time periods.

1.5 Significance of the Study

This study is expected to model the relationship amid inflation and seven other economic indicators in different scenarios and to assess the applicability of theories related to inflation of U.S.A. United States of America being a developed and a powerful Economy in the world has a stable inflation rate irrespective of time period and thus it is important to understand if the theories of inflation get proven during different periods under the circumstances.

By implementing the right policies government can balances inflation rate which will leads to prosperity of an economy. As an example in an economy where there is high unemployment rate the government tries to increase the employment rate which again leads to high inflation. When the inflation increases in to an unacceptable level then the policy makers try to implement fiscal policies which help to decrease the inflation rate. Decrement of inflation again leads to higher unemployment rate. Likewise many strategic policies can give optimal balance of low inflation rate which has been achieved by the economy of the United States of America.

This study will be significant to economic policy makers to make decision on policies on inflation rate. The researchers who are interested in inflation theories and economy of United States of America can use this study as a source of information.

1.6 Structure of the Dissertation

Following the Introduction of Chapter 1, Chapter 2 summarizes the literature review on economical theories on inflation and application of VAR. Chapter 3 explains the methodology used in this study and theoretical background. Chapter 4 discusses the explanatory data analysis of each variable and Chapter 5 explains the procedure of model building for the given variables for given time periods using VAR. Chapter 6 gives the conclusion and recommendations.

CHAPTER 2

LITERATURE REVIEW

2.1 Inflation of Presidency Elected on Economy in the United States of America

Inflation is a popular economical indicator subjected to be scrutiny throughout many economies. A study conducted by two economists Blinder and Watson, from 2015, have applied multivariate regression on GDP growth and inflation to find out if there is an influence of U.S.A presidency for its economic growth. They have shown that there is a notable performance in GDP of U.S.A when the chairman is appointed by Democrats than by Republicans. But fiscal and monetary policy actions are accelerated under the presidency of Republicans. Further, they conclude that the U.S.A economy is better under the presidency of a Democrat. GDP growth and inflation rate influences elections.

2.2 Influence of Other Factors on U.S.A Economy.

A study of determinants of inflation in the U.S.A was conducted by Sharif and Rajarshi (2017). They analyze the long-run and short-run impact of the economical variables such as unemployment rate, long-term interest rate, trade openness, budget deficit, money supply, economic growth rate and exchange rate on the inflation rate of U.S.A during the periods of 1978 to 2014. It is revealed that the variables are I(1) by the Augmented Dicky Fuller Unit Root test. An underlying relationship between variables is identified using the VECM and Granger Causality test. However, in this study no significant short-run impact was identified on the unemployment rate due to monetary expansion.

Furthermore, Simionescu (2016) has conducted a study to identify the determinants of inflation rate in U.S.A using Bayesian Econometric methods using monthly inflation rate during the economic crisis period of 2008 -2015. Variables used are the inflation rate, unemployment rate, the exchange rate, crude oil prices, Dollar Index and the M2 Money Stock. He concludes that the unemployment rate, exchange rate, crude oil prices, trade-weighted U.S. Dollar Index and M2 Money Stock determine the monthly inflation rate in U.S.A, since 2008. Results are in accordance with the economic theories.

Dhakal, Kandil, Sharma and Trescot P.B (2018) identified the main factors affecting inflation in the United States of America using a Vector Autoregressive model. They concluded that the major factors affecting inflation in the United States of America are money supply, the wage rate, and the budget deficit and energy prices. Demand and Supply shocks are potential in effecting the inflation rate of the U.S.A economy. The findings of the study is in accordance with the New Keynesian Phillips curve. Furthermore, they have identified the relationship between real variables, inflation and expectations of inflation which is independent of the oil cycle and have explained the dilemma of the behavior of the inflation in last decade by separating the Phillips curve from oil cycle.

Berger and Österholm (2015) examined that money supply granger cause the inflation rate of U.S.A by using a quarterly sample from 1960 to 2015 with applying Bayesian VAR as the research methodology. They extended the study further to find indications of real GDP growth and interest rates in the model built for the inflation rate. An outcome of the study suggested that money growth effect less significant in determining the inflation in short-run which goes against monetarism and other monetary models.

2.3 Influential factors of Inflation

Measuring Core Inflation, the study conducted by Quah and Vahey (1995) confirms that monetary policy has a direct collision with core inflation where the core inflation is defined as the measure of inflation excluding food and energy prices. Data used were the real gross domestic product and the consumer price index limited influence estimator of twelve countries dated from 1980 to 1990 and early 2000. They have used the VAR model for analyzing data.

Lim and Papi (1997) have taken Time Series data from1970 to 1995 to determine the variables affecting Inflation in Turkey. Johansen Co-integration technique was used in this study and it concludes that money, prices of exports, and prices of Imports positively affect domestic price level. Exchange Rate has an inverse effect on the domestic price level in Turkey. The study claimed that monetary factors such as exchange rate and money play a central role in determining the inflation rate of the country.

Rabiul, Ahmad, Abdul, Emil, Narmatha (2017) have studied factors affecting inflation in Malaysia. They conclude that there is demand-pull inflation in Malaysia. The variables he used for the study are money supply growth, unemployment rate and dollar exchange rate as explanatory variables and have used Multi-Linear Regression Analysis. Furthermore, he suggests that there can be other variables affecting inflation of Malaysia as the determinant of regression is below sixty per cent.

Khan and Gill (2010) use several price indicators to find out the determinants for the inflation of Pakistan using ordinary least square method. The study explains that variables such as the budget deficit, wheat support price, imports , exchange rate, support price of sugarcane and cotton and money supply affects all the price indicators directly. Further the interest rate is ultimately affecting the all the variables included in the study in Pakistan. Determinants of inflation have been shifted in the modern era and inflation has less sensitivity to the domestic economy and more sensitivity to global factors and inflation expectations.

Muhammad and Nousheen (2014) identified that the money supply affects the inflation rate in Pakistan. Money supply grows due to the increase of government sector borrowings in Pakistan. They have used producer price index, money supply, durable goods, electricity, import, exchange rate, export, natural gas, crude petroleum, capital goods export, oil products, capital goods import, food import, food export, agricultural products export and wages as explanatory variables. In order to remove the multi co-linearity among explanatory variables principle component analysis has been performed.

Determinants of inflation of several selected countries were studied by Eftekhari and Kiaee (2015). They focused on developing a suitable model for inflation of countries available in the World Bank Database during 2008-2012 using random effect log-linear and ordinal logistic models. As variables are skewed log transformation has been used for all variables. Two models are built and they both indicate a potential effect on next year inflation by the oil price, money growth, GDP and income levels of the current year. Potential association of inflation in different time levels can be identified by both the models. The researchers attempted to study the demand and supply effects on inflation. Countries are divided into three ordinal categories of the low inflation rate, medium inflation rate and high inflation rate. The study is different as it used all countries with available data and while other studies focus on only one country, ordinal logistic model and log-linear models are used for the time series data instead of time series analysis methods.

Mehrotra, Peltonen and Rivera (2007) tried to model the inflation rate in China. They selected inflation rates from 29 provinces in China during 1974 to 2004 and tried to apply New Keynesian Phillips Curve to the inflation in China in provinces. A study reveals that the New Keynesian Phillips Curve is applicable only in coastal areas. In provinces where they have an advanced market, there is an excessive demand pressure, therefore output gap and forward-looking inflation components drive the inflation in those provinces. Forward-looking inflation element is significant in 22 provinces which prove the importance of it. The provinces located in coastal areas show a significant effect from forward-looking inflation element and gap of the output. Those coastal provinces are open to international trade, experience a high rate of economic and labor productivity growth and have modicum share of state-controlled enterprises. Next paper reveals the effectiveness of monetary policies over provinces in China. Probit model, a regression model is used for the analysis and there is potential multicollinearity between the variables used in the study which are the ratio of industry output to GRP , real Gross Regional Product (GRP), and share of State Controlled Enterprises' (SCE) output of Gross Industrial Output.

Grönlund (2017) in his study of identifying inflation differentials among Euro-countries used data from 1993to 2005 to scrutiny the inflation rate of 13 countries who use Euro as the currency. Euro countries try to maintain their inflation rate of around 2 %. The researcher examines that 10 countries out of 13 significantly contribute to the inflation rate of the economy of Europe. After the crisis of 2008, the effect of comment currency on inflation was diverging from each and other countries, this study significantly proved the statement of increment of inflation differentials due to Euro converging process. Regression with Ordinary Least Squared method is used in the study. It further discusses the economic trends of countries of which inflation is significantly affecting each other and not.

Belloumi (2009) applied the autoregressive distributed lag model in his study on identifying the relationship between foreign direct investment, trade and economic growth in Tunisia using the data gathered from 1970 to 2008. Findings of the study show that there is a long run effect of trade openness and economic growth on foreign direct investment in the country. There is no significant effect from economic growth on foreign direct investment in the country in the short term. Study finally shows the foreign direct investment in Tunisia has a positive effect on economic growth.

2.4 Application of Vector Autoregressive Model (VAR)

Jacobson, Jansson, Vredin and Warne (1999) tried to show that the Vector Autoregressive model is effective in modelling the different variables related to monetary policies and inflation rate. It further suggested that the other commonly applied models Vector Autoregressive model has more appropriate features in analyzing inflation rate. Gathingi (2014) modelled inflation rate in Kenya using both ARIMA and VAR model, he identified that the VAR model is a better technique for modelling inflation in Kenya than ARIMA model. He used data on money supply, urban oil price, exchange rate and consumer price index for his study.

Hiroshi (2001) studied the distribution and demand formation patterns in economy of Japan using VAR model using data between 1985 to 2008. Post Keynesian model of inflation is used as the theory. It reveals that the Japanese government couldn't achieve a growth led by domestic demand since 1990s , but after 2002 demand of exports expanded and Japanese government could recover the share of profits. M'Amanja, Lloyd and Morrissey (2005)try to predict the impact of foreign aid and fiscal policy on growth of Kenyan economy using annual time series data from 1964 to 2002. Vector autoregressive method and vector error correaction method is used to establish short and long run relationships between the variables. Paper concludes that the government spending has a long term relationship with the growth rate but no evidence of influence of tax rate impeding the growth.

2.5 Application of Vector Error Correction Model (VECM)

Andrei (2015) used VECM to analyze the long and short run association of some macroeconomic variables in Romania using a dummy to establish the influence. Granger causality test was also used to identify uni/bi directional effects between the variables. Results suggests that economic crisis has influence on suggested variables of foreign direct investment , imports, exports and gross domestic products.

Dlamini and Nxumalo (2011) used the explanatory variables of real income, nominal money supply, nominal interest rate, nominal exchange rates, nominal wages, and South African consumer prices and dependent variable of Swaziland consumer price index as the to analyze the determinants of inflation of Swaziland. They used co-integration and error correction model for the analysis. Findings indicates that the money supply and interest rate has doesn't play a significant role on influencing inflation rate while long term exchange rate is shows significant influence long term.

Bergen (2003) uses time series VECM approach to explain the impact of relationship among interest rate and inflation rate towards the volatility of exchange rate in Malaysia between 1999 and 2009. Impulse response function explained the shock amongst the variables in his study. `Stationarity tests, co-integration test, stability test and granger causality test has been conducted to analyze data for more details. It is found that the interest rate has impact on exchange rate of the country and increment of interest rate can restrict volatility of exchange rate efficiently.

Umoru (2013) has used vector error correction model to analyze the inflation rate and unemployment in Nigeria during twenty seven years. It is identified that the inflation rate and the unemployment rate has a positive relationship which means increasing inflation rate results in increasing unemployment rate. The results of the study are not in accrodance with the Phillips curve theorm. It is suggested to maintain inflation rate at a single digit rate. Inorder to achieve single digit inflation rate GDP growth should be increased.

2.6 Application of Autoregressive Distributed Lag Model (ARDL)

Belloumi (2009) applied autoregressive distributed lag model in his study on identifying the relationship among trade, foreign direct investment and economic growth in Tunisia using the data gathered from 1970 to 2008. Outcome of the study indicates that there is a long run effect of trade openness and economic growth on foreign direct investment in the country. There is no significant effect from economic growth on foreign direct investment in the country in short run. Foreign direct investment in Tusnisia shows a positive influence on economic growth.

Pesaran (2001) examines the usage of autoregressive distributed lag model to express long run relationship when the variables are cointegrated at level or 1st lag order. Measuring long run relationship is important in theoretical and empirical research in econometric analysis. Standard asymptotic normal theory is used for carrying out estimation for the long run properties. Demko (2010) studied on natural gas consumption and regional economic growth in Ukraine. He wanted to identify the nature of causality occurred by natural gas consumption on regional growth. As the sample margin data from 2000 to 2008 of Kyiv and 25 other Ukrainian regions is used. Time Series are integrated at first order and ARDL model is used for the Study. Natural Gas Consumption granger cause gross regional product and labor force.

Nkoro and Kelvin (2017) studied further on Autoregressive Distributed Lag (ARDL) model. The researchers examined the issues of applying cointegration techniques because most cointegration techniques in time series variables are wrongly applied in studies. Findings of the study suggests that unit root test is not necessarily required before running ARDL model unlike it being necessary to test unit root before applying other time series techniques. ADRL is preferable when variables are integrated in first order or level or in both. ADRL can be used effectively when the sample size is relatively small. This study tries to give a solution for misapplication of time series techniques for long run relationships with constant mean and variance. If Wald test identify a single long run relationship in a sample above 30, using ARDL Error Correction representation is more efficient. In such a situation ARDL can be reparameterized in to Error Correction Mode which shows the short run and long run effects of underlying variables. When there are more than one co-integrating factors Johansen and Juselius approaches should be applied.

2.7 Summary of Chapter 2

There have been many studies which focused to identify the influence of various external factions on inflation rate. Of the various methodologies VAR and VECM methods have been widely used. Almost all past studies were concentrated on one period. No studies were found to compare impact of various factions on different scenarios.

CHAPTER 3

MATERIAL AND METHODOLOGY

3.1 Secondary Data

Quarterly data from 1981Q1 to 2016Q4 were obtained from the database of International Monetary Fund (www. http://data.imf.org/) and from the database of Federal Reserve Bank of St.Louise (www. https://fred.stlouisfed.org/). Variables collected are described below in table 3.1.

Table 3.1: List of the variables used for the study

Notation	**Stands For**	**Description**	**Units**
INF	Inflation Rate	Quarterly inflation rate calculated	Percentage Value
GDP	Gross Domestic Product	Real Gross Domestic Product, Quarterly and Seasonally Adjusted Annual Rate	Billions of US Dollars
TOB	Trade of Balance	Trade of Balance	Millions of US Dollars
EXC	Exchange Rate	Real Effective Exchange Rate, based on Consumer Price Index	Percentage Value
MS	Money Supply	M2 Money Supply	Billions of US Dollars
FDI	Foreign Direct Investment	Rest of the world; foreign direct investment in U.S.A.; asset, Flow, Quarterly, Seasonally Adjusted Annual Rate	Millions of US Dollars
GE	Government Expenditures	Federal government total expenditures, Quarterly, Seasonally Adjusted Annual Rate	Billions of US Dollars
UMP	Unemployment Rate	Percentage of unemployment rate quarterly	Percentage Value

3.2 Basic Concepts of Economic Theory

3.2.1 Inflation

Inflation is the persistent growth of general price level of a country. Inflation has both positive and negative impact on economy. Excess accretion of inflation can be a controversial social and political phenomenon in a country as it can hinder the growth of any economy (Kasidi, 2013) , therefore every economy around the globe tries to keep inflation in control. Even a magnate economy can be oppressed by high inflation for a short period. Keynesian economics and monetarism explains the theoretical background of effect of economic indicators on inflation.

3.2.2 Inflation Gap

Figure 3.1 illustrates the demand pull inflation. Y_F represents the full employment level of output. When aggregate demand increases from AD_1 to AD_3, production increases from Y_1 to Y_F and price level from P_1 to P_3. But when aggregate demand increases from AD_3 to AD_4, only price level or the inflation increases from P_3 to P_4 as aggregate supply curve increase vertically after the full employment level of output. Aggregate supply curve between AD_3 and AD_4 represents the inflation gap.

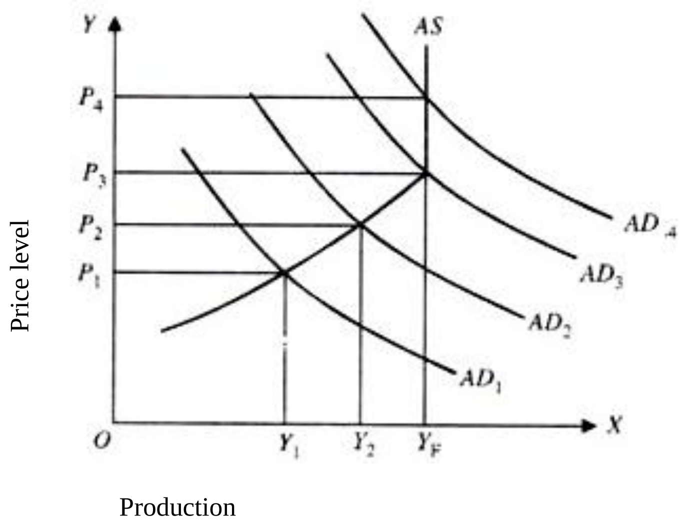

Figure 3.1: Keynesian economy Demand and Supply Curve
Source: Ahuja (1986)

3.2.3 Keynesian Theory on Inflation

Keynesian economic theories were introduced by John Maynard Keynes in 1930s as an endeavor to comprehend Great Depression which started with stock market crash of U.S.A in 1929 (Ahuja, 1986). Keynes explains when aggregate demand (AD) exceeds aggregate supply(AS) at full employment level of output, then the inflation occurs. Aggregate demand depends on consumption, investments, government expenditures, and exports. It is the total of spending on goods and services of government and consumers plus the net investments considered by entrepreneurs. The factors that increase aggregate demand are increase of private consumption, private investments, individual exports, and government expenditure. Decreasing the imports and tax rate underpin augmenting the inflation rate.

It is assumed that low inflation and low wage rate will cause employers to make capital investments which will increase employment rate that restore the economic growth. Keynes anyhow refutes the idea of lower wage rate restoring full employment. He indicates that with lower wage rate the demand will be lower, hence the employers won't hire more employees to produce the products as there is less demand. Keynes writes his popular book named "The General Theory of Employment, Interest and Money," during the great recession, therefore Keynes economy sometimes is referred as depression economics. He rejects the idea of natural state of equilibrium suggesting that economy will be in constant flux or natural cycle which will be referred as boom and bust. Keynes suggests increasing government expenditure to alleviate the inflation. His notion is when government expenditure is increased, consumer demand will be increased which results in overall dynamic of economic activities that reduces inflation.

3.2.4 Multiplier Effect

Multiplier Effect is a main component suggested in Keynesian economics which indicates that government expenditure increases business activities adding more spending to the economy. This spending will expand aggregate supply and income will be increased. When extra income is spent, the Gross Domestic Product will increase and the economy will bloom. Keynes is not in accordance with the idea of savings and in conformity with spending more. Spending will become income of another person which will achieve full employment. Full employment supports economic growth. Multiplier Effect becomes a controversial notion that later economists such as Milton Friedman pointed that Keynesian model has misinterpreted the relationship between savings, investments and economic growth (Friedman , 1970).

Keynesian economics emphasizes on government's intervention on alleviating economical crisis. Lowering interest rate is a method to enhance the condition of economical well being of a country. When interest rates are lower, many will borrow money and there will be an expansion in financial sector. But only lowering interest rate doesn't help improving economic situation. As an example, during 1990s even though Japan lowered interest rate, it didn't help in economic improvement (Chappelow, 2019).

3.2.5 Fiscal Policy

Fiscal policy is a concept based mainly on the Keynesian Economics. It defines the use of government expenditure and tax policies to manupulate the macroeconomic phenomenon like inflation, economic growth, employment, and aggregate demand. Expansionary fiscal policy increases money supply and government expenditure and lowers tax rates in order to increase aggregate demand and economic growth. With lower tax there will be more individual expenditure which will lead to high demand and high employment. Other than that, government can increase government expenditure by constructing public properties as highways, schools, universities which ultimately will create more employment.

Contractionary fiscal policy is a rare situation where government tries to balance the economy by reducing government expenditure and increasing tax when there is a budget surplus. When the fiscal policy is not contractionary or expansionary, then it is neutral.

3.2.6 Monetary Policy: The quantity theory of money

The quantity theory of money is an infamous theory of inflation from 18th century. David Hume (1711-1776) identifies the impact of monetary changes in economy from one sector to the other in form of quantity and price. In 1797, David Ricardo, a classical economist reveals that the inflation in Britain was caused majorly by the irresponsible supply of money of Bank of England due to the war caused by Napoleons. Irving Fisher (1876-1947) in supporting the Monetarism presents the below equation to describe the monetary relationship between economic indicators:

$$\mathbf{M*V = P*T} \qquad \mathbf{P = \frac{MV}{T}} \tag{3.1}$$

Where

MV = Money supply

M= Currency

V= Velocity of circulation

P= General price level

T=Total trade (sales and purchase)

Above equation 3.1 shows that general price level increase proportionately to the money supply and the total trade.

3.2.7 Printing Money

Printing money is a method of increasing the money supply of an economy. If money is printed excessively disregard of the growth of the amount of goods, then the households will have more money to spend, thereby increasing the market price of goods due to competition of demand. During the Civil War of 1861-1864 in the U.S.A the confederacy printed supplementary paper money of $1 billion which aggregate an inflation rate of 700% by April 1864. At the end of civil war, people lost confidence in currency as the inflation rose to 5000%. From 1922 to 1923 due to excess money supply in Germany, US dollar became equal to 4,210,500,000,000 German marks. It caused hyper-inflation and loss of value of the currency (Weidenmier, 2018).

3.3 Monetarism: Friedman's Modern Quantity Theory of Money

Milton Friedman in supporting the monetarism suggests his new theory of money called Modern Quantity Theory of Money. He explains the main factor that affects the inflation is the money supply. In economic stabilization, monetary policy plays a more effective role than fiscal policy. Monetarists focus to stabilize inflation by controlling the money supply. Both excess and insufficient money supply are not healthy for inflation in an economy. When there is a high inflation in a country, then contractionary monetary policy is applied and, in a deflation, expansionary monetary policy is used. According to the supply of money, interest rate will fluctuate supporting or opposing the amount of borrowing which again balance the aggregate supply and the aggregate demand (Chappelow, 2019).

Milton Friedman in short, revived the Classical Monetary Theory which indicated that inflation is proportionate to the supply of the money Milton Friedman in contrast suggests that the increase of inflation is not proportionate to the money supply (Friedman, 1970).

3.3.1 Equation of Modern Quantitative Theory of Money

Later Milton Freedman presented a new equation of

$$\mathbf{M} * \bar{\mathbf{V}} = \mathbf{P} * \bar{\mathbf{Y}} \qquad \textbf{(3.2)}$$

Where

M= Money supply,

V= Average velocity of circulation

P= Price level

Y= Average National Income (T = number of transactions)

In quantitative Monetary Theory it is assumed that

1. Velocity of circulation or speed of money circulation is constant in short run.

2. Due to full employment in the economy National Income is also constant.

Therefore, money supply and price level have a proportional relationship. When money supply goes up in x%, price level also increases by x%. Simply increasing money supply will increase the price level. Monetarists indicate that in short run, velocity is fixed as the rate of money circulation doesn't change often and even thought velocity changes, it varies by a little amount so that amount can be ignored (Barone, 2019).

Monetarists also assume that Y (output) is fixed, stating that Y may fluctuate in the short run excluding the long-run (LRAS is inelastic and it is decided by the factors in supply-side). Hence, increasing Money Supply will increase inflation (Friedman, 1970)

3.3.2 Monetarist View on Aggregate Demand (AD) and Supply Curve

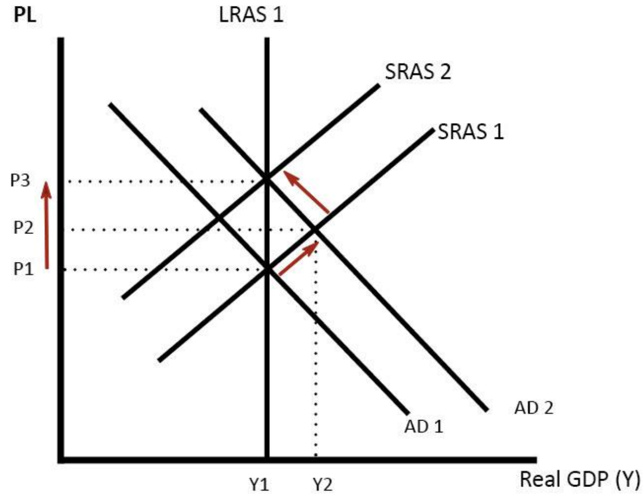

Figure 3.2: Monetarist inflation in Aggregate Demand(AD) and Aggregate Supply (AS) model.
Source : Ahuja (1986)

When Money Supply increases, citizens get more money, which raises individual consumptions. This shifts aggregate demand (AD) to right from AD_1 to AD_2.Responding to these producers increases Short Run Aggregate Supply (SRAS). Real output rises from Y_1 to Y_2. Inflationary gap happens as national output exceeds the output level in accordance with the equilibrium. Producers will hire more employees and it will make rise in costs and prices due to rise in wages. When prices increase, purchasing power will be low. Employees will demand for more wages which will cause Short Run Aggregate Supply to shift the left. With SRAS2 economy will get output of equilibrium level ,Y_1 . Then the price level will be higher, P_3. Long Run Aggregate Supply Rise (LRAS) is not elastic. Increase of money supply will cause rice of demand which will cause demand pull inflation.

Economists who criticize monetarism explains that the relationship between inflation and money supply is not powerful and direct in practical world. United States of America few times in recent history injected money supply due to recessions and it did not increase inflation (Radcliffe, 2019).

3.4 Phillips Curve

Phillips Curve describes the relationship among inflation and unemployment rate. The Phillips curve is named after A.W.H. Phillips (1958) an economist who created empirical model with a single equation. Concepts of demand and supply can be used to explain the theories of the Phillips Curve. If labor demand is greater than its supply, then the wage rate pushes upward due to excessive demand. It has an impact on inflation rate which makes the inflation high. In contrast, when the labor supply is greater than the deman,d then the wages pushes downwards. It would results in a low inflation rate in the country and the unemployment rate will go up. Rising inflation has a correlation with falling unemployment. Monetarists believe in the short run, there is a trade-off relationship among inflation and unemployment. Equilibrium of Long Run Phillips Curve (LRPC) with shift of Short Run Phillips Curve (SRPC) are shown in figure 3.3.

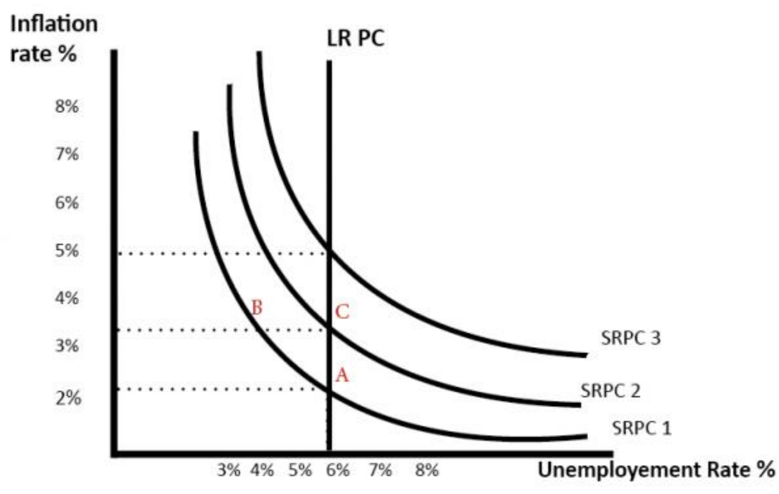

Figure 3.3: Phillips curve.
Source : Ahuja (1986)

3.5 Vector Auto-Regression Model

Economic indicators show long term relationship among variables. These time series don't have constant mean or variance as they differ according to the time. Analyzing non stationary time series directs the relationship in to spurious regression, which output error some results. De-trending and differentiating is used to analyze non stationary data (Maddala, 2001). Co-integration on the other hand is a technique with de-trending and differencing non stationary data which was introduced by Granger's representation theorem.

If Y_t and X_t are order one I(1) integrated, then Y_t and X_t are co-integrated if and only if $Y_t - \beta X_t = Z_t$,where Z_t in integrated order zero I(0). Therefore if Y_t and X_t are co-integrated, then they move mutually in long run and they cannot glide arbitrary away from each other with time (Maddala , 2001). Two typical methods to which recommended examining long run relationship of variables are Engle and Granger (1987) co-integration test and Johansen-Juselius (1990) coitegration test. Engle and Grange test is suitable for bivariate analysis and Johansen –Juselius is suitable for multivariate analysis.

3.5.1 Johansen –Juselius (1990) Co-integration Test

Johansen Juselius co-integration test identifies long run relationships that may exist among representative variable and is based on VAR model of order p. In Johansen Juselius co-integration all variables are treated as endogenous variables and it doesn't segregate dependent variables and independent variables. Johansen Juselius approach is a one step approach compared to two stepped Engle Granger methodology. Due to these reasons Johansen Juselius co-integration is considered as an effective statistical method for testing co-integration.

Johansen Juselius co-integration approach can be expressed using below equation.

$$Y_t = \mu + A_1 Y_{t-1} + A_2 Y_{t-2} + A_3 Y_{t-3} + \ldots\ldots\ldots\ldots\ldots + A_p Y_{t-p} + \varepsilon_t \qquad \textbf{(3.3)}$$

Where Y_t is a vector which contains p variables. These variables are order one integreated I(1). t can be recognized as time period. A_p is an (n*n) matrix of coefficients. ρ denotes the maximum lag shows in the model. μ is vector of constants. ε_t is vector of error term. Assuming that the cointegration or order is p , this model can be written as an error correction model. Enders (2004) shows how to rewrite above equation as :

$$\Delta Y_t = \mu + (A_1 - I)Y_{t-1} + A_2 Y_{t-2} + A_3 Y_{t-3} + \ldots\ldots\ldots\ldots\ldots + A_p Y_{t-p} + \varepsilon_t \qquad \textbf{(3.4)}$$

In the above model ($A_1 + A_2 + \ldots + A_{P-1-I}$) denotes the dynamics in short run that are explained in the model. In above equation the long run relationship between the variables explained in the "Y" vector is shown by ($A_1 + A_2 + \ldots + A_{P-I}$). I is the identity vector of the model. Main purpose of the Johansen Juselius method is to conclude the rank inside matrix (A_1 + A_2+…+ A_{P-I}), which stand for the number of independent cointegration vectors or the number of error correction terms belong in the model.

3.6 Error Correction Model

When there is no long run equilibrium relationship among variables Granger Causality test is valid, therefore Engle and Granger (1987) explains including error terms in equation which turns it in to Error Correction Model. Error Correction Model is used for data with underlying variables having a long run stochastic trend or a co-integration. It estimates both long term and short term effects of one time series on another time series. Error is short run dynamics and the error correction term is long-run equilibrium.

When there are two variables in model and when X and Y are I(1) or integrated in order one. This error correction model (ECM) can be written as:

$$\Delta X_t = \delta_i + \sum_{i=1}^{p} a_i \,\Delta X_{t-i} + \sum_{i=1}^{p} \beta_i \,\Delta X_{t-i} + \gamma_1 \hat{\varepsilon}_{1t-1} + v_{1t} \quad \textbf{(3.5)}$$

$$\Delta Y_t = \lambda_i + \sum_{i=1}^{p} d_j \,\Delta X_{t-i} + \sum_{i=1}^{p} c_i \,\Delta X_{t-i} + \gamma_2 \hat{\varepsilon}_{2t-1} + v_{2t} \quad \textbf{(3.6)}$$

$\hat{\varepsilon}_{1t-1}$ and $\hat{\varepsilon}_{2t-1}$ represents error correction terms when long run model is lagged once. It is also the deviation of X and Y variables of their long run equilibrium. Error correction term shows the short-run forces which are needed to achieve the long run equilibrium. This further supports to detect Granger causality (Granger, 1988). γ_1 shows the long run causal relationship among the variable. When γ_1 is not significant model shows that the variables are independent. When γ_1 is statistically significant but γ_2 is not there is a unidirectional causality from Y to X , that shows that Y leads X to long run equilibrium but X doesn't lead Y to long run equilibrium. The opposite unidirectional causality occurs when γ_2 significant and γ_i is not. When both γ_1 and γ_2 are significant there is a bidirectional Granger causality relationships. β_i shows the short run effect of changes happens in X variable on Y variable , d_j shows the short run effects of changes that happens in Y variable on X variable. v_{it} is the standard error term.

CHAPTER 4

BEHAVIOUR OF INFLATION RATE AND OTHER ECONOMIC VARIABLES

4.1 Grouping of Data in U.S.A

Four scenarios as explained in section 1.3, the four periods considered in this study are:

- 1st Period- 1981 Q1 to 1992 Q4 (Republican Period)
- 2nd Period – 1993 Q1 to 2000 Q4 (Democratic Period)
- 3rd Period- 2001Q1 to 2008 Q4 (Republican Period)
- 4th Period – 2009 Q1 to 2016 Q4 (Democratic Period)

4.2 Temporal Variability of Inflation Rate (INF) during Four Periods

Inflation rate generally is the growth of price levels of goods and services. During 2010s, inflation rate of USA took an average rate of 2.1% comparing to the average rate of 2.9% in China and 2% in European Union (IMF, 2011). In United States of America the inflation is considered to be below average as there is an excess supply and weak demand. In 2008 United States of America faced financial crisis and due to the same reason there is slow augmentation of wages which hinder the rising of inflation rate. 2017 Consumer Price index of U.S.A went up from 1.8% which takes a close value targeted by Federal Reserves of 2%. Economic policy goal of Federal Reserve System aims for a constant inflation rate of 2%.

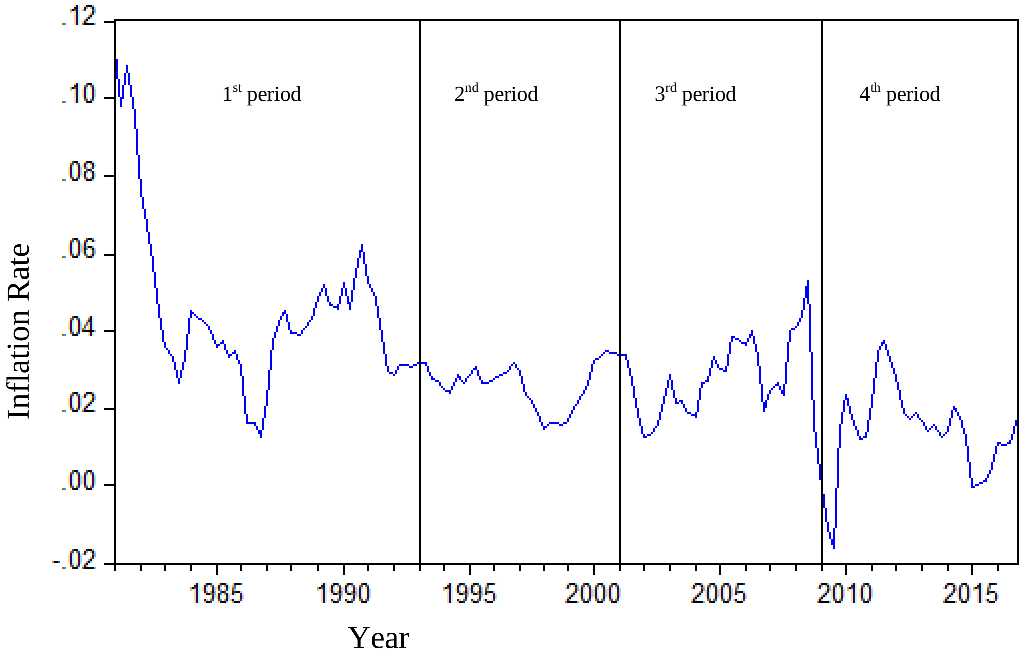

Figure 4.1: Inflation rate from 1981 to 2016 according to four time periods.

Inflation rate of U.S.A from 1981 to 1999 take an average rate of 5.23% and range from 2% to 11.49%. During the period of 1981 to 1999 in 1989 3rd quarter inflation took a maximum value of 11.49 % and then in 1992, 3rd quarter it took the lowest value of 3.16% . July 1981 recession in U.S.A started and ended in November 1982. During 1981 the average inflation rate of U.S.A was 10.48% and during 1982 it took a rate of 7.45% . As shown in figure 4.1 it can be seen that by 1983 inflation rate decreased and during 1991 again the inflation rate shows an unstable increase which possibly has happened due to the recession occurred around March 1991 that existed for 8 months. During the period of 1981 to 1999 in 1989 3rd quarter inflation took a hike of 11.49 % and then in 1999 3rd quarter it took a low value of 2%. In July 1981 recession in U.S.A started and ended in November 1982. During 1981 the average inflation rate of United States of America was 10.48% and during 1982 it took a rate of 7.45%. As shown in figure 4.1 it can be seen that by 1983 inflation rate decreases and during 1991 again the inflation rate shows an unstable increase which has possibly happened due to the recession happened around March 1991 that existed for 8 months. Inflation rate of U.S.A from 1993 to 2000 take an average rate of 2.6% and range from 2.0% to 3.4%. Maximum inflation rate of 3.48% was reported in 1st quarter of 1993 and minimum of 2% was reported in 3rd quarter of 1999. Starting from 1997 Q1 to 2000 Q2 there is a huge fall of inflation rate.

Inflation rate of U.S.A from 2001 to 2008 take an average rate of 2.19% and ranges from 1.1% to 2.82% as shown in figure 4.1. Maximum inflation rate of 2.82% was reported in 3^{rd} quarter of 2006 and minimum of 1.1% was reported in 4th quarter of 2003. According to the National Bureau of Economic Research, it was reported that during March 2001 to November 2001 there was a recession in U.S.A at the beginning of 3^{rd} period.

Inflation rate of U.S.A from 2009 to 2016 take an average rate of 1.74% and range from 0.73% to 2.26%. Maximum inflation rate of 2.26% was reported in second quarter of 2002 and minimum of 0.73% was reported in 4th quarter of 2010 as shown in figure 4.1. $111.87 in 2016 had the purchasing power of $100 in 2009. In 2009 there was a inflation rate of -0.36 and in 2016 it was 1.64%

4.2.1 Basic Statistics for Inflation Rate

Table 4.1 describes the descriptive statistics of four different time periods of the U.S.A. Jarque –Bera test statistic is significant (P-Value < 0.05) during1981 to 1992, time series is not normally distributed. Time series is positively skewed. Inflation during early 1980s should have caused the skewness of the series. Jarque –Bera test statistic are not significant during other time periods at 5% significance level. (P-Value > 0.05), time series are not significantly deviated from normal distribution.

Table 4.1: Descriptive Statistics of Inflation rate over different periods

Statistics	1981-1992	1993-2000	2001-2008	2009-2016
Mean	0.0456	0.0259	0.0283	0.0137
Median	0.0415	0.0269	0.02715	0.01435
Maximum	0.1124	0.0351	0.053	0.0376
Minimum	0.0128	0.0146	0.0125	-0.0162
Std. Dev.	0.0215	0.005846	0.009805	0.011782
Skewness	1.5378	-0.50051	0.38287	-0.39923
Kurtosis	5.3765	2.283453	2.596183	3.562122
Coef Var	47.3500	22.5400	34.6300	85.5900
Jarque-Bera	30.2158	2.0206	0.9992	1.2713
Probability	0.0000	0.3641	0.6067	0.5295

4.2.2 Comparison of Inflation Rate between four periods

The Analysis of Variance was carried out to compare Inflation Rates (Table 4.2). Test statistic of ANOVA test is significant (F=31.9, p=0.0000). It can be concluded that there is a significant difference between the means of the inflation during four periods at 95% of significance level.

Table 4.2: ANOVA output for INF

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.021	3	.007	31.973	.000
Within Groups	.030	140	.000		
Total	.051	143			

The plot of means of Inflation Rate in four periods is shown in figure 4.2. Republican periods have higher mean of inflation rate than the following democratic periods.

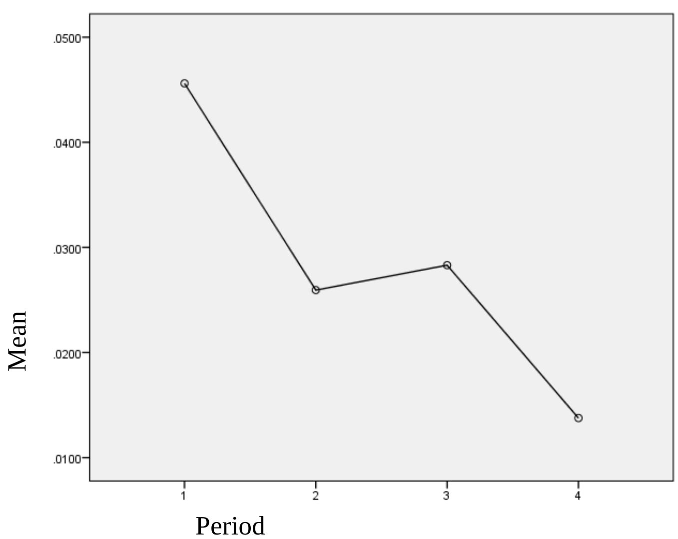

Figure 4.2: Plot of Mean of Inflation rate

4.3 Temporal Variability of Gross Domestic Product (GDP) during Four Periods

Gross Domestic Product (GDP) is the monetary value of all the goods and services produced with in an Economy in a specific time period. GDP can be calculated annually and quarterly basis. GDP can be defined as an overall measurement of economic activities of an economy including all private and public consumption , foreign balance of trade, government expenditures, private inventories , investments and construction costs. (*GDP = Consumption + Government Expenditure+ Investment + Net Exports (Exports – Imports)).*

Growth of GDP indicates that the economy is becoming stronger. GDP therefore is a measure of health of an economy. In 2009 as a result of Federal Reserve releasing $2 trillion in to the economy to bolster recession fallout there was a misleading visible growth of GDP by 4%, this indicates that GDP is not a flawless economical indicator. Augmentation of inflation indicates a rise in price level which causes reduction in purchasing power of money. Lower purchasing power of money reduces the consumption which further results decrease in GDP. According to the Phillip Curve theory high inflation is related to low unemployment rate. Low unemployment rate indicates a growth in economy which results in growth of GDP.

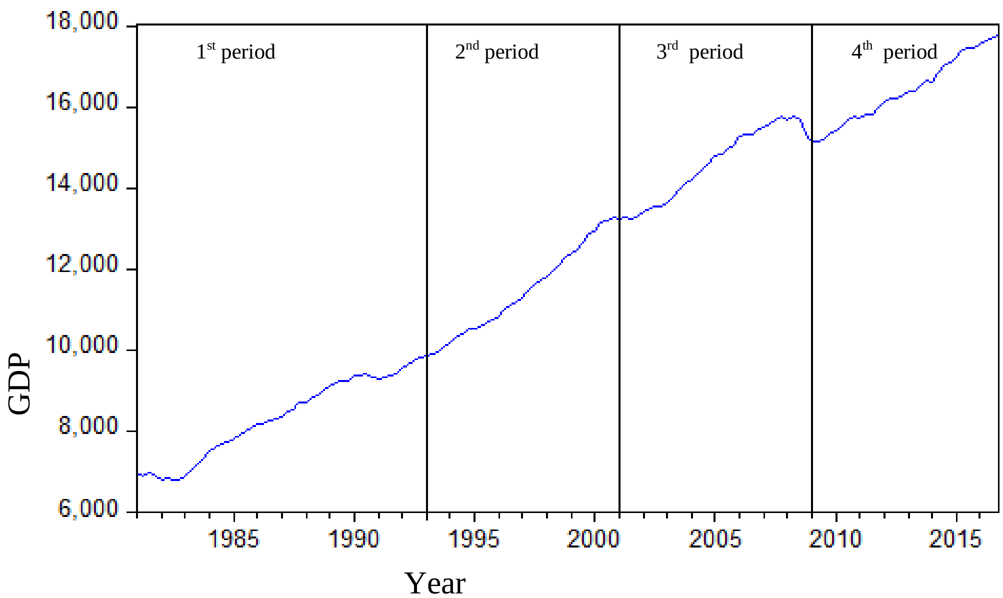

Figure 4.3: GDP of United States of America for Four Periods

Real Gross Domestic Product of U.S.A takes an average of $ Billion 8303.32 during the 1st period 1981 to 1992. Minimum of $ Billion 6794.878 is reported in 1982 Q1 and maximum of 9834.51 is reported in 1992 Q4.During the 2nd period of 1993 to 2000, it takes an average of $ Billion 11408.41. Minimum of $ Billion 9850.973 is reported in 1993 Q1 and maximum of 13260.51 is reported in 2000 Q4. With the growth of economy GDP tends to increase continuously in an upward motion. At the end of 2008 (Figure 4.5), it tends to decrease ostensibly due to the recession. During the 3rd period average GDP is $ Billion 14565.27. Minimum of $ Billion 13222.69 is reported in 2001 Q1 and maximum of 15761.97 is reported in 2007 Q4. Again during the 4th period GDP starts to recover its growth and during the period GDP reports an average of $ Billion 16410.79. Minimum of $ Billion 15134.12 is reported in 2009 Q2 and maximum of 17784.19 is reported in 2016 Q4.

4.3.1 Basic Statistics for Gross Domestic Product

Table 4.3: Descriptive Statistics of GDP of U.S.A over different periods.

Statistics	1981-1992	1993-2000	2001-2008	2009-2016
Mean	8303.32	11408.41	14565.27	16410.79
Median	8338.97	11248.40	14690.74	16311.05
Maximum	9834.51	13260.51	15761.97	17784.19
Minimum	6794.87	9850.97	13222.69	15134.12
Std. Dev.	989.39	1075.12	907.90	829.54
Skewness	-0.18	0.25	-0.16	0.12
Kurtosis	1.64	1.79	1.49	1.78
CoefVar	23.53	13.32	12.07	8.87
Jarque-Bera	3.94	2.27	3.14	2.05
Probability	0.13	0.31	0.20	0.35

Table 4.3 describes the descriptive statistics of GDP during the four given periods in the study. Four time series are not significantly deviated from normally distribution according to the Jarque-Bera Test statistics (Jarque Bera =3.94, p = 0.13).

4.3.2 Comparison of Gross Domestic Product between four periods

The Analysis of Variance was done to compare the GDP during four periods (Table 4.6). Test statistic of the ANOVA test is significant (F=542.07, P= 0.0000). It can be concluded that there is a significant difference between the means of GDP at 5% of significance level. The plot of means of GDP in four periods is shown in figure 4.4. Mean plot in Figure 4.4 shows a gradual linear increase of mean of the GDP of U.S.A with a slight hindrance of the growth from period 3 to period 4 possibly due to economic crisis in 2008.

Table 4.4: ANOVA output for GDP

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1495271802.96	3	498423934.32	542.07	.0000
Within Groups	128726798.55	140	919477.13		
Total	1623998601.51	143			

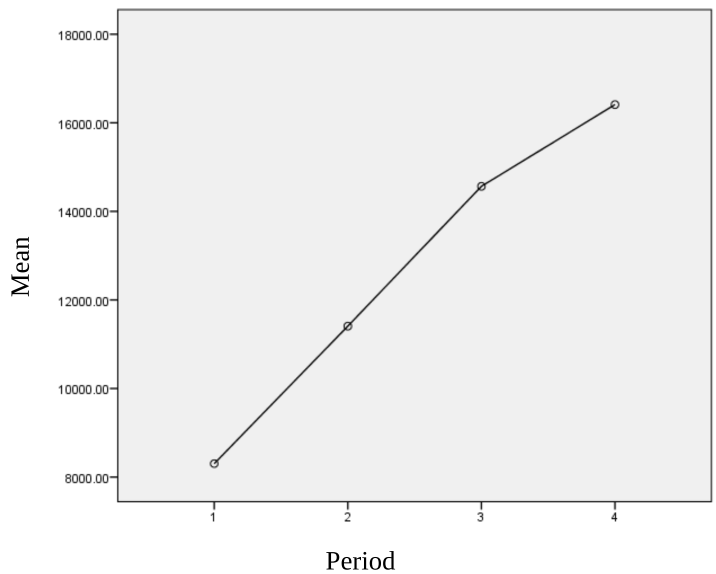

Figure 4.4 Mean Plot of GDP according to different time periods

4.4 Temporal Variability of Trade of Balance during Four Periods

Trade of balance is the value of exports minus imports in a country. This is equal to the value of net exports which also is measured by subtracting the imports from exports. Positive trade of balance means more exports than imports which is beneficial for economy. Negative trade of balance means fewer imports than exports which will hinder the growth of the economy in longer term.

Export is a term used for international trade where local production of goods is sold to another country. Exports increase the national income and aids economical growth. Exports create employment opportunities and bring revenue. In 2017 the world's largest exporting countries in terms of value of US dollars are China, United States of America, Germany, Japan and South Korea. United States of America in 2017 exported approximately $1.6 trillion of goods preceded by China with reported approximate value of $2.2 trillion.

High inflation is in relation with negative trade of balance. Which means with negative trade of balance inflation rate will be higher. High inflation increases the exchange rate. When the exchange rate goes up it brings in more value of exports. Mundell-Fleming model explains that "As the price level drops, interest rates fall, domestic investment in foreign countries increases, the real exchange rate depreciates, net exports increases, and aggregate demand increases." (Mundell & Felming ,1971). Depreciation of currency brings less foreign exchange which causes expensive imports and cheap exports, which is identified as imported inflation.

Import is a term used for international trade where foreign products of goods or services are brought in to a country. If the value of exports in a country surpasses the value of imports then the balance of trade is positive. Countries mainly import goods which cannot be produced at all or cheaply in the local market. Such one product is oil.

United States of America increased its imports from $473 billion in 1989 to $ 2.9 trillion in 2017. (Reference) China Canada and Mexico are the countries from which the goods are mainly imported to United States of America. With free trade agreement many countries could do production at cheaper production zones and import in a cost effective way.

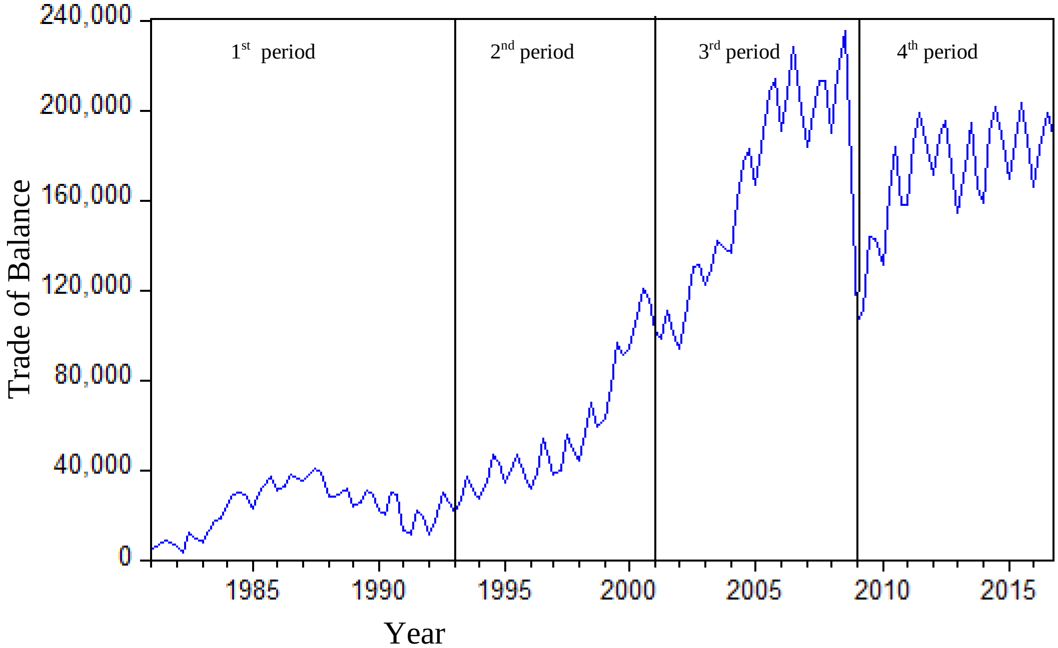

Figure 4.5: Trade of Balance of United States of America for Four Periods

During period 1 trade of balance of the country fluctuates continuously. It takes an average value of $ Mil 23404.40. Maximum of $ Mil 40662 is reported in 1987Q3 . Minimum value of $Mil 3470 is reported in 1982 Q2. It has a range of $Mil 37192. Trade of balance during period 2 is presented in the Figure 4.5 in $ Million values. During this period trade of balance of the country has ostensibly seasonal fluctuation. It takes an average value of $ Mil 55,375.92. Maximum of $ Mil 120,833.10 is reported in 2000 Q3 . Minimum value of $Mil 20,904.60 is reported in 1993 Q1. It has a range of $Mil 99,928.50.

Trade of Balance during period 3 has ostensibly seasonal fluctuation. It takes an average value of $ Mil 165,395.20. Maximum of $ Mil 235666.30 is reported in 2008 Q3 . Minimum value of $Mil 93541.87 is reported in 2002 Q1. It has a range of $Mil 71,853.33. Trade of Balance during period 4 from 2009 to 2016 (Figure 4.5) also has ostensibly seasonal fluctuations. It takes an average value of $ Mil 171901.50. Maximum of $ Mil 203281.00 is reported in 2015 Q3 . Minimum value of $Mil 106437.60 is reported in 2009 Q1. It has a range of $Mil 71,853.33.

4.4.1 Basic Statistics for Trade of Balance

The descriptive statistics of trade of balance in U.S.A during the four given periods in the study is shown in table 4.5. Jarque-Bera statistic shows that trade of balance during republican periods is normally distributed. Trade of balance during democratic periods is not normally distributed.

Table 4.5 : Descriptive Statistics of Trade of Balance of U.S.A over different periods.

Statistics	1981-1992	1993-2000	2001-2008	2009-2016
Mean	23404.40	55375.92	165395.20	171901.50
Median	25502.05	45884.15	175268.20	179309.70
Maximum	40662.00	120833.10	235666.30	203281.00
Minimum	3470.00	20904.60	93541.87	106437.60
Std. Dev.	10498.96	27165.63	43285.99	24586.62
Skewness	-0.34	1.06	-0.17	-1.07
Kurtosis	1.95	3.03	1.70	3.66
Coef Var	44.86	49.06	26.17	14.30
Jarque-Bera	3.14	6.03	2.39	6.65
Probability	0.20	0.04	0.30	0.04

4.4.2 Comparison of Trade of Balance between four periods

The analysis of variance was carried out to compare the trade of balance (Table 4.6). Test statistic of the ANOVA test is significant (F=286.59 , p=0.0000). Therefore null hypothesis is rejected. Thus it can be concluded that there is a significant difference between the means of trade of balance among four periods at 5% of significance level.

Table 4.6: ANOVA Table for TOB

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	644104879149.25	3	214701626383.08	286.59	.000
Within Groups	104881382202.33	140	749152730.01		
Total	748986261351.58	143			

The plot of means of TOB in four periods is shown in figure 4.6. Mean plot in Figure 4.6 shows a gradual linear increase of mean of the GDP of U.S.A with a slight hindrance of the growth from third to fourth.

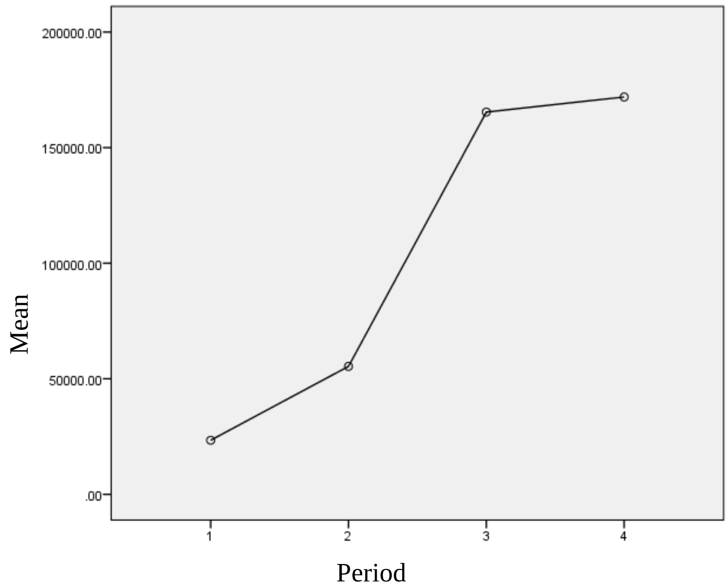

Figure 4.6: Mean Plot of TOB in U.S.A during different time periods

4.5 Temporal Variability of Exchange Rate (EXC) during Four Periods

Exchange rate is the value of a domestic currency in terms of a foreign currency which mostly expressed in terms of US dollar. Exchange rate expressed other than in US dollar is called cross rate. Domestic currency is called based currency and foreign currencies are called counter currency. Exchange rates can be floating or fixed. Floating exchange rate depends on the phenomenon of market force. In order to manage trade relations some countries try to fix their exchange rate. Exchange rates are influenced by interest rates. Interest rates on the other hand are influenced majorly by inflation rate. Higher interest rates attract more foreign investments which make the currency demanding. High inflation rate have a negative relationship to the value of the currency and its exchange rate. Rate of economic growth, balance of trade, interest rate, debt level of the country and inflation rate are the factors affecting exchange rate.

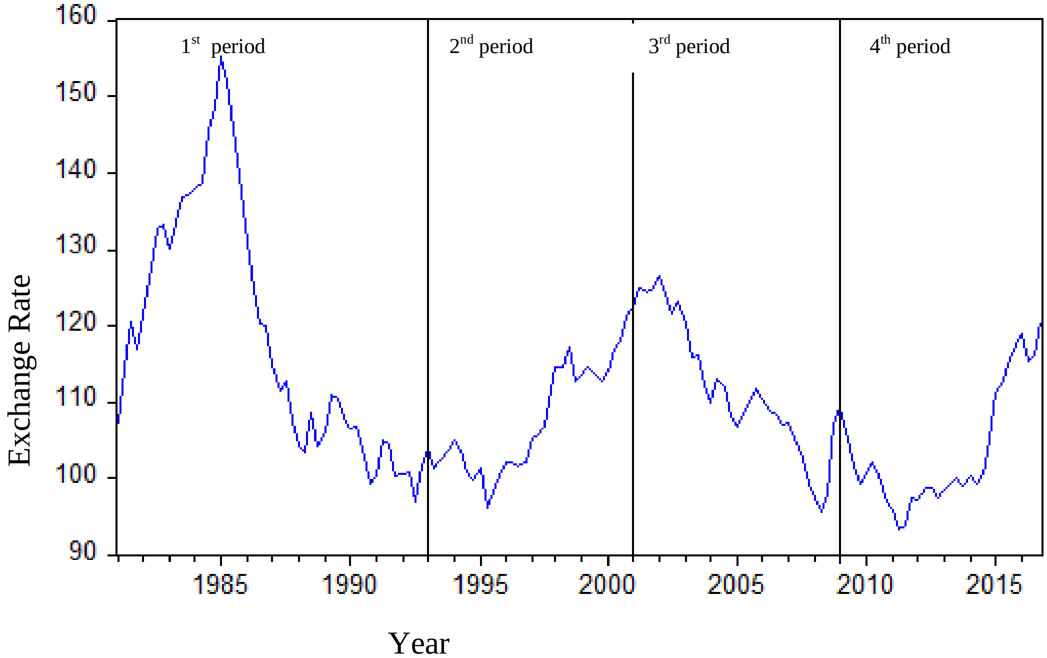

Figure 4.7: Exchange Rate of United States of America for Four Periods

Exchange rate during period 1 is presented in the Figure 4.7. Exchange rate of the country takes a hike between 1984 and 1985. It takes an average value of \$ 118.66. Maximum of \$ 155.15 is reported in 1985 Q1. Minimum value of \$ 97.02 is reported in 1992 Q3. It has a range of \$ 58.13. Exchange rate during period 2 is presented in the Figure 4.7. It takes an average value of \$ 107.38. Maximum of \$ 121.21 is reported in 2000 Q4. Minimum value of \$ 96.08 is reported in 1995 Q2. It has a range of \$ 25.13. During period 3 exchange rate presents an average value of \$ 111.994.During this period exchange rate of the country takes a hike between 2001 and 2002. Maximum of \$ 126.61 is reported in 2002Q1. Minimum value of \$95.74 is reported in 2008 Q2 with a range of 30.87. Exchange rate during period 4 is presented in the Figure 4.7. It takes an average value of \$ 103.70. Maximum of \$ 120.61 is reported in 2016 Q4. Minimum value of \$ 93.41 is reported in 2011 Q2.

4.5.1 Basic Statistics for Exchange Rate

Table 4.7 descriptive statistics shows that exchange rate during different periods are normally distributed according to the Jarque –Bera Test statistics. Mean exchange rates are lower during 2^{nd} and 4^{th} periods when the democrats are running the presidency compared to the periods during which are with republican presidents.

Table 4.7 : Descriptive Statistics of Exchange Rate of U.S.A over different periods.

Statistics	1981-1992	1993-2000	2001-2008	2009-2016
Mean	118.6591	107.3844	111.9944	103.7035
Median	113.5461	105.132	110.1767	100.4106
Maximum	155.1555	121.2109	126.6102	120.6114
Minimum	97.01748	96.08448	95.74717	93.41358
Std. Dev.	16.31115	6.845307	8.796434	7.944179
Skewness	0.603222	0.320479	0.06519	0.846061
Kurtosis	2.139096	1.791922	2.10474	2.340702
Coef Var	13.75	6.37	7.85	7.66
Jarque-Bera	4.393322	2.493706	1.091319	4.397269
Probability	0.111174	0.287408	0.579459	0.110955

4.5.2 Comparison of Exchange rate between four periods

The analysis of variance was carried out to compare exchange rate (table 4.8). The analysis of variance was carried out to compare exchange rates in four different periods. Test statistic of the ANOVA test is significant (F=12.62, p= 0.000). It can be concluded that there is a significant difference between the means of exchange rate among four periods at 5% of significance level.

Table 4.8: ANOVA Table for Exchange Rate

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4952.11	3	1650.70	12.62	.000
Within Groups	18312.04	140	130.80		
Total	23264.15	143			

Mean of exchange rate according to the four periods are shown in a graph in figure 4.8. Mean of exchange rate during democratic periods are relatively low than the preceding republican periods as shown in figure 4.8.

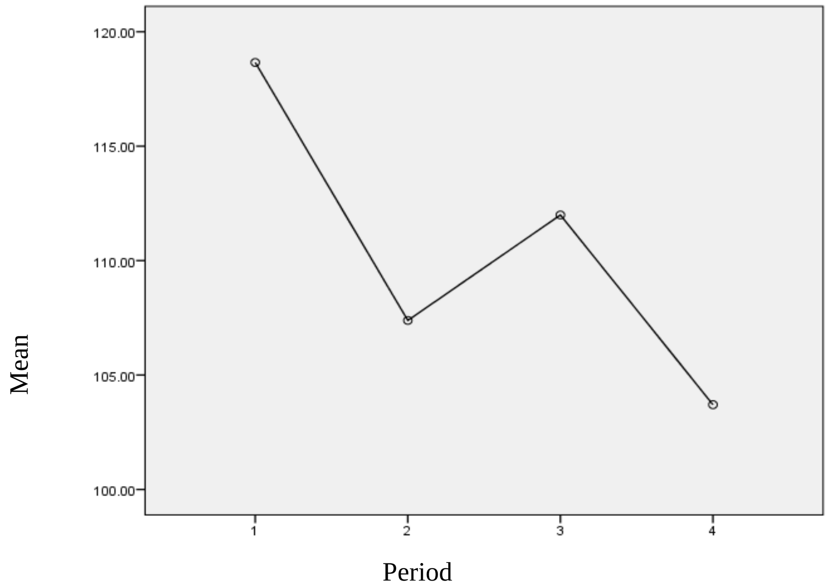

Figure 4.8: Plot of mean of Exchange Rate during Four Periods in U.S.A

4.6 Temporal Variability of Money Supply (MS) during Four Periods

Money supply in United States of America consists of all the cash in circulation inside the country and the money deposited in savings and checking accounts. It excludes the investments, home equity and other physical assets which can be converted to cash. Federal Reserve uses different indicators to measure money supply. M1 is the measure used to identify the amount of liquid form of money which includes currency circulation. M2 consists of liquid form of money explained by M1, saving accounts, money market accounts plus mutual funds and deposits under $100,000. Considering these measures in this study money supply measure of M2 is used. In October 2018 the value of M2 was $14.271 trillion. Saving accounts held $9.1 trillion out of total M2, $702 billion in money market, $400 billion in time deposits and the remaining of it is M1. Although monetarists suggests that expansion of money supply increases inflation , the act of Federal Reserve injecting extra two fold of value to the monetary supply in order to end the financial crisis in 2008 didn’t affect inflation in a negative way. Furthermore the quantitative easing program of Federal Reserve’s began in 2008 , injected $4 trillion to banking system to keep interest rates down.

Table 4.9: Money Supply (As of December).
Source: "Money Stock Measures," The Board of Governors of the Federal Reserve System

Year	M2($ Trillion)	M2 Growth	Inflation rate
2005	6.7	4.1%	3.4%
2006	7.0	5.9%	2.5%
2007	7.4	5.7%	4.1%
2008	8.2	9.7%	0.1%
2009	8.5	3.7	2.7
2010	8.8	3.6	1.5

Money supply in U.S.A history has close relationship with inflation; therefore Milton Friedman insists that money supply is an effective economic indicator to evaluate the inflation rate. In 1990s people borrowed money for low interest rate and invested them in stock market. This made fall of M2 but inflation and economy were growing. Chairman of Federal Reserve Alan Greenspan was having controversial notions on money supply. Greenspan suggests if the economy relies on M2 money supply then it will lead to an economic recession (Alan Greenspan, 2018). After the economical occurrences in 1990s Federal Reserve exclude targeting indicator of money supply on economical policy making. M2 reveals the direction and efficacy of central bank policy. Traditionally increment of money supply promoted inflation and reduces interest rates.

Money Supply during period 1 (Figure 4.9) takes an average value of $ 2645267 Maximum of $ 3445400 is reported in 1992 Q4 . Minimum value of $ 1633200 is reported in 1981 Q1.Money Supply during period 2 from 1993 to 2000 takes an average of $ Million 3975800. 1993 Q1 reports the minimum Money supply during the period worth $ Million 3414800 and maximum of 4945500 in Q3 of 2000. Money Supply during period 3 takes an average value of $ 6488316. Maximum of $ 8269200 is reported in 1992 Q4 . Minimum value of $ 1633200 is reported in 1981 Q1.Money Supply period 4 takes an average of $ Million 10466894. 1993 Q1 reports the minimum Money supply during the period worth $ Million 3414800 and maximum of $ Million 4945500 in Q3 of 2000. According to the Figures 4.11 Money supply increases positively along with the quarters pass by**.**

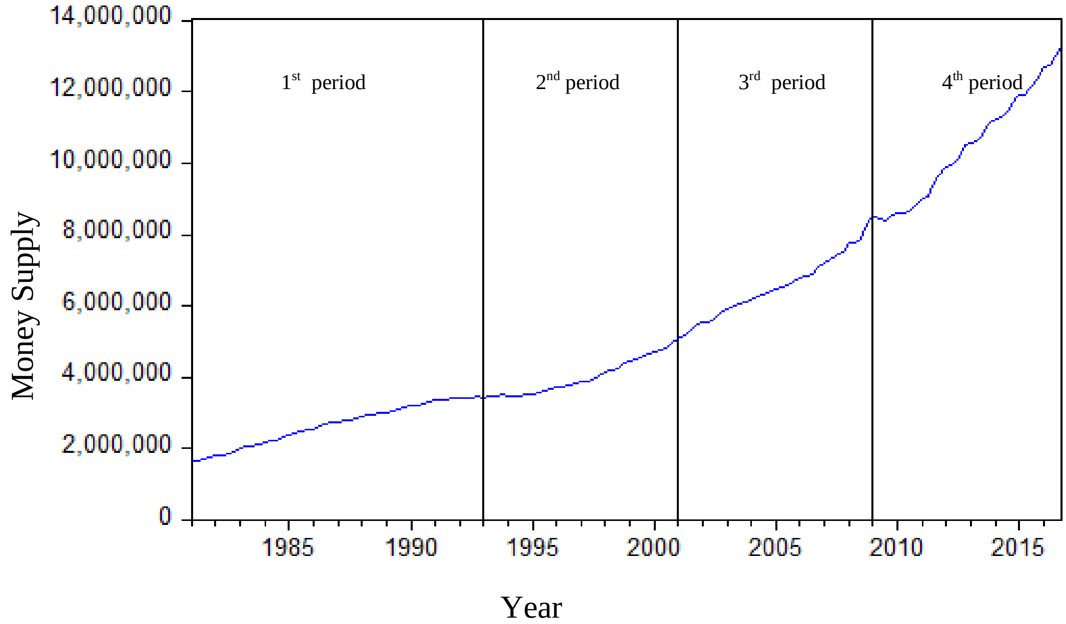

Figure 4.9 : Money Supply of United States of America for Four Periods

4.6.1 Basic Statistics for Money Supply

Table 4.10 shows a summary of descriptive statistics which will be helpful in illustrating the behavior of the variable of money supply. Each time series for the period is normally distributed according to the Jarque-Bera test statistics which is not significant under the null hypothesis of variable is normally distributed.

Table 4.10: Descriptive Statistics of Money Supply of U.S.A over different periods.

Statistics	1981-1992	1993-2000	2001-2008	2009-2016
Mean	2645267	3975800	6488316	10466894
Median	2747800	3853600	6445500	10537700
Maximum	3445400	4945500	8269200	13273000
Minimum	1633200	3414800	5092100	8401000
Std. Dev.	573164.3	486853.4	846927.5	1552265
Skewness	-0.2377	0.546122	0.232125	0.172022
Kurtosis	1.758615	1.917644	2.173514	1.746851
Coef Var	21.67	12.25	13.05	14.83
Jarque-Bera	3.534093	3.152656	1.198142	2.251664
Probability	0.170837	0.206733	0.549322	0.324382

4.6.2 Comparison of Money Supply between four periods.

The analysis of variance was carried out to compare the money supply in U.S.A during given periods (Table 4.11). Test statistic of the ANOVA test is significant (F= 501.30 , P = 0.000). It can be concluded that there is a significant difference between the means of the money supply of four periods at 5% of significance level.

Table 4.11: ANOVA Table for Money Supply

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1286058015650659.80	3	428686005216886.56	501.30	.000
Within Groups	119719308587604.17	140	855137918482.88		
Total	1405777324238264.00	143			

The plot of mean of money supply in four periods is shown in figure 4.10. Figure 4.10 shows that the mean of the money supply continuously increases over the given periods.

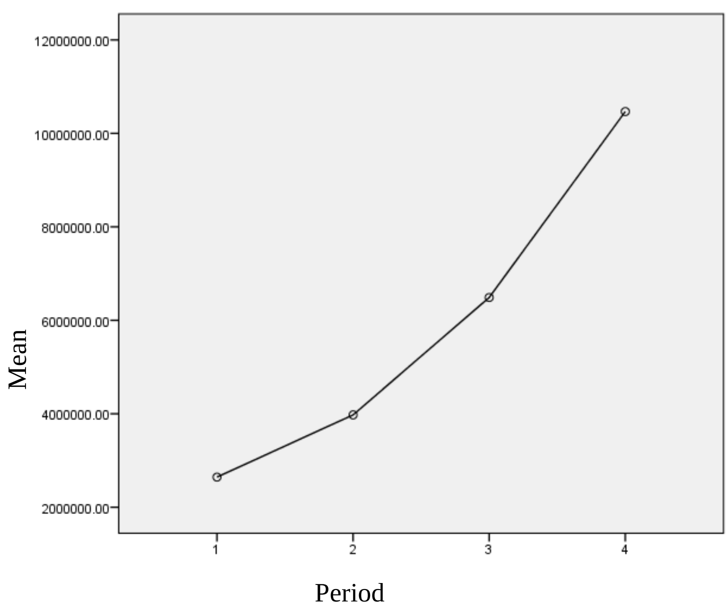

Figure 4.10: Plot of Mean of Money Supply during four periods in U.S.A

4.7 Temporal Variability of Foreign Direct Investment (FDI) for Four Periods

Foreign direct investment (FDI) is an investment made in business of a country by a foreign firm or an individual investor. FDI commonly happens in open economies as they offer skilled work force and above average growth prospects.

Horizontal, vertical and conglomerate investments are categories of foreign direct investments. Horizontal investment is investor establishing a homogenous business operation in a foreign country. Vertical investment means investor investing in a foreign country in a related business but not the same business in mother country. Conglomerate investment is a investment made in a foreign country which is not related to the business in the home country. Foreign direct investment creates employment rates and increases income. Increased income leads to higher consumer expenditure. If the products and services won't proportionally increase according to the demand, then the price level will increase. Therefore businesses will try to increase supply by increasing production or importing which will results growth in economy. In long term increasing in FDI will cause rise in inflation moderately

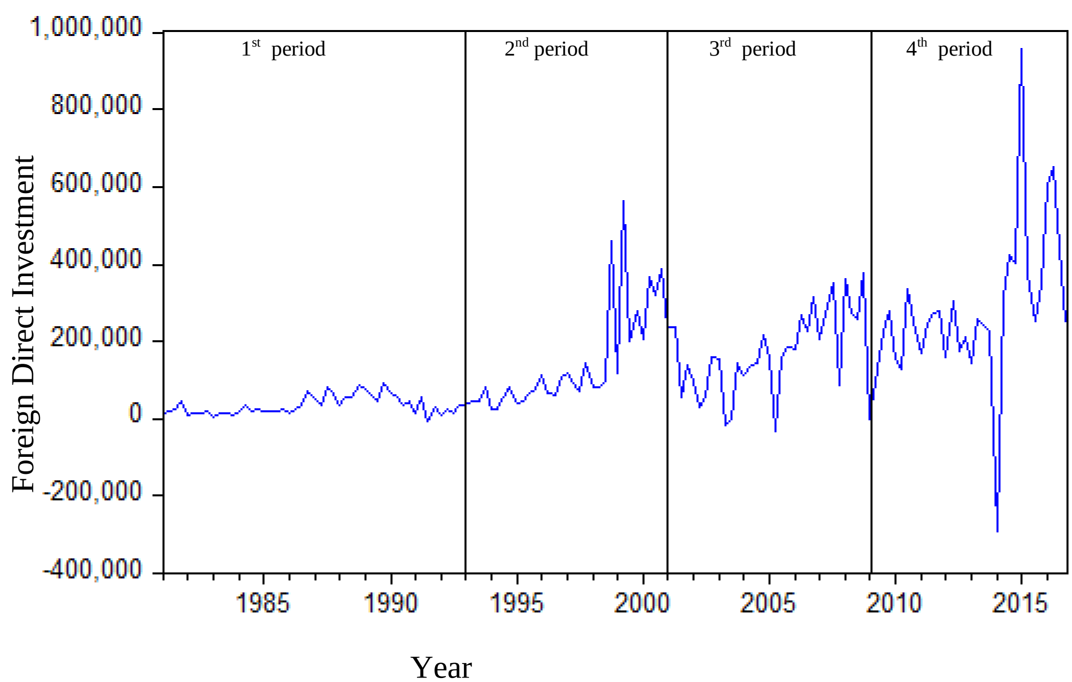

Figure 4.11: Foreign Direct Investment of United States of America for Four Periods

According to the above given Figures of 4.13, it is ostensible that foreign direct investment values are fluctuating almost each quarter during the republican periods. During the 1st period maximum of $ Mil 91380 was reported in 1989 Q4 and minimum of $ Mil (-5412) is reported in 1991 Q3. Then during the 2nd period maximum of $ Mil 562,804 was reported in 1992 Q2 and minimum of $ Mil 23068 was reported in 1994 Q2. During the 3rd period maximum of $ Mil 377,564 was reported in 2008 Q4 and minimum of $ Mil (32020) was reported in 2005 Q2.Finally in 4th period maximum of $ Mil 957556 was reported in 2015Q1 and minimum of $ Mil (291664) was reported in 2014 Q1.

4.7.1 Basic Statistics for Foreign Direct Investment

More descriptive statistics on the foreign direct investment is summarized at table 4.12. Jarque Bera statistic shows that foreign direct investment is normally distributed during republican periods and not normally distributed during democratic periods. Mean of Foreign Direct Investment increase with the period.

Table 4.12: Descriptive Statistics of Foreign Direct Investment of U.S.A

Statistics	**1981-1992**	**1993-2000**	**2001-2008**	**2009-2016**
Mean	33650.42	141980.8	173174	277338.3
Median	24937	82306	158784	249806
Maximum	91380	562804	377564	957556
Minimum	-5412	23068	-32020	-291664
Std. Dev.	23731.53	137223	107433	206606.2
Skewness	0.77	1.64	-0.00	0.706775
Kurtosis	2.69	4.74	2.41	6.56238
Coef Var	70.52	96.65	62.04	74.50
Jarque-Bera	4.95	18.50	0.45	19.58
Probability	0.08	0.00	0.79	0.00

4.7.2 Comparison of Foreign Direct Investment between four periods

The analysis of variance was carried out to compare the foreign direct investment as shown in table 4.13. Test statistic of the ANOVA test is significant (F= 24.04 , P=0.0000). It can be concluded that there is a significant difference between the means of the foreign direct investment during four periods at 5% of significance level.

Table 4.13: ANOVA Table for Foreign Direct Investment

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1180614684027.33	3	393538228009.11	24.04	.00
Within Groups	2291271588423.66	140	16366225631.59		
Total	3471886272451.00	143			

The plot of mean of foreign direct investment U.S.A over the given periods is shown in figure 4.12 of. Mean of the foreign direct investment is gradually increasing over the periods.

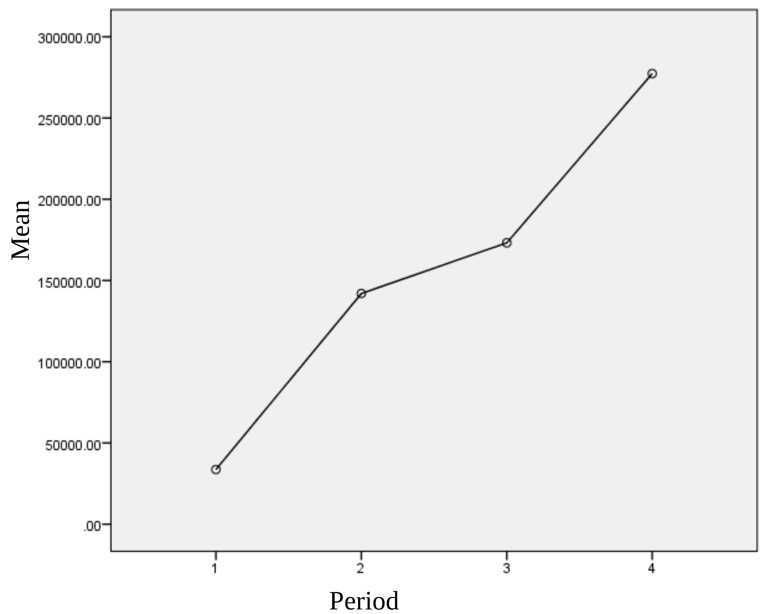

Figure 4.12: Plot of Mean of Foreign Direct Investment during four periods in U.S.A

4.8 Temporal Variable of Government Expenditure (GE) for Four Periods

Government expenditure means the purchase of goods and services that are provided by the public sector which is important for public welfare. Government expenditures mainly occur on defense, health, infrastructure, welfare facilities and services such as road network. It further helps to redistribute the personnel income. Government expenditure effects the growth and the level of production of private sector. Higher level of government spending increase the cost of production and real GDP increases which will again lead to increase inflation of an economy.

Figure 4.13 shows that government expenditure is increasing continuously throughout the decades. Maximum government expenditure during period 1 is $ Billion 673.51 reported in 1992 Q4 and minimum of $ billion 366.026 is reported in 1983 Q1. During the period 2 minimum of $ billion 656.94 is reported in 1993Q1 and maximum of $ billion 1306.22 is reported in 2000Q4. Period 3 shows S shaped curve of government expenditure. During period 3 maximum of $ billion 1619.09 is reported in 2007 Q2 and minimum of $ billion 994.71 is reported in 2003Q3. During the period 4 again the government expenditure takes a gradual increment. Maximum government expenditure of $ billion 2065.49 is reported in 2016Q4 and minimum of $billion 1102.46 is reported in 2009 Q2.

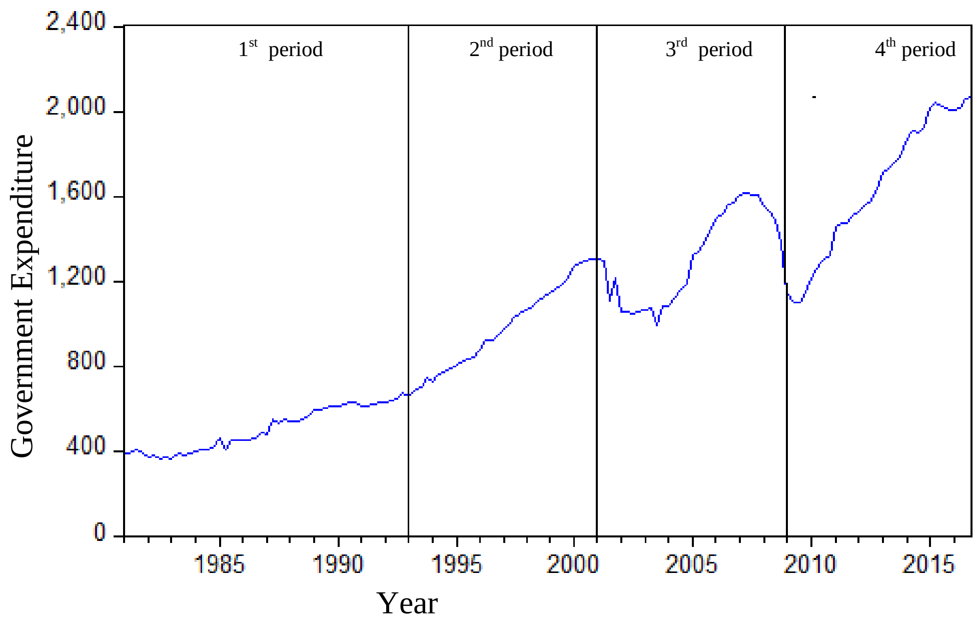

Figure 4.13: Government Expenditure of United States of America for Four Periods

4.8.1 Basic Statistics for Government Expenditure

Table 4.14: Descriptive Statistics of Government Expenditure of U.S.A

Statistics	1981-1992	1993-2000	2001-2008	2009-2016
Mean	501.7197	972.3504	1309.28	1643.659
Median	481.6365	962.2025	1313.632	1670.133
Maximum	673.51	1306.215	1619.091	2065.492
Minimum	366.026	656.938	994.708	1102.464
Std. Dev.	100.9369	198.4179	214.7628	324.6891
Skewness	0.0887	0.143772	0.061135	-0.25323
Kurtosis	1.432421	1.787968	1.455506	1.726934
Jarque-Bera	4.977552	2.068939	3.200547	2.50294
Probability	0.083012	0.355415	0.201841	0.286084

Descriptive statistics of four different time periods given are described in table 4.16. Jarque-Bera test statistic in table 4.14 shows that time series variable of Government Expenditure over four periods not significantly deviated from normal distribution.

4.8.2 Comparison of Government Expenditure between four periods

Test statistic of the ANOVA test is significant (F=204.51, P= 0.000). It can be concluded that there is a significant difference between the means of government expenditure during four periods at 5% of significance level.

Table 4.15: ANOVA table for Government Expenditure

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	28035522.38	3	9345174.13	204.51	.00
Within Groups	6397236.89	140	45694.54		
Total	34432759.28	143			

The plot of means of government expenditure in four periods is shown in figure 4.14. According to the figure 4.13 it shows that the government expenditure has a positive and strong correlation with the time period.

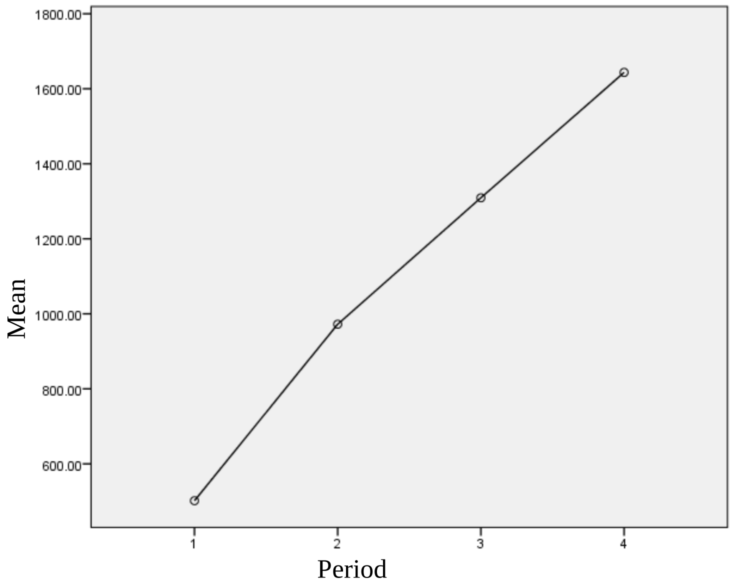

Figure 4.14: Plot of Mean of Government Expenditure during four periods in U.S.A

4.9 Temporal Variable of Unemployment Rate (UMP) for Four Periods

By dividing the number of unemployed citizens by the number of citizens in workforce of the country unemployment rate can be calculated. Phillips curve theorem built by the economist A.W.H Phillips insists that there is a inverse relationship among inflation and unemployment. Concepts of demand and supply can be used to explain the theories of the Phillips Curve. If labor demand is greater than its supply then the wage rate push upward due to excessive demand. It has an impact on inflation rate which makes the inflation high. In contrast when the labor supply is greater than the demand then the wages push downwards. It would results a low inflation rate in the country and the unemployment rate will goes up. Rising inflation has a correlation with falling unemployment.

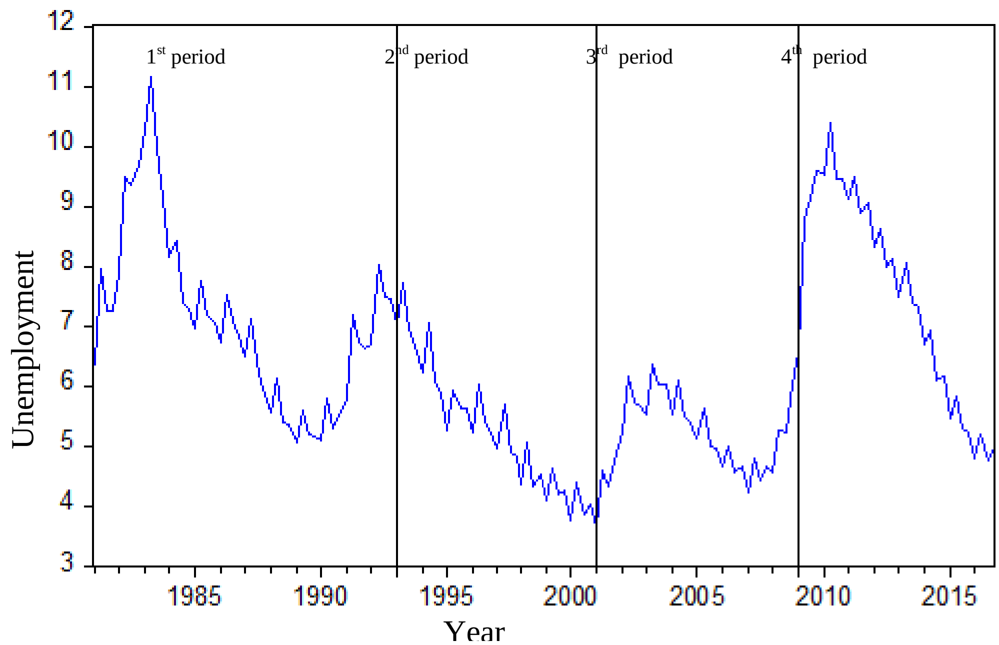

Figure 4.15: Unemployment of United States of America for Four Periods

Unemployment rate in United States of America during the given four periods shows falling gradually but there seems to have a seasonal fluctuation according to figure from 4.17. Minimum unemployment rate of 5.06% in 1st period is reported in 1989 Q1 and the maximum rate for the period is 11.16% which is reported in 1983 Q2. During the period 2 the gap of unemployment decreases, its maximum of value of 7.73 % is achieved in 1993 Q2 and minimum of 3.76% is achieved in 2000Q1. During the 3rd period it starts with a low unemployment rate but after few quarters it increases and decreases again. Maximum rate of 6.3% is reported in 2003 Q2 and minimum is reported in 2001 Q1. Period 4 has an average unemployment rate is 7.5% (Table 4.17) , reports a maximum unemployment rate of 10.4% in 2010 Q2and reports a minimum unemployment rate of 4.76% in 2016 Q3.

4.9.1 Basic Statistics for Unemployment Rate

Table 4.16 descriptive statistics of the unemployment rate shows that during four periods unemployment rate is normally distributed as the Jarque–Bera test statistic is not significant under null hypothesis of variable is normally distributed. Natural unemployment rate of U.S.A is below 5%. Natural unemployment rate or the full employment rate is the level of unemployment that will not affect inflation.

Table 4.16: Descriptive Statistics of Unemployment Rate

Statistics	1981-1992	1993-2000	2001-2008	2009-2016
Mean	7.12	5.31	5.15	7.51
Median	7.10	5.23	5.06	7.75
Maximum	11.16	7.73	6.36	10.40
Minimum	5.06	3.76	3.66	4.76
Std. Dev.	1.49	1.04	0.67	1.72
Skewness	0.70	0.48	-0.04	-0.18
Kurtosis	3.02	2.39	2.30	1.68
Jarque-Bera	3.90	1.76	0.57	2.50
Probability	0.14	0.41	0.74	0.28

4.9.2 Comparison of Unemployment Rate between Four Periods

Test statistic of the ANOVA test is significant (F=29.35, P= 0.0000) as shown in table 4.17. It can be concluded that there is a significant difference between the means of unemployment rate in four periods at 5% of significance level.

Table 4.17: ANOVA table for unemployment rate

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	152.34	3	50.78	29.35	.00
Within Groups	242.15	140	1.73		
Total	394.50	143			

The plot of mean of unemployment rate is shown in figure 4.16. Figure 4.16 shows that during the second and 3rd period the unemployment rate is lower but during 1st and 4th period unemployment rate rises.

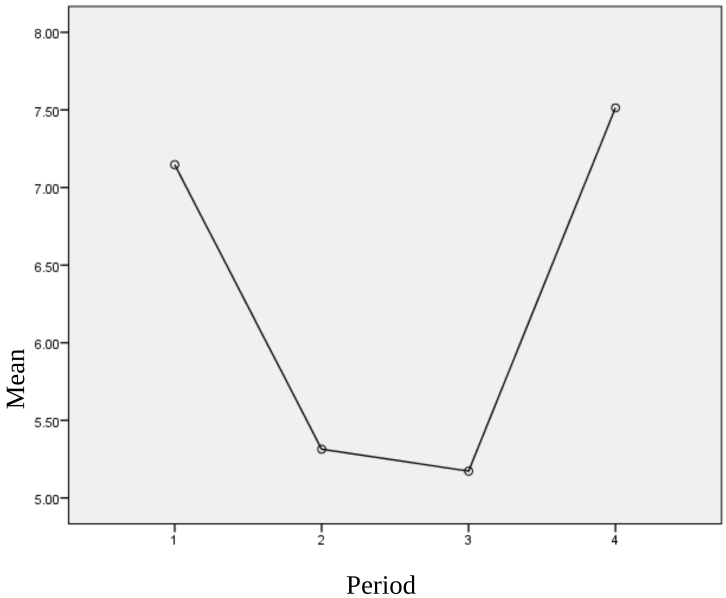

Figure 4.16: Plot of Mean of Unemployment Rate during four periods in U.S.A

4.10 Summary of Chapter 4

It was found that the mean of all eight variables are significantly different among four periods and the ranking order of means in four periods in given in table 4.18.

Table 4.18: Summary of the ranking order of means of variables during four periods

Variable	Trend
INF	$INF_1 > INF_2 < INF_3 > INF_4$
GDP	$GDP_1 < GDP_2 < GDP_3 < GDP_4$
TOB	$TOB_1 < TOB_2 < TOB_3 < TOB_4$
EXC	$EXC_1 > EXC_2 < EXC_3 > EXC_4$
MS	$MS_1 < MS_2 < MS_3 < MS_4$
FDI	$FDI_1 < FDI_2 < FDI_3 < FDI_4$
UMP	$UMP_1 > UMP_2 > UMP_3 < UMP_4$
GE	$GE_1 < GE_2 < GE_3 < GE_4$

CHAPTER 5

APPLICATION OF VAR MODEL

5.1 Association among variables

The Correlation matrix is a fundamental statistical test which is used to identify the mutual relationship among variables. All variables were transformed in to natural log to minimize the variance and heteroskedasticity. The correlation matrices among ten variables (Table 3.1) for the four periods are shown in Tables 5.1 to 5.4 .

Table 5.1: Correlation Matrix of the selected 10 economical variables in U.S.A –Period 1

	lnINF	lnEXC	lnFDI	lnGDP	lnGE	lnMS	lnTOB
lnEXC	-0.126						
	0.393						
lnFDI	-0.050	-0.417					
	0.735	0.003					
lnGDP	-0.346	-0.694	0.541				
	0.016	0.000	0.000				
lnGE	-0.200	-0.790	0.554	0.978			
	0.174	0.000	0.000	0.000			
lnMS	-0.459	-0.633	0.506	0.984	0.947		
	0.001	0.000	0.000	0.000	0.000		
lnTOB	-0.626	-0.011	0.522	0.571	0.446	0.608	
	0.000	0.943	0.000	0.000	0.001	0.000	
lnUMP	-0.044	0.573	-0.729	-0.735	-0.747	-0.676	-0.502
	0.766	0.000	0.000	0.000	0.000	0.000	0.000

Table 5.1 shows that there are significant correlations ($p<0.05$) between inflation rate and other selected variables from 1981 to 1992 except exchange rate (EXC) , foreign direct investment (FDI), government expenditure (GE) and unemployment (UMP). Furthermore there are significant correlation among independent variables except combination of exchange rate and trade of balance.

Table 5.2: Correlation Matrix of the selected 10 economical variables in U.S.A –Period 2

	lnINF	lnEXC	lnFDI	lnGDP	lnGE	lnMS	lnTOB
lnEXC	-0.326						
	0.068						
lnFDI	-0.060	0.711					
	0.743	0.000					
lnGDP	-0.189	0.867	0.856				
	0.301	0.000	0.000				
lnGE	-0.217	0.841	0.843	0.993			
	0.232	0.000	0.000	0.000			
lnMS	-0.152	0.903	0.870	0.988	0.971		
	0.406	0.000	0.000	0.000	0.000		
lnTOB	-0.020	0.767	0.809	0.925	0.904	0.920	
	0.914	0.000	0.000	0.000	0.000	0.000	
lnUMP	0.229	-0.787	-0.775	-0.938	-0.939	-0.914	-0.854
	0.207	0.000	0.000	0.000	0.000	0.000	0.000

Table 5.2 shows that there are no significant correlations among inflation rate and other selected seven variables during the period 2 except with exchange rate. There are significant correlations ($p<0.05$) between all independent variables.

Table 5.3: Correlation Matrix of the selected 10 economical variables in U.S.A –Period 3

	lnINF	lnEXC	lnFDI	lnGDP	lnGE	lnMS	lnTOB
lnEXC	-0.567						
	0.001						
lnFDI	0.252	-0.276					
	0.164	0.127					
lnGDP	0.511	-0.935	0.308				
	0.003	0.000	0.086				
lnGE	0.581	-0.738	0.491	0.848			
	0.000	0.000	0.004	0.000			
lnMS	0.406	-0.923	0.282	0.956	0.747		
	0.021	0.000	0.118	0.000	0.000		
lnTOB	0.578	-0.879	0.243	0.947	0.749	0.883	
	0.001	0.000	0.179	0.000	0.000	0.000	
lnUMP	-0.407	0.115	-0.332	-0.191	-0.605	-0.039	-0.102
	0.021	0.532	0.064	0.294	0.000	0.831	0.580

Table 5.3 shows that there are significant correlations among inflation rate and other selected independent variables from 2001 to 2008 except with foreign direct investment (FDI).

Furthermore there are significant correlation among independent variables except combinations of exchange rate (EXC) and foreign direct investment (FDI), exchange rate (EXC) and unemployment rate (UMP); foreign direct investment (FDI) and gross domestic product (GDP), foreign direct investment (FDI) and money supply (MS), foreign direct investment (FDI) and trade of balance (TOB) , foreign direct investment (FDI) and unemployment rate(UMP), gross domestic products (GDP) and unemployment rate (UMP) , money supply (MS) and unemployment rate (UMP) and trade of balance (TOB) and unemployment rate (UMP).

Table 5.4: Correlation Matrix of the selected 10 economical variables in U.S.A – Period 4

	lnINF	lnEXC	lnFDI	lnGDP	lnGE	lnMS	lnTOB
lnEXC	-0.492						
	0.004						
lnFDI	-0.023	0.459					
	0.900	0.008					
lnGDP	-0.030	0.670	0.685				
	0.870	0.000	0.000				
lnGE	0.062	0.506	0.638	0.970			
	0.738	0.003	0.000	0.000			
lnMS	-0.047	0.661	0.649	0.988	0.968		
	0.797	0.000	0.000	0.000	0.000		
lnTOB	0.470	0.061	0.505	0.649	0.697	0.599	
	0.007	0.739	0.003	0.000	0.000	0.000	
lnUMP	0.293	-0.853	-0.616	-0.890	-0.815	-0.903	-0.321
	0.103	0.000	0.000	0.000	0.000	0.000	0.074

Table 5.4 shows that there are no significant correlations between inflation rate and other selected independent variables during 2009-2016 except with exchange rate (EXC) and trade of balance (TOB). Further there are significant correlation among other seven variables except combinations of exchange rate (EXC) and trade of balance (TOB) and trade of balance (TOB) and unemployment rate (UMP).

5.2 VAR Model for the Period 1 (1981-1992)

5.2.1 Stationary of time series for Period 1

Stationary of the variables should be identified before applying any time series model. Augmented Dicky Fuller Test (ADF) and P-Perron (PP) test were used to identify the stationary of the economical time series effectively.

Table 5.5: Probability values of Root Test results of Sequence of Level

Variable	Level		First Difference	
	ADF	PP	ADF	PP
LNINF	0.8640	0.0998	0.0007	0.0002
LNEXC	0.8483	0.7329	0.0001	0.0002
LNFDI	0.2785	0.0120	0.0000	0.0000
LNGDP	0.8270	0.9206	0.1202	0.0022
LNGE	0.9694	0.9364	0.0000	0.0000
LNMS	0.0001	0.0000	0.0006	0.0008
LNTOB	0.2340	0.1155	0.0000	0.0000
LNUMP	0.2234	0.4667	0.0119	0.0000

As indicated in table 5.5 ADF tests and PP tests show that all variables become stationary by applying first difference as all p values are less than 5%.

5.2.2 Lag Length Criteria for Period 1

Identifying a suitable lag length is important before applying VEC model. According to the table 5.6 the suitable lag length for the given economical variables is lag order 3 as selected by Akaike Information Criterea , Shwartz Baysian and Hannan Quinn (HQ). But the VAR model with lag order 3 doesn't pass the residual tests as shown in appendix 5, page number 121. Therefore next best lag order of 1 is used for VEC Model calculation.

Table 5.6: Determine Lag Intervals with VAR Lag order Selection Criteria for 8 Economical Variables in U.S.A (Period 1)

VAR Lag Order Selection Criteria
Endogenous variables: LNINF LNGDP LNEXC LNFDI LNGE LNMS LNTOB LNUMP
Exogenous variables: C
Date: 04/20/19 Time: 08:17
Sample: 1981Q1 1992Q4
Included observations: 45

Lag	LogL	LR	FPE	AIC	SC	HQ
0	291.1706	NA	4.73e-16	-12.58536	-12.26417	-12.46563
1	629.8779	541.9316	2.46e-21	-24.79457	-21.90391*	-23.71696
2	716.6744	108.0135	1.17e-21	-25.80775	-20.34762	-23.77227
3	850.0373	118.5448*	1.22e-22*	-28.89055*	-20.86094	-25.89719*

* 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

5.2.3 Co-integration of the Time Series for Period 1

As mentioned in Chapter 3 VEC models are used for I(1) variables. Presence of co-integration indicates non stationary variables. Johansen Co-integration test is used to identify the existence of the co-integration. As indicated in table 5.7 there exists co-integration between endogenous variables. VEC model should be applied for the time series data.

Table 5.7: Johansen Cointegration test for 8 economical variables in U.S.A (Period 1)

Date: 04/21/19 Time: 16:28
Sample: 1981Q1 1992Q4
Included observations: 46
Series: LNINF LNEXC LNFDI LNGDP LNGE LNMS LNTOB LNUMP
Lags interval: 1 to 1
Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	4	5	4	5	4
Max-Eig	2	3	0	3	3

*Critical values based on MacKinnon-Haug-Michelis (1999)

5.2.4 VEC Model for period 1

Table 5.8 shows the VEC model estimated using lag order 1. The t- statistics shown in the squared brackets should be greater than 2.0 for lag order to be significant. Inflation rate is taken as the endogenous variable and other seven variables as the exogenous variables. Using VEC model long term error correction among the variables has been identified.

Table 5.8: VEC Model for selected economical variables in U.S.A (Period 1)

Vector Error Correction Estimates
Date: 04/21/19 Time: 16:30
Sample (adjusted): 1981Q3 1992Q4
Included observations: 46 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNINF(-1)	1.000000
LNEXC(-1)	-6.808127
	(1.19952)
	[-5.67571]
LNFDI(-1)	-1.201298
	(0.25429)
	[-4.72420]
LNGDP(-1)	-9.438562
	(7.15725)
	[-1.31874]
LNGE(-1)	3.195232
	(3.31089)
	[0.96507]
LNMS(-1)	-1.457730
	(2.43768)
	[-0.59800]
LNTOB(-1)	2.768994
	(0.34206)
	[8.09509]
LNUMP(-1)	-0.160214
	(1.23483)
	[-0.12975]
C	107.2463

Error Correction:	D(LNINF)	D(LNEXC)	D(LNFDI)	D(LNGDP)	D(LNGE)	D(LNMS)	D(LNTOB)	D(LNUMP)
CointEq1	-0.017418	0.011071	0.413115	0.003553	-0.001503	0.002344	-0.160158	-0.036393
	(0.04017)	(0.00973)	(0.15347)	(0.00208)	(0.00996)	(0.00275)	(0.07679)	(0.01853)
	[-0.43362]	[1.13766]	[2.69182]	[1.70527]	[-0.15096]	[0.85312]	[-2.08554]	[-1.96348]

Table 5.8 (continued)

D(LNINF(-1))	0.239587	0.024979	-0.037081	-0.014494	0.065751	-0.015980	0.138792	0.015008
	(0.18853)	(0.04567)	(0.72030)	(0.00978)	(0.04672)	(0.01290)	(0.36043)	(0.08699)
	[1.27083]	[0.54694]	[-0.05148]	[-1.48227]	[1.40719]	[-1.23908]	[0.38507]	[0.17253]
D(LNEXC(-1))	-0.178523	0.452679	7.852288	0.058184	-0.193944	0.111337	1.444986	-0.455777
	(0.76215)	(0.18463)	(2.91192)	(0.03953)	(0.18889)	(0.05214)	(1.45709)	(0.35167)
	[-0.23424]	[2.45177]	[2.69660]	[1.47193]	[-1.02675]	[2.13555]	[0.99169]	[-1.29602]
D(LNFDI(-1))	-0.008220	-0.002083	-0.487556	0.001031	-0.007145	-0.000203	-0.070692	-0.062326
	(0.03782)	(0.00916)	(0.14451)	(0.00196)	(0.00937)	(0.00259)	(0.07231)	(0.01745)
	[-0.21732]	[-0.22729]	[-3.37397]	[0.52556]	[-0.76225]	[-0.07845]	[-0.97765]	[-3.57128]
D(LNGDP(-1))	0.822646	-0.228136	21.14328	0.645146	1.183730	-0.053289	19.47169	-3.939092
	(2.82147)	(0.68351)	(10.7799)	(0.14634)	(0.69927)	(0.19300)	(5.39412)	(1.30189)
	[0.29157]	[-0.33377]	[1.96136]	[4.40864]	[1.69280]	[-0.27610]	[3.60980]	[-3.02567]
D(LNGE(-1))	0.535253	-0.018913	1.414401	-0.042902	-0.545979	-0.008916	0.722609	-0.106546
	(0.61958)	(0.15009)	(2.36719)	(0.03213)	(0.15356)	(0.04238)	(1.18451)	(0.28589)
	[0.86390]	[-0.12601]	[0.59750]	[-1.33508]	[-3.55558]	[-0.21038]	[0.61005]	[-0.37268]
D(LNMS(-1))	-0.202506	0.793128	13.16977	0.032251	0.166005	0.354187	-0.457987	-1.065304
	(2.12752)	(0.51540)	(8.12852)	(0.11034)	(0.52728)	(0.14553)	(4.06741)	(0.98168)
	[-0.09518]	[1.53887]	[1.62019]	[0.29228]	[0.31483]	[2.43371]	[-0.11260]	[-1.08518]
D(LNTOB(-1))	-0.029484	-0.026278	-0.084621	-0.005951	0.011657	0.002139	-0.029736	-0.057705
	(0.07558)	(0.01831)	(0.28876)	(0.00392)	(0.01873)	(0.00517)	(0.14449)	(0.03487)
	[-0.39010]	[-1.43524]	[-0.29304]	[-1.51817]	[0.62230]	[0.41369]	[-0.20579]	[-1.65466]
D(LNUMP(-1))	-0.286795	0.105776	1.316374	0.006474	0.002562	-0.027545	1.284953	-0.372111
	(0.27048)	(0.06553)	(1.03342)	(0.01403)	(0.06704)	(0.01850)	(0.51711)	(0.12481)
	[-1.06031]	[1.61427]	[1.27380]	[0.46148]	[0.03822]	[-1.48873]	[2.48486]	[-2.98149]
C	-0.022490	-0.010680	-0.348943	0.002988	0.006895	0.010392	-0.102626	0.046541
	(0.04223)	(0.01023)	(0.16134)	(0.00219)	(0.01047)	(0.00289)	(0.08073)	(0.01949)
	[-0.53258]	[-1.04400]	[-2.16274]	[1.36409]	[0.65877]	[3.59750]	[-1.27117]	[2.38852]
R-squared	0.158096	0.250142	0.543037	0.376671	0.356254	0.368310	0.559729	0.612339
Adj. R-squared	-0.052380	0.062678	0.428796	0.220838	0.195318	0.210387	0.449661	0.515424
Sum sq. resids	0.640177	0.037570	9.344952	0.001722	0.039323	0.002996	2.339859	0.136300
S.E. equation	0.133352	0.032305	0.509492	0.006916	0.033050	0.009122	0.254943	0.061531
F-statistic	0.751135	1.334346	4.753435	2.417152	2.213632	2.332218	5.085314	6.318301
Log likelihood	33.04581	98.26341	-28.61365	169.1646	97.21454	156.4317	3.235494	68.62413
Akaike AIC	-1.001992	-3.837540	1.678855	-6.920200	-3.791937	-6.366597	0.294109	-2.548875
Schwarz SC	-0.604461	-3.440009	2.076385	-6.522669	-3.394406	-5.969067	0.691640	-2.151344
Mean dependent	-0.019401	-0.002554	0.011349	0.007718	0.011707	0.015782	0.031810	-0.001409
S.D. dependent	0.129991	0.033367	0.674127	0.007835	0.036843	0.010266	0.343660	0.088393

Determinant resid covariance (dof adj.)	8.00E-22
Determinant resid covariance	1.13E-22
Log likelihood	640.2209
Akaike information criterion	-24.00961
Schwarz criterion	-20.51134

Below equation of VEC model 1 was derived from the table 5.8 as it can be used to check the significance of the coefficients as shown in table 5.9.

D(LNINF) = C(1)*(LNINF(-1) - 6.80812700768*LNEXC(-1) - 1.20129779089*LNFDI(-1) - 9.43856150149*LNGDP(-1) + 3.19523240427*LNGE(-1) - 1.45773016775*LNMS(-1) + 2.76899372*LNTOB(-1) - 0.160214286399*LNUMP(-1) + 107.246332361) + C(2)*D(LNINF(-1)) + C(3)*D(LNEXC(-1)) + C(4)*D(LNFDI(-1)) + C(5)*D(LNGDP(-1)) + C(6)*D(LNGE(-1)) + C(7)*D(LNMS(-1)) + C(8)*D(LNTOB(-1)) + C(9)*D(LNUMP(-1)) + C(10) **(VEC Model 1)**

As shown in table 5.9, significance of coefficients will be identified at 5% of significance level in order to confirm the effect on inflation rate.

Table 5.9: Properties of the coefficient of the VEC Model 1

Dependent Variable: D(LNINF)
Method: Least Squares
Date: 04/21/19 Time: 16:32
Sample (adjusted): 1981Q3 1992Q4
Included observations: 46 after adjustments
D(LNINF) = C(1)*(LNINF(-1) - 6.80812700768*LNEXC(-1) - 1.20129779089*LNFDI(-1) - 9.43856150149*LNGDP(-1) + 3.19523240427*LNGE(-1) - 1.45773016775*LNMS(-1) + 2.76899372 *LNTOB(-1) - 0.160214286399*LNUMP(-1) + 107.246332361) + C(2) *D(LNINF(-1)) + C(3)*D(LNEXC(-1)) + C(4)*D(LNFDI(-1)) + C(5) *D(LNGDP(-1)) + C(6)*D(LNGE(-1)) + C(7)*D(LNMS(-1)) + C(8) *D(LNTOB(-1)) + C(9)*D(LNUMP(-1)) + C(10)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.017418	0.040169	-0.433622	0.6672
C(2)	0.239587	0.188528	1.270828	0.2119
C(3)	-0.178523	0.762151	-0.234235	0.8161
C(4)	-0.008220	0.037822	-0.217323	0.8292
C(5)	0.822646	2.821473	0.291566	0.7723
C(6)	0.535253	0.619577	0.863900	0.3934
C(7)	-0.202506	2.127518	-0.095184	0.9247
C(8)	-0.029484	0.075580	-0.390102	0.6988
C(9)	-0.286795	0.270483	-1.060307	0.2961
C(10)	-0.022490	0.042229	-0.532578	0.5976

R-squared	0.158096	Mean dependent var	-0.019401
Adjusted R-squared	-0.052380	S.D. dependent var	0.129991
S.E. of regression	0.133352	Akaike info criterion	-1.001992
Sum squared resid	0.640177	Schwarz criterion	-0.604461
Log likelihood	33.04581	Hannan-Quinn criter.	-0.853074
F-statistic	0.751135	Durbin-Watson stat	2.038431
Prob(F-statistic)	0.660545		

One lagged inflation rate, foreign direct investment, gross domestic product, money supply and unemployment rate have significant negative effect on inflation rate. One lagged exchange rate, government expenditure and trade of balance has a significant positive relationship to inflation rate in table 5.9.

5.2.5 Residual Tests for VEC Model 1

Residual tests were done to confirm the validity of the model developed. Table 5.10 shows the test results of portmanteau test for autocorrelation under the null hypothesis of no residual autocorrelations up to lag 12 proves that there is no autocorrelation among the lags at 5% of significant level.

Table 5.10: Portmanteau Test for Autocorrelation for VEC Model 1

VEC Residual Portmanteau Tests for Autocorrelations
Null Hypothesis: no residual autocorrelations up to lag h
Date: 04/21/19 Time: 16:35
Sample: 1981Q1 1992Q4
Included observations: 46

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
1	31.68004	NA*	32.38404	NA*	NA*
2	83.70653	0.9952	86.77538	0.9903	120
3	135.1496	0.9973	141.8075	0.9908	184
4	201.7090	0.9859	214.7059	0.9379	248
5	252.6800	0.9941	271.8929	0.9508	312
6	302.0012	0.9980	328.6123	0.9626	376
7	363.5066	0.9968	401.1570	0.9078	440
8	424.6914	0.9956	475.2229	0.8168	504
9	470.7839	0.9988	532.5271	0.8544	568
10	511.7464	0.9998	584.8680	0.9101	632
11	561.6348	0.9999	650.4356	0.8908	696
12	603.2515	1.0000	706.7406	0.9165	760

*The test is valid only for lags larger than the VAR lag order.
df is degrees of freedom for (approximate) chi-square distribution

Null hypothesis of no serial correlation at lag order 12 is tested in table 5.11. It confirms that the hypothesis is significant at 5% of significant level. There is no serial correlation among the lags.

Table 5.11: Serial Correlation LM Test for VEC Model 1

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 04/21/19 Time: 16:35
Sample: 1981Q1 1992Q4
Included observations: 46

Lags	LM-Stat	Prob
1	94.87869	0.0073
2	68.89682	0.3153
3	64.50707	0.4587
4	67.95152	0.3442
5	57.02050	0.7195
6	47.39647	0.9403
7	66.22362	0.4001
8	68.80019	0.3182
9	52.34913	0.8508
10	44.24577	0.9717
11	58.09537	0.6842
12	48.16152	0.9299

Probs from chi-square with 64 df.

Table 5.12: Normality Tests VEC Model 1

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 04/20/19 Time: 08:26
Sample: 1981Q1 1992Q4
Included observations: 44

Component	Jarque-Bera	df	Prob.
1	0.761584	2	0.6833
2	5.195985	2	0.0744
3	1.236877	2	0.5388
4	1.652605	2	0.4377
5	1.476601	2	0.4779
6	1.155100	2	0.5613
7	0.227077	2	0.8927
8	1.119198	2	0.5714
Joint	12.82503	16	0.6855

Jarque –Bera test statistic under the null hypothesis of residuals are multivariate normal is shown in table 5.12. Statistics of skewness and kurtosis supports the above indication.

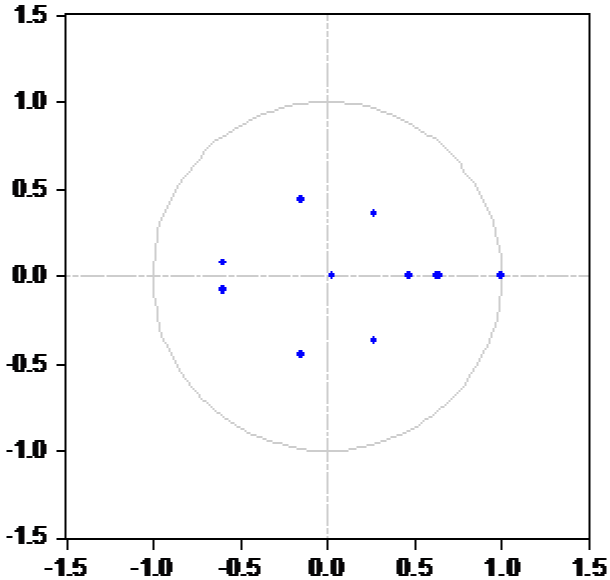

Figure 5.1: Inverse Roots of AR Stability of the VEC Model 1

Stability of the variables can be identified using the AR root graph. Unit root graph in figure 5.1 confirms that there is no root outside the unit circle therefore VAR satisfies the stability condition.

5.2.6 Granger Causality for Period 1

Table 5.13: Granger Causality test

Pairwise Granger Causality Tests
Date: 05/12/19 Time: 12:00
Sample: 1981Q1 1992Q4
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LNEXC does not Granger Cause LNINF	47	1.24043	0.2714
LNINF does not Granger Cause LNEXC		9.28823	0.0039
LNFDI does not Granger Cause LNINF	47	3.11894	0.0843
LNINF does not Granger Cause LNFDI		0.49339	0.4861
LNGDP does not Granger Cause LNINF	47	0.43432	0.5133
LNINF does not Granger Cause LNGDP		26.7825	5.E-06
LNGE does not Granger Cause LNINF	47	0.65230	0.4236
LNINF does not Granger Cause LNGE		4.61782	0.0372
LNMS does not Granger Cause LNINF	47	0.18608	0.6683
LNINF does not Granger Cause LNMS		0.77795	0.3826
LNTOB does not Granger Cause LNINF	47	0.50329	0.4818
LNINF does not Granger Cause LNTOB		8.36077	0.0059
LNUMP does not Granger Cause LNINF	47	2.02735	0.1615
LNINF does not Granger Cause LNUMP		1.20889	0.2775

Except exchange rate (EXC), government expenditure (GE) and trade of balance (TOB) there is no granger causality among other variables to inflation rate during the period 1 as explained in table 5.13.

5.2.7 Impulse Responses Function for Period 1

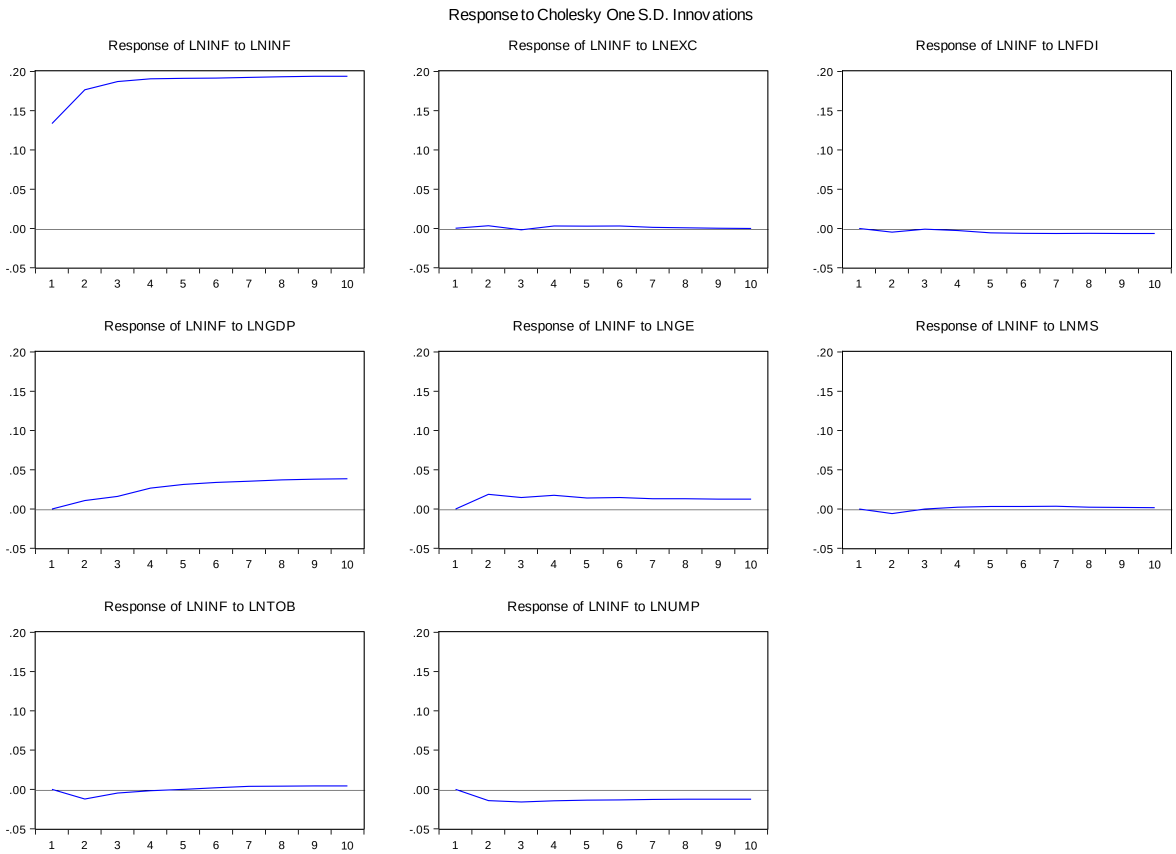

Figure 5.2: Impulse Responses Function for Period 1

Impulse responses function shows in figure 5.2 indicate that there is a positive reaction of inflation to the shock of inflation rate, exchange rate and gross domestic product. There is a negative reaction of inflation to the shock of foreign direct investment government expenditure and unemployment rate. There are both negative and positive responses of inflation rate to money supply and trade of balance.

5.3 VAR Model for the Period 2 (1993-2000)

5.3.1 Stationary of Time Series for Period 2

Stationary of the variables should be identified prior applying a time series model. P-Perron (PP) and Augmented Dicky Fuller Test (ADF) test can be used to identify the stationary of the economical time series effectively.

Table 5.14: Probability Values of Unit Root Test results of Sequence of level for Period 1

Variable	Level		First Difference	
	ADF	PP	ADF	PP
LNINF	0.0256	0.4006	0.0742	0.0024
LNEXC	0.9635	0.9635	0.0001	0.0001
LNFDI	0.7476	0.2614	0.0000	0.0001
LNGDP	0.9902	0.9930	0.0000	0.0000
LNGE	0.6498	0.0173	0.0047	0.0000
LNMS	0.9554	1.0000	0.6001	0.0048
LNTOB	0.9952	0.7369	0.4174	0.0000
LNUMP	0.8082	0.5915	0.1752	0.0001

As indicated in table 5.14 ADF test and PP tests show that all variables become stationary by applying first difference as all p-values are less than 5%.

5.3.2 Lag Length Criteria for Period 2

Identifying a suitable lag length is important before applying VEC model. According to the table 5.15 the suitable lag length for the given economical variables is lag order 1 as selected by Akaike Information Criterea , Shwartz Baysian and Hannan Quinn (HQ).

Table 5.15: Determine Lag Intervals with VAR Lag order selection criteria for 8 economical variables in U.S.A (Period 2)

VAR Lag Order Selection Criteria
Endogenous variables: LNINF LNEXC LNFDI LNGDP LNGE LNMS LNTOB LNUMP
Exogenous variables: C
Date: 04/20/19 Time: 13:07
Sample: 1993Q1 2000Q4
Included observations: 31

Lag	LogL	LR	FPE	AIC	SC	HQ
0	337.0990	NA	8.30e-20	-21.23219	-20.86213	-21.11156
1	583.4546	349.6660*	7.40e-25*	-32.99707*	-29.66652*	-31.91140*

* 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

5.3.3 Co-integration of the Time Series for Period 2

As mentioned in Chapter 3 VEC models are used for I(1) variables. Presence of co-integration indicates non stationary variables. Johansen Co-integration test is used to identify the existence of the co-integration. As indicated in table 5.16 there exists co-integration between endogenous variables. VEC model should be applied for the time series data.

Table 5.16: Johansen Co-integration test for 8 economical variables in U.S.A (Period 2)

Date: 04/20/19 Time: 13:05
Sample: 1993Q1 2000Q4
Included observations: 30
Series: LNINF LNEXC LNFDI LNGDP LNGE LNMS LNTOB LNUMP
Lags interval: 1 to 1

Selected (0.05 level*) N
Cointegrating Relations

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	6	7	7	8	5
Max-Eig	4	3	2	3	3

*Critical values based on MacKinnon-Haug-Michelis (1999)

5.3.4 VEC Model for Period 2

Table 5.17 shows the VEC model estimated using lag order 1. The t- statistics shown in the squared brackets should be greater than 2.0 for lag order to be significant. Inflation rate is taken as the endogenous variable and other nine variables as the exogenous variables. Using VEC model long term error correction among the variables has been identified.

Table 5.17: VEC Model for selected economical variables in U.S.A (Period 2)

Vector Error Correction Estimates
Date: 04/20/19 Time: 13:15
Sample (adjusted): 1993Q3 2000Q4
Included observations: 30 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNINF(-1)	1.000000
LNEXC(-1)	-0.080068 (0.34182) [-0.23424]

Table 5.17: (Continued)

LNFDI(-1)	-0.090865							
	(0.02928)							
	[-3.10379]							
LNGDP(-1)	-3.265895							
	(2.28566)							
	[-1.42887]							
LNGE(-1)	-2.374673							
	(0.59820)							
	[-3.96969]							
LNMS(-1)	5.363180							
	(0.84257)							
	[6.36526]							
LNTOB(-1)	-1.268402							
	(0.07336)							
	[-17.2907]							
LNUMP(-1)	-4.519676							
	(0.24961)							
	[-18.1068]							
C	-8.867394							

Error Correction:	D(LNINF)	D(LNEXC)	D(LNFDI)	D(LNGDP)	D(LNGE)	D(LNMS)	D(LNTOB)	D(LNUMP)
CointEq1	-0.005425	-0.021588	0.002931	0.008294	0.010011	0.001634	0.672129	0.356238
	(0.09943)	(0.02580)	(0.71130)	(0.00682)	(0.02448)	(0.00993)	(0.14310)	(0.03498)
	[-0.05457]	[-0.83686]	[0.00412]	[1.21589]	[0.40900]	[0.16457]	[4.69677]	[10.1827]
D(LNINF(-1))	0.418058	-0.022298	0.902292	-0.002504	-0.018503	0.012529	-0.437760	-0.186691
	(0.23516)	(0.06101)	(1.68230)	(0.01613)	(0.05789)	(0.02348)	(0.33846)	(0.08274)
	[1.77778]	[-0.36547]	[0.53634]	[-0.15523]	[-0.31961]	[0.53363]	[-1.29340]	[-2.25628]
D(LNEXC(-1))	0.095131	0.185499	2.495829	0.020341	-0.050782	0.130414	-2.183144	-0.225420
	(0.82939)	(0.21519)	(5.93338)	(0.05690)	(0.20418)	(0.08281)	(1.19372)	(0.29183)
	[0.11470]	[0.86203]	[0.42064]	[0.35747]	[-0.24871]	[1.57483]	[-1.82885]	[-0.77244]
D(LNFDI(-1))	-0.026533	-0.004315	-0.544093	0.001578	0.001640	-0.000680	0.014000	0.020419
	(0.02988)	(0.00775)	(0.21379)	(0.00205)	(0.00736)	(0.00298)	(0.04301)	(0.01052)
	[-0.88786]	[-0.55648]	[-2.54496]	[0.76971]	[0.22296]	[-0.22786]	[0.32550]	[1.94184]
D(LNGDP(-1))	6.912856	-2.124134	-18.15603	0.083223	0.063532	0.081836	10.96206	2.114968
	(4.04950)	(1.05065)	(28.9697)	(0.27782)	(0.99691)	(0.40432)	(5.82835)	(1.42486)
	[1.70709]	[-2.02173]	[-0.62672]	[0.29955]	[0.06373]	[0.20240]	[1.88082]	[1.48434]
D(LNGE(-1))	-0.538005	-0.101845	-0.224245	0.021477	-0.451680	-0.201957	1.064596	0.225627
	(0.74744)	(0.19392)	(5.34711)	(0.05128)	(0.18400)	(0.07463)	(1.07577)	(0.26299)
	[-0.71980]	[-0.52518]	[-0.04194]	[0.41882]	[-2.45472]	[-2.70617]	[0.98961]	[0.85792]
D(LNMS(-1))	-0.240979	1.670967	11.14475	-0.031311	-0.403498	0.524567	-7.695026	-2.696004
	(1.91600)	(0.49711)	(13.7069)	(0.13145)	(0.47168)	(0.19130)	(2.75765)	(0.67416)
	[-0.12577]	[3.36136]	[0.81308]	[-0.23820]	[-0.85545]	[2.74206]	[-2.79043]	[-3.99904]

Table 5.17 (Continued)

D(LNTOB(-1))	-0.011937	-0.005184	1.821381	0.013112	-0.005583	0.029812	0.623654	0.260166
	(0.13357)	(0.03465)	(0.95552)	(0.00916)	(0.03288)	(0.01334)	(0.19224)	(0.04700)
	[-0.08937]	[-0.14958]	[1.90617]	[1.43084]	[-0.16979]	[2.23548]	[3.24416]	[5.53585]
D(LNUMP(-1))	0.001860	0.044947	-0.921423	-0.002585	-0.007630	0.002496	1.813581	-0.167435
	(0.17754)	(0.04606)	(1.27012)	(0.01218)	(0.04371)	(0.01773)	(0.25553)	(0.06247)
	[0.01048]	[0.97575]	[-0.72546]	[-0.21222]	[-0.17458]	[0.14081]	[7.09728]	[-2.68025]
C	-0.048749	0.010346	0.028231	0.007766	0.035581	0.007544	0.016290	-0.034913
	(0.04364)	(0.01132)	(0.31221)	(0.00299)	(0.01074)	(0.00436)	(0.06281)	(0.01536)
	[-1.11702]	[0.91375]	[0.09042]	[2.59368]	[3.31178]	[1.73117]	[0.25935]	[-2.27360]
R-squared	0.299673	0.430323	0.625036	0.197113	0.341188	0.576487	0.799902	0.959518
Adj. R-squared	-0.015475	0.173968	0.456303	-0.164187	0.044723	0.385906	0.709858	0.941300
Sum sq. resids	0.100161	0.006742	5.126070	0.000471	0.006070	0.000999	0.207485	0.012400
S.E. equation	0.070767	0.018361	0.506264	0.004855	0.017422	0.007066	0.101854	0.024900
F-statistic	0.950897	1.678624	3.704280	0.545566	1.150855	3.024897	8.883456	52.67126
Log likelihood	42.96448	83.43994	-16.06528	123.3454	85.01523	112.0884	32.04025	74.30013
Akaike AIC	-2.197632	-4.895996	1.737686	-7.556357	-5.001015	-6.805890	-1.469350	-4.286676
Schwarz SC	-1.730566	-4.428930	2.204751	-7.089291	-4.533950	-6.338824	-1.002284	-3.819610
Mean dependent	0.001901	0.005965	0.071538	0.009714	0.021053	0.012063	0.048998	-0.021698
S.D. dependent	0.070226	0.020202	0.686592	0.004500	0.017825	0.009017	0.189092	0.102775

Determinant resid covariance (dof adj.)	4.50E-26
Determinant resid covariance	1.76E-27
Log likelihood	583.5438
Akaike information criterion	-33.03625
Schwarz criterion	-28.92607

Below equation of VEC model 2 can be derived from the table 5.17 and it can be used to check the significance of the coefficients as shown in table 5.18.

D(LNINF) = C(1)*(LNINF(-1) - 0.0800679792647*LNEXC(-1) - 0.0908653828276*LNFDI(-1) - 3.26589511482*LNGDP(-1) - 2.37467305011*LNGE(-1) + 5.36318035659*LNMS(-1) - 1.26840178669*LNTOB(-1) - 4.51967568795*LNUMP(-1) - 8.86739360747) + C(2)*D(LNINF(-1)) + C(3)*D(LNEXC(-1)) + C(4)*D(LNFDI(-1)) + C(5)*D(LNGDP(-1)) + C(6)*D(LNGE(-1)) + C(7)*D(LNMS(-1)) + C(8)*D(LNTOB(-1)) + C(9)*D(LNUMP(-1)) + C(10) **(VEC Model 2)**

As shown in table 5.18, significance of coefficients will be identified at 5% of significance level in order to confirm the effect on inflation rate.

Table 5.18: Properties of the coefficient of the VEC model 2

Dependent Variable: D(LNINF)
Method: Least Squares
Date: 05/12/19 Time: 09:56
Sample (adjusted): 1993Q3 2000Q4
Included observations: 30 after adjustments
D(LNINF) = C(1)*(LNINF(-1) - 0.0800679792647*LNEXC(-1) - 0.0908653828276*LNFDI(-1) - 3.26589511482*LNGDP(-1) - 2.37467305011*LNGE(-1) + 5.36318035659*LNMS(-1) - 1.26840178669*LNTOB(-1) - 4.51967568795*LNUMP(-1) - 8.86739360747) + C(2)*D(LNINF(-1)) + C(3)*D(LNEXC(-1)) + C(4)*D(LNFDI(-1)) + C(5)*D(LNGDP(-1)) + C(6)*D(LNGE(-1)) + C(7)*D(LNMS(-1)) + C(8)*D(LNTOB(-1)) + C(9)*D(LNUMP(-1)) + C(10)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.005425	0.099428	-0.054565	0.9570
C(2)	0.418058	0.235158	1.777776	0.0907
C(3)	0.095131	0.829390	0.114700	0.9098
C(4)	-0.026533	0.029885	-0.887858	0.3852
C(5)	6.912856	4.049495	1.707091	0.1033
C(6)	-0.538005	0.747439	-0.719798	0.4800
C(7)	-0.240979	1.915998	-0.125772	0.9012
C(8)	-0.011937	0.133566	-0.089374	0.9297
C(9)	0.001860	0.177542	0.010475	0.9917
C(10)	-0.048749	0.043642	-1.117018	0.2772

R-squared	0.299673	Mean dependent var	0.001901
Adjusted R-squared	-0.015475	S.D. dependent var	0.070226
S.E. of regression	0.070767	Akaike info criterion	-2.197632
Sum squared resid	0.100161	Schwarz criterion	-1.730566
Log likelihood	42.96448	Hannan-Quinn criter.	-2.048214
F-statistic	0.950897	Durbin-Watson stat	2.165755
Prob(F-statistic)	0.505703		

One lagged inflation rate, foreign direct investment, gross domestic product, money supply, exchange rate and unemployment rate have significant negative effect on inflation rate. One lagged government expenditure and trade of balance has a significant positive relationship to inflation rate as in table 5.18.

5.3.5 Residual Tests for VEC Model 2

Residual tests are done to confirm the validity of the model created. Table 5.19 shows the test results of portmanteau test the autocorrelation under the null hypothesis of no residual autocorrelations up to lag h proves that there is no autocorrelation among the lags at 5% of significant level.

Table 5.19: Portmanteau Test for Autocorrelation for VEC Model 2

VEC Residual Portmanteau Tests for Autocorrelations
Null Hypothesis: no residual autocorrelations up to lag h
Date: 04/20/19 Time: 13:20
Sample: 1993Q1 2000Q4
Included observations: 30

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
1	36.79504	NA*	38.06384	NA*	NA*
2	114.1872	0.6324	120.9840	0.4576	120
3	162.2172	0.8746	174.3506	0.6834	184
4	241.2799	0.6082	265.5769	0.2115	248
5	290.2842	0.8061	324.3820	0.3030	312
6	350.5217	0.8229	399.6789	0.1921	376
7	405.2193	0.8814	471.0236	0.1481	440
8	460.1756	0.9194	545.9640	0.0955	504
9	501.7604	0.9787	605.3708	0.1346	568
10	552.5955	0.9897	681.6236	0.0839	632
11	590.8349	0.9984	742.0015	0.1104	696
12	643.3056	0.9992	829.4526	0.0403	760

*The test is valid only for lags larger than the VAR lag order.
df is degrees of freedom for (approximate) chi-square distribution

Null hypothesis of no serial correlation at lag order 12 is tested in table 5.20; it confirms that the hypothesis is significant at 5% of significant level. There is no serial correlation among the lags.

Table 5.20: Serial Correlation LM Test for VEC Model 2

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 05/12/19 Time: 09:50
Sample: 1993Q1 2000Q4
Included observations: 30

Lags	LM-Stat	Prob
1	75.69379	0.1504
2	76.92441	0.1289
3	32.86307	0.9996
4	91.19983	0.0144
5	53.37330	0.8257
6	68.53147	0.3263
7	63.13378	0.5071
8	64.23180	0.4684
9	70.72427	0.2633
10	57.31647	0.7099
11	52.45635	0.8483
12	70.97881	0.2565

Probs from chi-square with 64 df.

Table 5.21: Normality Tests for VEC Model 2

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 05/11/19 Time: 19:59
Sample: 1993Q1 2000Q4
Included observations: 30

Component	Jarque-Bera	df	Prob.
1	1.684313	2	0.4308
2	21.74035	2	0.0000
3	0.555336	2	0.7575
4	1.532379	2	0.4648
5	2.296769	2	0.3171
6	0.198741	2	0.9054
7	0.078498	2	0.9615
8	1.752877	2	0.4163
Joint	29.83926	16	0.0189

Jarque –Bera test statistic under the null hypothesis of residuals are multivariate normal is shown in table 5.21. Statistics of skewness and kurtosis supports the above indication.

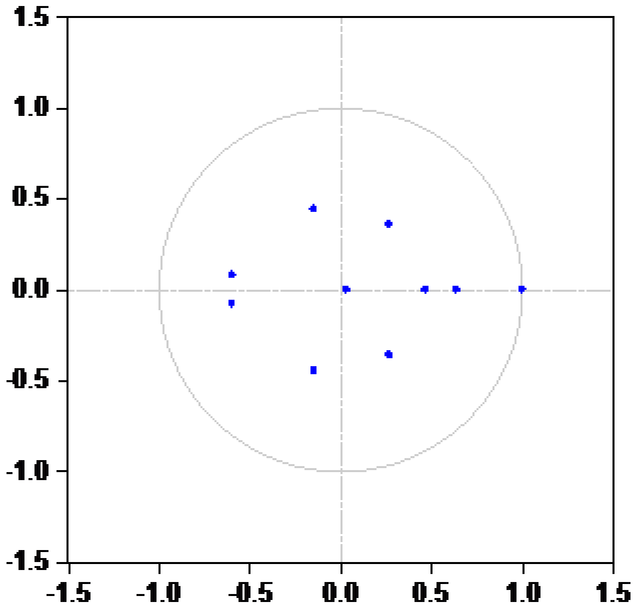

Figure 5.3: Inverse Roots of AR Stability of the VEC model 2

Stability of the variables can be identified using the AR root graph. Unit root graph in figure 5.3 confirms that there is no root outside the unit circle, therefore VAR satisfies the stability condition

5.3.6 Granger Causality for Period 2

Table 5.22: Granger Causality Test for Period 2

Pairwise Granger Causality Tests
Date: 05/12/19 Time: 19:47
Sample: 1993Q1 2000Q4
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LNEXC does not Granger Cause LNINF	31	1.47076	0.2354
LNINF does not Granger Cause LNEXC		0.37257	0.5465
LNFDI does not Granger Cause LNINF	31	0.94169	0.3402
LNINF does not Granger Cause LNFDI		0.27560	0.6037
LNGDP does not Granger Cause LNINF	31	2.15322	0.1534
LNINF does not Granger Cause LNGDP		1.34713	0.2556
LNGE does not Granger Cause LNINF	31	1.26751	0.2698
LNINF does not Granger Cause LNGE		1.0E-05	0.9975
LNMS does not Granger Cause LNINF	31	2.44156	0.1294
LNINF does not Granger Cause LNMS		0.75557	0.3921
LNTOB does not Granger Cause LNINF	31	3.20147	0.0844
LNINF does not Granger Cause LNTOB		0.35110	0.5582
LNUMP does not Granger Cause LNINF	31	1.49841	0.2311
LNINF does not Granger Cause LNUMP		0.61254	0.4404

There is no granger causality running among all variables to inflation rate during the period which confirms there is no short term causality running among variables as explained in table 5.22.

5.3.7 Impulse Responses Functions for Period 2

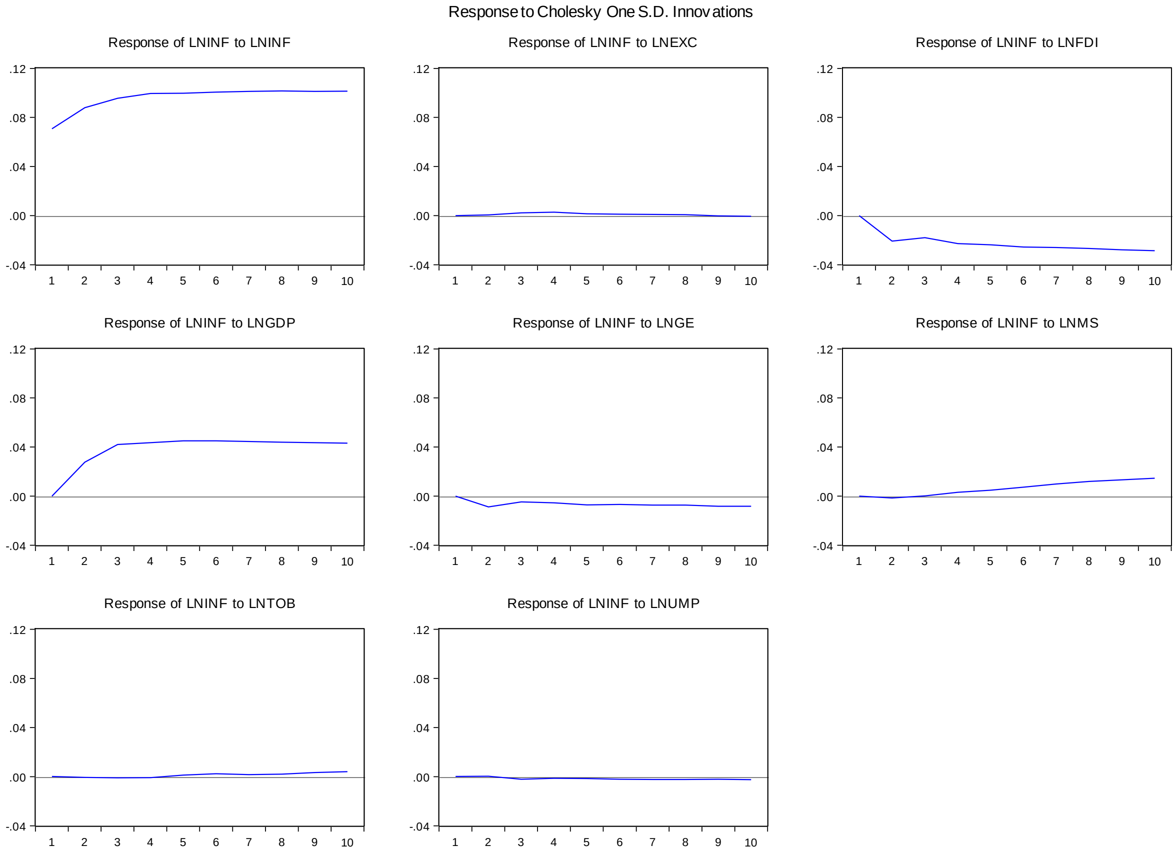

Figure 5.4: Impulse Responses Functions for Period 2

Impulse responses at figure 5.4 shows that there is a positive reaction of inflation to the shock of inflation rate , exchange rate , gross domestic product money supply and trade of balance . There is a negative reaction of inflation to the shock of foreign direct investment government expenditure and unemployment rate.

5.4 VAR Model for the Period 3

5.4.1 Stationary of Time Series for Period 3

Stationary of the variables should be identified before applying any time series model. Augmented Dicky Fuller Test (ADF) and P-Perron(PP) test can be used to identify the stationary of the economical time series effectively.

Table 5.23 : Unit root Test Results of Sequence of level for Period 3

	Level		First Difference	
	ADF	PP	ADF	PP
LNINF	0.1119	0.0992	0.0002	0.0034
LNEXC	0.3098	0.6449	0.1108	0.1108
LNFDI	0.0003	0.0003	0.0000	0.0001
LNGDP	0.4344	0.5403	0.4467	0.5546
LNGE	0.1704	0.7278	0.8943	0.0000
LNMS	0.9772	0.9816	0.0002	0.0112
LNTOB	0.4606	0.4244	0.0000	0.0005
LNUMP	0.0915	0.0452	0.2468	0.0000

As indicated in table 5.23 ADF test and PP tests show that most variables become stationary by applying first difference.

5.4.2 Lag Length Criteria for Period 3

Identifying a suitable lag length is important before applying VEC model. According to the table 5.24 the suitable lag length for the given economical variables is lag order 1 as selected by Akaike Information Criterea , Shwartz Baysian and Hannan Quinn (HQ).

Table 5.24 : Determine Lag Intervals with VAR Lag order selection criteria for 8 economical variables in U.S.A (Period 3)

VAR Lag Order Selection Criteria
Endogenous variables: LNINF LNGE LNFDI LNGDP LNEXC LNTOB LNUMP LNMS
Exogenous variables: C
Date: 04/20/19 Time: 15:31
Sample: 2001Q1 2008Q4
Included observations: 31

Lag	LogL	LR	FPE	AIC	SC	HQ
0	256.6059	NA	1.49e-17	-16.03909	-15.66903	-15.91846
1	474.7803	309.6668*	8.21e-22*	-25.98583*	-22.65528*	-24.90015*

* 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

5.4.3 Co-integration of the Time Series for Period 3

As mentioned in Chapter 3 VEC models are used for I(1) variables. Presence of co-integration indicates non stationary variables. Johansen Co-integration test is used to identify the existence of the co-integration. As indicated in table 5.25 there exists co-integration between endogenous variables. VEC model should be applied for the time series data.

Table 5.25: Johansen Co-integration test for 8 economical variables in U.S.A (Period 3)

Date: 04/20/19 Time: 16:06
Sample: 2001Q1 2008Q4
Included observations: 30
Series: LNINF LNGE LNFDI LNGDP LNEXC LNTOB LNUMP LNMS
Lags interval: 1 to 1

Selected (0.05 level*)
Number of Cointegrating
Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	4	7	5	6	5
Max-Eig	4	3	2	3	3

*Critical values based on MacKinnon-Haug-Michelis (1999)

5.4.4 VEC Model for period 3

Table 5.26 shows the VEC model estimated using lag order 1. T statistics shown in the squared brackets should be greater than 2.0 for lag order to be significant. Inflation rate is taken as the endogenous variable and other nine variables as the exogenous variables. Using VEC model long term error correction among the variables has been identified.

Table 5.26 : VEC Model for selected economical variables in U.S.A (Period 3)

Vector Error Correction Estimates
Date: 05/01/19 Time: 18:34
Sample (adjusted): 2001Q3 2008Q4
Included observations: 30 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNINF(-1)	1.000000
LNEXC(-1)	1.150042

Table 5.26 : (Continued)

	(0.22115)
	[5.20035]
LNFDI(-1)	0.146643
	(0.00476)
	[30.8125]
LNGDP(-1)	15.62104
	(0.86507)
	[18.0575]
LNGE(-1)	3.360133
	(0.24555)
	[13.6842]
LNMS(-1)	-0.936284
	(0.28886)
	[-3.24126]
LNTOB(-1)	-5.159458
	(0.09808)
	[-52.6052]
LNUMP(-1)	4.419073
	(0.19490)
	[22.6733]
C	-108.5129

Error Correction:	D(LNINF)	D(LNEXC)	D(LNFDI)	D(LNGDP)	D(LNGE)	D(LNMS)	D(LNTOB)	D(LNUMP)
CointEq1	0.323104	0.012858	-5.458568	0.005149	-0.077157	-0.001649	0.359724	0.142919
	(0.20863)	(0.02607)	(1.77266)	(0.00683)	(0.04365)	(0.01111)	(0.08226)	(0.04980)
	[1.54868]	[0.49315]	[-3.07931]	[0.75402]	[-1.76756]	[-0.14843]	[4.37284]	[2.86965]
D(LNINF(-1))	-0.120466	-0.035826	5.753813	-0.016672	0.061930	0.006036	-0.120812	-0.046009
	(0.29501)	(0.03687)	(2.50659)	(0.00966)	(0.06173)	(0.01571)	(0.11632)	(0.07042)
	[-0.40834]	[-0.97176]	[2.29548]	[-1.72645]	[1.00332]	[0.38430]	[-1.03859]	[-0.65332]
D(LNEXC(-1))	-2.298604	0.297608	19.40402	-0.026034	-0.257114	0.057192	-0.285387	0.070728
	(2.11995)	(0.26493)	(18.0123)	(0.06939)	(0.44356)	(0.11286)	(0.83589)	(0.50606)
	[-1.08427]	[1.12334]	[1.07726]	[-0.37517]	[-0.57966]	[0.50675]	[-0.34142]	[0.13976]
D(LNFDI(-1))	-0.009652	-0.001569	0.000440	-0.000505	0.006845	-1.06E-05	-0.019767	-0.016456
	(0.02433)	(0.00304)	(0.20669)	(0.00080)	(0.00509)	(0.00130)	(0.00959)	(0.00581)
	[-0.39677]	[-0.51603]	[0.00213]	[-0.63371]	[1.34482]	[-0.00816]	[-2.06082]	[-2.83372]
D(LNGDP(-1))	25.79697	-2.225170	-64.66469	0.829367	2.656285	-1.017494	12.34473	-5.050856
	(10.6767)	(1.33427)	(90.7155)	(0.34949)	(2.23389)	(0.56840)	(4.20981)	(2.54869)
	[2.41619]	[-1.66770]	[-0.71283]	[2.37308]	[1.18909]	[-1.79010]	[2.93237]	[-1.98174]
D(LNGE(-1))	0.113554	0.100918	-10.97401	0.034260	-0.407693	0.004311	-0.180272	-0.396999
	(0.91057)	(0.11379)	(7.73674)	(0.02981)	(0.19052)	(0.04848)	(0.35904)	(0.21737)
	[0.12471]	[0.88684]	[-1.41843]	[1.14941]	[-2.13991]	[0.08892]	[-0.50210]	[-1.82640]
D(LNMS(-1))	10.93506	-0.471718	-138.1036	0.443846	-0.737053	-0.214665	1.671340	-1.419810
	(7.07648)	(0.88435)	(60.1259)	(0.23164)	(1.48061)	(0.37673)	(2.79025)	(1.68926)
	[1.54527]	[-0.53341]	[-2.29691]	[1.91610]	[-0.49780]	[-0.56981]	[0.59899]	[-0.84049]

Table 5.26: (Continued)

D(LNTOB(-1))	1.097540	0.063949	-16.58688	0.033633	-0.054029	0.020047	0.760278	-0.194178
	(0.77403)	(0.09673)	(6.57660)	(0.02534)	(0.16195)	(0.04121)	(0.30520)	(0.18477)
	[1.41796]	[0.66110]	[-2.52211]	[1.32743]	[-0.33362]	[0.48650]	[2.49110]	[-1.05091]
D(LNUMP(-1))	-1.351930	-0.059315	14.15434	-0.029162	-0.026990	0.000694	-1.175184	-0.987817
	(0.95499)	(0.11935)	(8.11417)	(0.03126)	(0.19981)	(0.05084)	(0.37655)	(0.22797)
	[-1.41564]	[-0.49700]	[1.74440]	[-0.93286]	[-0.13508]	[0.01365]	[-3.12090]	[-4.33308]
C	-0.348793	0.015247	2.798744	-0.007118	-0.000951	0.024361	-0.082012	0.078103
	(0.15713)	(0.01964)	(1.33510)	(0.00514)	(0.03288)	(0.00837)	(0.06196)	(0.03751)
	[-2.21972]	[0.77644]	[2.09627]	[-1.38379]	[-0.02894]	[2.91206]	[-1.32368]	[2.08218]
R-squared	0.314532	0.299749	0.621223	0.406815	0.619738	0.299564	0.645031	0.790262
Adj. R-squared	0.006071	-0.015363	0.450773	0.139882	0.448620	-0.015632	0.485294	0.695879
Sum sq. resids	0.811923	0.012680	58.61426	0.000870	0.035544	0.002301	0.126231	0.046267
S.E. equation	0.201485	0.025180	1.711933	0.006595	0.042157	0.010727	0.079445	0.048098
F-statistic	1.019682	0.951245	3.644609	1.524035	3.621696	0.950405	4.038100	8.372990
Log likelihood	11.57505	73.96544	-52.61486	114.1555	58.50469	99.56486	39.49446	54.54957
Akaike AIC	-0.105003	-4.264363	4.174324	-6.943699	-3.233646	-5.970990	-1.966297	-2.969971
Schwarz SC	0.362063	-3.797297	4.641390	-6.476633	-2.766580	-5.503925	-1.499231	-2.502905
Mean dependent	-0.014565	-0.005163	0.015347	0.004731	0.002318	0.015747	0.019117	0.009041
S.D. dependent	0.202099	0.024988	2.309993	0.007111	0.056773	0.010644	0.110736	0.087217

Determinant resid covariance (dof adj.)	9.92E-24
Determinant resid covariance	3.87E-25
Log likelihood	502.6222
Akaike information criterion	-27.64148
Schwarz criterion	-23.53130

Below equation of VEC model 3 can be derived from the table 5.26 and it can be used to check the significance of the coefficients as shown in table 5.27.

D(LNINF) = C(1)*(LNINF(-1) + 1.15004214192*LNEXC(-1) + 0.146643354238*LNFDI(-1) + 15.6210397558*LNGDP(-1) + 3.36013261353*LNGE(-1) - 0.936284126563*LNMS(-1) - 5.15945848117*LNTOB(-1) + 4.41907288864*LNUMP(-1) - 108.51292029) + C(2)*D(LNINF(-1)) + C(3)*D(LNEXC(-1)) + C(4)*D(LNFDI(-1)) + C(5)*D(LNGDP(-1)) + C(6)*D(LNGE(-1)) + C(7)*D(LNMS(-1)) + C(8)*D(LNTOB(-1)) + C(9)*D(LNUMP(-1)) + C(10) **(VEC Model 3)**

As shown in table 5.27, significance of coefficients will be identified at 5% of significance level in order to confirm the effect on inflation rate.

Table 5.27: Properties of the coefficient of the VEC model 3

Dependent Variable: D(LNINF)
Method: Least Squares
Date: 05/01/19 Time: 18:38
Sample (adjusted): 2001Q3 2008Q4
Included observations: 30 after adjustments
D(LNINF) = C(1)*(LNINF(-1) + 1.15004214192*LNEXC(-1) + 0.146643354238*LNFDI(-1) + 15.6210397558*LNGDP(-1) + 3.36013261353*LNGE(-1) - 0.936284126563*LNMS(-1) - 5.15945848117*LNTOB(-1) + 4.41907288864*LNUMP(-1) - 108.51292029) + C(2)*D(LNINF(-1)) + C(3)*D(LNEXC(-1)) + C(4) *D(LNFDI(-1)) + C(5)*D(LNGDP(-1)) + C(6)*D(LNGE(-1)) + C(7) *D(LNMS(-1)) + C(8)*D(LNTOB(-1)) + C(9)*D(LNUMP(-1)) + C(10)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.323104	0.208632	1.548679	0.1371
C(2)	-0.120466	0.295011	-0.408344	0.6874
C(3)	-2.298604	2.119950	-1.084273	0.2911
C(4)	-0.009652	0.024326	-0.396771	0.6957
C(5)	25.79697	10.67671	2.416191	0.0254
C(6)	0.113554	0.910571	0.124707	0.9020
C(7)	10.93506	7.076480	1.545268	0.1380
C(8)	1.097540	0.774029	1.417958	0.1716
C(9)	-1.351930	0.954993	-1.415644	0.1723
C(10)	-0.348793	0.157134	-2.219716	0.0382

R-squared	0.314532	Mean dependent var	-0.014565
Adjusted R-squared	0.006071	S.D. dependent var	0.202099
S.E. of regression	0.201485	Akaike info criterion	-0.105003
Sum squared resid	0.811923	Schwarz criterion	0.362063
Log likelihood	11.57505	Hannan-Quinn criter.	0.044415
F-statistic	1.019682	Durbin-Watson stat	1.995657
Prob(F-statistic)	0.457691		

One lagged inflation rate, foreign direct investment, gross domestic product, money supply; exchange rate and unemployment rate have significant negative effect on inflation rate. One lagged government expenditure and trade of balance has a significant positive relationship to inflation rate in table 5.27.

5.4.5 Residual Tests for VEC Model 3

Residual tests are done to confirm the validity of the model created. Table 5.28 shows the test results of portmanteau test the autocorrelation under the null hypothesis of no residual autocorrelations up to lag 12 proves that there is no autocorrelation among the lags at 5% of significant level.

Table 5.28: Portmanteau Test for Autocorrelation for VEC Model 3

VEC Residual Portmanteau Tests for Autocorrelations
Null Hypothesis: no residual autocorrelations up to lag h
Date: 05/01/19 Time: 18:39
Sample: 2001Q1 2008Q4
Included observations: 30

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
1	25.39637	NA*	26.27211	NA*	NA*
2	79.67062	0.9983	84.42309	0.9943	120
3	135.2355	0.9972	146.1618	0.9817	184
4	198.0602	0.9914	218.6519	0.9104	248
5	257.2740	0.9895	289.7084	0.8127	312
6	318.6753	0.9855	366.4601	0.6280	376
7	367.7190	0.9948	430.4301	0.6188	440
8	428.7939	0.9934	513.7140	0.3726	504
9	481.7294	0.9963	589.3362	0.2595	568
10	515.9567	0.9997	640.6772	0.3968	632
11	565.1881	0.9999	718.4110	0.2702	696
12	604.7623	1.0000	784.3679	0.2625	760

*The test is valid only for lags larger than the VAR lag order.
df is degrees of freedom for (approximate) chi-square distribution

Null hypothesis of no serial correlation at lag order 12 is tested in table 5.29, it confirms that the hypothesis is significant at 5% of significant level. There is no serial correlation among the lags.

Table 5.29: Serial Correlation LM Test for VEC Model 3

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 05/01/19 Time: 18:39
Sample: 2001Q1 2008Q4
Included observations: 30

Lags	LM-Stat	Prob
1	56.89827	0.7234
2	50.47181	0.8910
3	64.69199	0.4523
4	80.89332	0.0754
5	90.80821	0.0154
6	66.94242	0.3764
7	75.39060	0.1561
8	78.76215	0.1013
9	76.32920	0.1390
10	62.94072	0.5140
11	82.35402	0.0610
12	53.61920	0.8193

Probs from chi-square with 64 df.

Table 5.30: Normality Tests for VEC Model 3

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 05/01/19 Time: 18:40
Sample: 2001Q1 2008Q4
Included observations: 30

Component	Jarque-Bera	Df	Prob.
1	0.053533	2	0.9736
2	0.992337	2	0.6089
3	1.952124	2	0.3768
4	1.111649	2	0.5736
5	2.346787	2	0.3093
6	0.673329	2	0.7141
7	1.027599	2	0.5982
8	0.492184	2	0.7819
Joint	8.649543	16	0.9271

Jarque –Bera test statistic under the null hypothesis of residuals are multivariate normal is shown in table 5.30. Statistics of skewness and kurtosis supports the above indication.

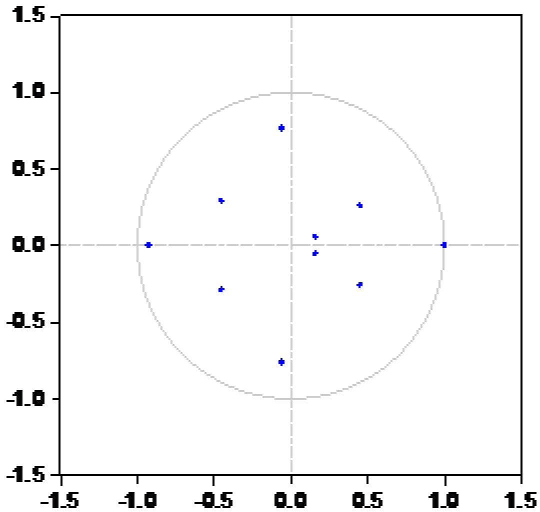

Figure 5.5: Inverse Roots of AR Stability of the VEC Model 3

Stability of the variables can be identified using the AR root graph. Unit root graph in figure 5.5 confirms that there is no root outside the unit circle, therefore VAR satisfies the stability condition.

5.4.6 Granger Causality for Period 3

Table 5.31: Granger Causality Test for Period 3

Pairwise Granger Causality Tests
Date: 05/12/19 Time: 12:10
Sample: 2001Q1 2008Q4
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LNEXC does not Granger Cause LNINF	31	3.68882	0.0650
LNINF does not Granger Cause LNEXC		2.29385	0.1411
LNFDI does not Granger Cause LNINF	31	0.78815	0.3822
LNINF does not Granger Cause LNFDI		3.89614	0.0583
LNGDP does not Granger Cause LNINF	31	3.42450	0.0748
LNINF does not Granger Cause LNGDP		4.07563	0.0532
LNGE does not Granger Cause LNINF	31	1.93271	0.1754
LNINF does not Granger Cause LNGE		0.11389	0.7383
LNMS does not Granger Cause LNINF	31	1.96006	0.1725
LNINF does not Granger Cause LNMS		2.32485	0.1385
LNTOB does not Granger Cause LNINF	31	2.63879	0.1155
LNINF does not Granger Cause LNTOB		1.13437	0.2959
LNUMP does not Granger Cause LNINF	31	0.10616	0.7470
LNINF does not Granger Cause LNUMP		0.43647	0.5142

There is no granger causality running among all variables to inflation rate during the period which confirms there is no short term causality running among variables as explained in table 5.31.

5.4.7 Impulse Responses Functions for Period 3

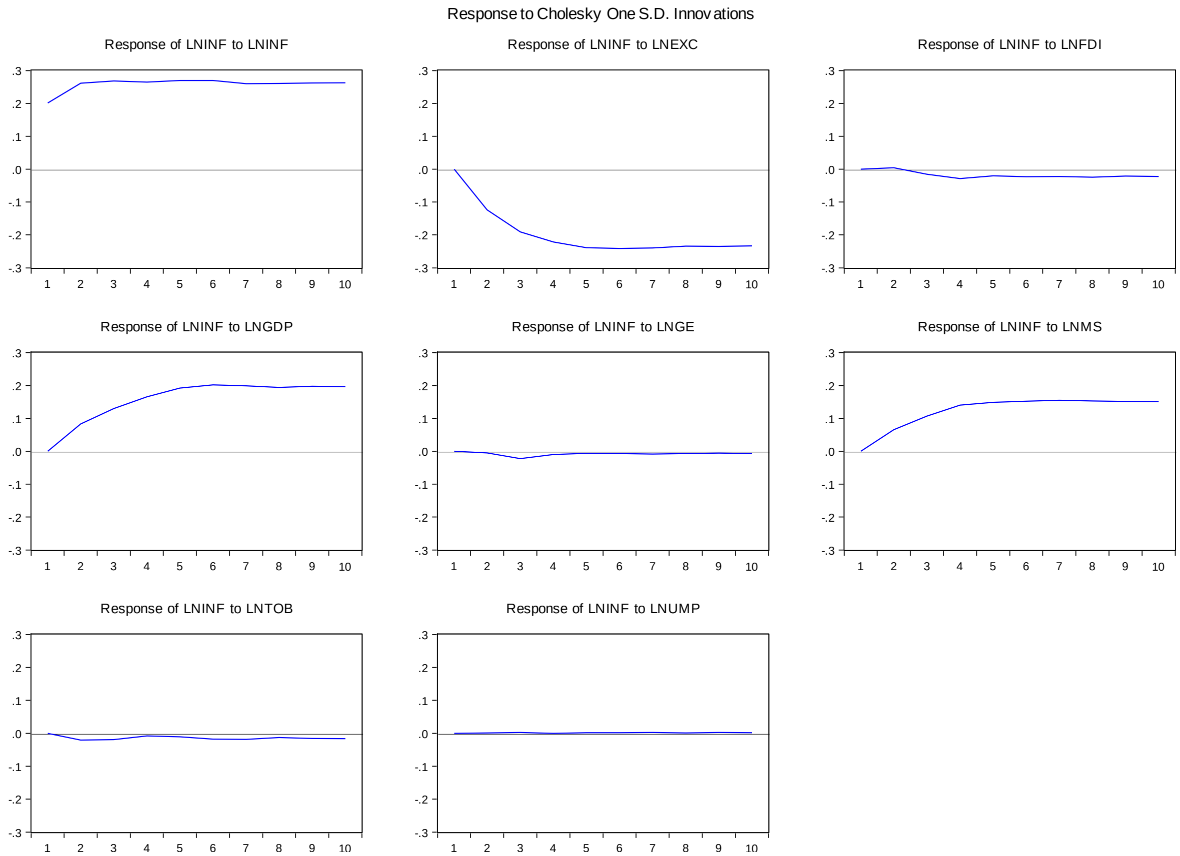

Figure 5.6: Impulse Responses Functions for Period 3

Impulse responses at figure 5.6 show that there is a positive reaction of inflation to the shock of inflation rate, money supply, unemployment rate and gross domestic product. There is a negative reaction of inflation to the shock of foreign direct investment, trade of balance and government expenditure.

5.5 VAR Model for the Period 4

5.5.1 Stationary of Time Series Period 4

Stationary of the variables should be identified before applying any time series model. Augmented Dicky Fuller Test (ADF) and P-Perron (PP) test can be used to identify the stationary of the economical time series effectively.

Table 5.32 Unit Root Test Results of Sequence of level for Period 4

Variable	Level		First Difference	
	ADF Test	PP test	ADF Test	PP test
LNINF	0.0002	0.0482	0.0000	0.0000
LNEXC	0.9688	0.9239	0.0135	0.0179
LNFDI	0.0262	0.0316	0.0000	0.0000
LNGDP	0.9525	0.9595	0.0000	0.0000
LNGE	0.5802	0.4905	0.0022	0.0007
LNMS	0.9873	0.9972	0.0204	0.0004
LNTOB	0.0253	0.0028	0.0000	0.0000
LNUMP	0.9133	0.9419	0.0001	0.0000

As indicated in table 5.32 ADF test and PP tests shows that all variables become stationary by applying first difference.

5.5.2 Lag Length Criteria for Period 4

Identifying a suitable lag length is important before applying VEC model. According to the table 5.33 the suitable lag length for the given economical variables is lag order 1 as selected by Akaike Information Criterea , Shwartz Baysian and Hannan Quinn (HQ).

Table 5.33: Determine Lag Intervals with VAR Lag order selection criteria for 8 economical variables in U.S.A (Period 4)

VAR Lag Order Selection Criteria
Endogenous variables: LNINF LNGE LNGDP LNFDI LNEXC LNMS LNTOB LNUMP
Exogenous variables: C
Date: 04/20/19 Time: 17:52
Sample: 2009Q1 2016Q4
Included observations: 31

Lag	LogL	LR	FPE	AIC	SC	HQ
0	319.7507	NA	2.54e-19	-20.11295	-19.74289	-19.99232
1	529.2165	297.3063*	2.45e-23*	-29.49784*	-26.16729*	-28.41216*

* 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

5.5.3 Co-integration of the Time Series for Period 4

As mentioned in Chapter 3 VEC models are used for I(1) variables. Presence of co-integration indicates non stationary variables. Johansen Co-integration test is applied to identify the presence of the co-integration. As indicated in table 5.34 there exists co-integration between endogenous variables. VEC model should be applied for the time series data.

Table 5.34: Johansen Co-integration test for 8 Economical Variables in U.S.A (Period 4)

Date: 05/01/19 Time: 18:51
Sample: 2009Q1 2016Q4
Included observations: 30
Series: LNINF LNEXC LNFDI LNGDP LNGE LNMS LNTOB LNUMP
Lags interval: 1 to 1
Selected (0.05 level*)
Number of Cointegrating
Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	6	7	6	5	5
Max-Eig	4	5	4	5	5

*Critical values based on MacKinnon-Haug-Michelis (1999)

5.5.4 VEC Model for Period 4

Table 5.35 shows the VEC model estimated using lag order 1. T statistics shown in the squared brackets should be greater than 2.0 for lag order to be significant. Inflation rate is taken as the endogenous variable and other nine variables as the exogenous variables. Using VEC model long term error correction among the variables has been identified.

Table 5.35: VEC Model for selected economical variables in U.S.A (Period 4)

Vector Error Correction Estimates
Date: 05/01/19 Time: 19:11
Sample (adjusted): 2009Q3 2016Q4
Included observations: 30 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNINF(-1)	1.000000
LNEXC(-1)	13.03348 (1.78020) [7.32137]

Table 5.35: (Continued)

LNFDI(-1)	-0.102760
	(0.13800)
	[-0.74463]
LNGDP(-1)	-158.1701
	(10.5698)
	[-14.9644]
LNGE(-1)	15.53531
	(1.39887)
	[11.1056]
LNMS(-1)	0.367573
	(1.91225)
	[0.19222]
LNTOB(-1)	2.907952
	(0.85835)
	[3.38785]
LNUMP(-1)	-15.20314
	(1.00670)
	[-15.1020]
C	1354.129

Error Correction:	D(LNINF)	D(LNEXC)	D(LNFDI)	D(LNGDP)	D(LNGE)	D(LNMS)	D(LNTOB)	D(LNUMP)
CointEq1	0.190837	-0.004861	0.075548	0.002378	-0.007563	-0.005743	0.030488	0.059829
	(0.05350)	(0.00552)	(0.14002)	(0.00090)	(0.00532)	(0.00211)	(0.02288)	(0.00810)
	[3.56710]	[-0.88112]	[0.53957]	[2.63397]	[-1.42160]	[-2.71583]	[1.33234]	[7.38868]
D(LNINF(-1))	-0.460971	0.007776	0.075679	0.001038	0.013616	0.005945	-0.053971	-0.049473
	(0.10110)	(0.01043)	(0.26460)	(0.00171)	(0.01005)	(0.00400)	(0.04324)	(0.01530)
	[-4.55950]	[0.74585]	[0.28602]	[0.60829]	[1.35440]	[1.48758]	[-1.24810]	[-3.23306]
D(LNEXC(-1))	-6.750149	0.411935	2.310550	0.072890	-0.364328	-0.037291	0.205353	-0.843905
	(1.87085)	(0.19292)	(4.89629)	(0.03157)	(0.18604)	(0.07395)	(0.80020)	(0.28316)
	[-3.60806]	[2.13531]	[0.47190]	[2.30918]	[-1.95838]	[-0.50429]	[0.25663]	[-2.98029]
D(LNFDI(-1))	-0.036447	-0.014447	-0.343458	0.001421	0.004891	0.000227	-0.032579	-0.019617
	(0.08253)	(0.00851)	(0.21600)	(0.00139)	(0.00821)	(0.00326)	(0.03530)	(0.01249)
	[-0.44161]	[-1.69750]	[-1.59010]	[1.02066]	[0.59600]	[0.06969]	[-0.92290]	[-1.57040]
D(LNGDP(-1))	-10.99580	0.876919	-16.03016	0.103682	0.073342	-0.576481	-3.910906	1.388757
	(10.9287)	(1.12693)	(28.6021)	(0.18439)	(1.08674)	(0.43197)	(4.67443)	(1.65412)
	[-1.00614]	[0.77815]	[-0.56045]	[0.56230]	[0.06749]	[-1.33453]	[-0.83666]	[0.83958]
D(LNGE(-1))	-2.488657	-0.178713	-3.398892	0.058855	0.194394	-0.137022	1.298772	0.110022
	(1.65638)	(0.17080)	(4.33499)	(0.02795)	(0.16471)	(0.06547)	(0.70847)	(0.25070)
	[-1.50247]	[-1.04632]	[-0.78406]	[2.10598]	[1.18023]	[-2.09287]	[1.83322]	[0.43886]
D(LNMS(-1))	-7.517136	0.787105	-4.271558	0.120471	0.576726	0.313415	-6.939769	-2.556603
	(4.67450)	(0.48202)	(12.2338)	(0.07887)	(0.46483)	(0.18477)	(1.99938)	(0.70751)
	[-1.60812]	[1.63293]	[-0.34916]	[1.52749]	[1.24073]	[1.69628]	[-3.47097]	[-3.61353]
	-0.488261	0.030101	-0.065551	0.013514	-0.065416	0.054176	-0.329496	-0.187353

Table 5.35: Continued

D(LNTOB(-1))								
	(0.43812)	(0.04518)	(1.14663)	(0.00739)	(0.04357)	(0.01732)	(0.18739)	(0.06631)
	[-1.11444]	[0.66629]	[-0.05717]	[1.82824]	[-1.50153]	[3.12841]	[-1.75832]	[-2.82534]
D(LNUMP(-1))	0.835071	0.014768	0.649864	0.017745	0.037293	-0.055687	0.352445	-0.452722
	(0.58329)	(0.06015)	(1.52655)	(0.00984)	(0.05800)	(0.02306)	(0.24948)	(0.08828)
	[1.43166]	[0.24552]	[0.42571]	[1.80310]	[0.64297]	[-2.41539]	[1.41270]	[-5.12805]
C	0.321410	-0.008522	0.248883	0.001658	0.010559	0.014463	0.123980	0.010461
	(0.11660)	(0.01202)	(0.30516)	(0.00197)	(0.01159)	(0.00461)	(0.04987)	(0.01765)
	[2.75650]	[-0.70874]	[0.81558]	[0.84294]	[0.91068]	[3.13810]	[2.48594]	[0.59273]
R-squared	0.815084	0.463767	0.199613	0.542902	0.477474	0.636553	0.638695	0.863029
Adj. R-squared	0.731872	0.222462	-0.160561	0.337208	0.242337	0.473002	0.476108	0.801393
Sum sq. resids	0.763926	0.008123	5.232469	0.000217	0.007554	0.001194	0.139756	0.017500
S.E. equation	0.195439	0.020153	0.511491	0.003297	0.019434	0.007725	0.083593	0.029581
F-statistic	9.795248	1.921911	0.554213	2.639365	2.030624	3.892072	3.928320	14.00187
Log likelihood	12.48907	80.64587	-16.37344	134.9518	81.73545	109.4127	37.96770	69.13292
Akaike AIC	-0.165938	-4.709725	1.758230	-8.330123	-4.782364	-6.627515	-1.864513	-3.942195
Schwarz SC	0.301128	-4.242659	2.225295	-7.863057	-4.315298	-6.160449	-1.397447	-3.475129
Mean dependent	0.066155	0.004574	0.021890	0.005379	0.020927	0.015025	0.017703	-0.019067
S.D. dependent	0.377433	0.022855	0.474793	0.004050	0.022327	0.010641	0.115491	0.066376

Determinant resid covariance (dof adj.)	2.56E-25
Determinant resid covariance	9.99E-27
Log likelihood	557.4811
Akaike information criterion	-31.29874
Schwarz criterion	-27.18856

Below equation of VEC model 4 can be derived from the table 5.35 and it can be used to check the significance of the coefficients as shown in table 5.36.

D(LNINF) = C(1)*(LNINF(-1) + 13.033475638*LNEXC(-1) - 0.102760082347*LNFDI(-1) - 158.17008453*LNGDP(-1) + 15.5353075698*LNGE(-1) + 0.36757304332*LNMS(-1) + 2.90795192399*LNTOB(-1) - 15.2031416572*LNUMP(-1) + 1354.12946711) + C(2)*D(LNINF(-1)) + C(3)*D(LNEXC(-1)) + C(4)*D(LNFDI(-1)) + C(5)*D(LNGDP(-1)) + C(6)*D(LNGE(-1)) + C(7)*D(LNMS(-1)) + C(8)*D(LNTOB(-1)) + C(9)*D(LNUMP(-1)) + C(10) **(VEC Model 4)**

As shown in table 5.37, significance of coefficients will be identified at 5% of significance level in order to confirm the effect on inflation rate.

Table 5.37: Properties of the coefficient of the VEC model 4

Dependent Variable: D(LNINF)
Method: Least Squares
Date: 05/01/19 Time: 19:13
Sample (adjusted): 2009Q3 2016Q4
Included observations: 30 after adjustments
D(LNINF) = C(1)*(LNINF(-1) + 13.033475638*LNEXC(-1) - 0.102760082347*LNFDI(-1) - 158.17008453*LNGDP(-1) + 15.5353075698*LNGE(-1) + 0.36757304332*LNMS(-1) + 2.90795192399*LNTOB(-1) - 15.2031416572*LNUMP(-1) + 1354.12946711) + C(2)*D(LNINF(-1)) + C(3)*D(LNEXC(-1)) + C(4) *D(LNFDI(-1)) + C(5)*D(LNGDP(-1)) + C(6)*D(LNGE(-1)) + C(7) *D(LNMS(-1)) + C(8)*D(LNTOB(-1)) + C(9)*D(LNUMP(-1)) + C(10)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.190837	0.053499	3.567098	0.0019
C(2)	-0.460971	0.101101	-4.559504	0.0002
C(3)	-6.750149	1.870851	-3.608063	0.0018
C(4)	-0.036447	0.082532	-0.441608	0.6635
C(5)	-10.99580	10.92872	-1.006138	0.3264
C(6)	-2.488657	1.656381	-1.502467	0.1486
C(7)	-7.517136	4.674500	-1.608115	0.1235
C(8)	-0.488261	0.438121	-1.114443	0.2783
C(9)	0.835071	0.583288	1.431662	0.1677
C(10)	0.321410	0.116601	2.756504	0.0122

R-squared	0.815084	Mean dependent var	0.066155
Adjusted R-squared	0.731872	S.D. dependent var	0.377433
S.E. of regression	0.195439	Akaike info criterion	-0.165938
Sum squared resid	0.763926	Schwarz criterion	0.301128
Log likelihood	12.48907	Hannan-Quinn criter.	-0.016520
F-statistic	9.795248	Durbin-Watson stat	1.926558
Prob(F-statistic)	0.000013		

One lagged inflation rate, foreign direct investment, gross domestic product, money supply , exchange rate and unemployment rate have significant negative effect on inflation rate. One lagged government expenditure and trade of balance has a significant positive relationship to inflation rate as indicated in table 5.37 co-efficient table.

5.5.5 Residual Tests for VEC model 4

Residual tests are done to confirm the validity of the model created. Table 5.38 shows the test results of portmanteau test the autocorrelation under the null hypothesis of no residual autocorrelations up to lag 12 proves that there is no autocorrelation among the lags at 5% of significant level.

Table 5.38: Portmanteau Test for Autocorrelation for VEC model 4

VEC Residual Portmanteau Tests for Autocorrelations
Null Hypothesis: no residual autocorrelations up to lag h
Date: 05/01/19 Time: 19:14
Sample: 2009Q1 2016Q4
Included observations: 30

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	Df
1	53.71270	NA*	55.56487	NA*	NA*
2	114.0223	0.6365	120.1823	0.4781	120
3	155.2505	0.9394	165.9914	0.8254	184
4	224.0086	0.8608	245.3276	0.5360	248
5	276.0634	0.9293	307.7934	0.5566	312
6	340.7667	0.9037	388.6725	0.3152	376
7	388.0129	0.9644	450.2980	0.3568	440
8	433.9989	0.9891	513.0062	0.3810	504
9	472.4991	0.9986	568.0065	0.4920	568
10	510.6301	0.9999	625.2030	0.5687	632
11	551.2132	1.0000	689.2816	0.5647	696
12	588.2610	1.0000	751.0280	0.5847	760

*The test is valid only for lags larger than the VAR lag order.
df is degrees of freedom for (approximate) chi-square distribution

Null hypothesis of no serial correlation at lag order 12 is tested in table 5.39, it confirms that the hypothesis is significant at 5% of significant level. There is no serial correlation among the lags.

Table 5.39: Serial Correlation LM Test VEC model 4

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 05/01/19 Time: 19:18
Sample: 2009Q1 2016Q4
Included observations: 30

Lags	LM-Stat	Prob
1	101.9437	0.0018
2	59.24034	0.6452
3	35.42927	0.9986
4	65.05559	0.4397
5	81.11653	0.0730
6	84.02485	0.0474
7	63.21052	0.5044
8	55.03832	0.7802
9	58.19774	0.6808
10	49.75198	0.9044
11	66.30609	0.3973
12	51.44705	0.8711

Probs from chi-square with 64 df.

Table 5.40: Normality Tests for VEC model 4

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 05/01/19 Time: 19:19
Sample: 2009Q1 2016Q4
Included observations: 30

Component	Jarque-Bera	Df	Prob.
1	1.027999	2	0.5981
2	1.224548	2	0.5421
3	1.573487	2	0.4553
4	2.520553	2	0.2836
5	0.838776	2	0.6574
6	1.401810	2	0.4961
7	0.230870	2	0.8910
8	1.411235	2	0.4938
Joint	10.22928	16	0.8544

Jarque –Bera test statistic under the null hypothesis of residuals are multivariate normal is shown in table 5.40. Statistics of skewness and kurtosis supports the above indication.

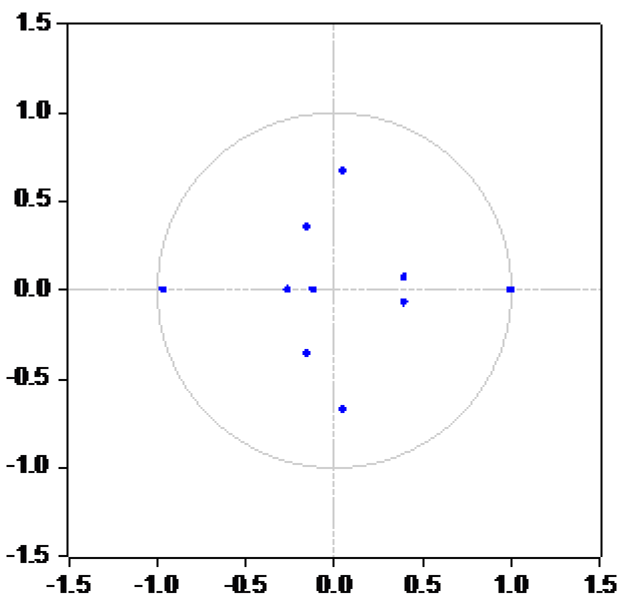

Figure 5.7 : Inverser Roots of AR Stability of the VEC model 4

Stability of the variables can be identified using the AR root graph. Unit root graph in figure 5.7 confirms that there is no root outside the unit circle and VAR satisfies the stability condition

5.5.6 Granger Causality Test for period 4

Table 5.41: Granger Causality Test for period 4

Pairwise Granger Causality Tests
Date: 05/12/19 Time: 12:12
Sample: 2009Q1 2016Q4
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LNEXC does not Granger Cause LNINF	31	3.85937	0.0595
LNINF does not Granger Cause LNEXC		4.10419	0.0524
LNFDI does not Granger Cause LNINF	31	0.13058	0.7205
LNINF does not Granger Cause LNFDI		0.12887	0.7223
LNGDP does not Granger Cause LNINF	31	0.37284	0.5464
LNINF does not Granger Cause LNGDP		1.85876	0.1836
LNGE does not Granger Cause LNINF	31	0.28485	0.5977
LNINF does not Granger Cause LNGE		3.36627	0.0772
LNMS does not Granger Cause LNINF	31	0.40974	0.5273
LNINF does not Granger Cause LNMS		7.02772	0.0131
LNTOB does not Granger Cause LNINF	31	0.56869	0.4571
LNINF does not Granger Cause LNTOB		0.00289	0.9575
LNUMP does not Granger Cause LNINF	31	3.81257	0.0609
LNINF does not Granger Cause LNUMP		1.52854	0.2266

There is no granger causality running among all variables to inflation rate except money supply during the period which confirms there is no short term causality running among variables as shown in table 5.41

5.5.7 Impulse Responses Functions for Period 4

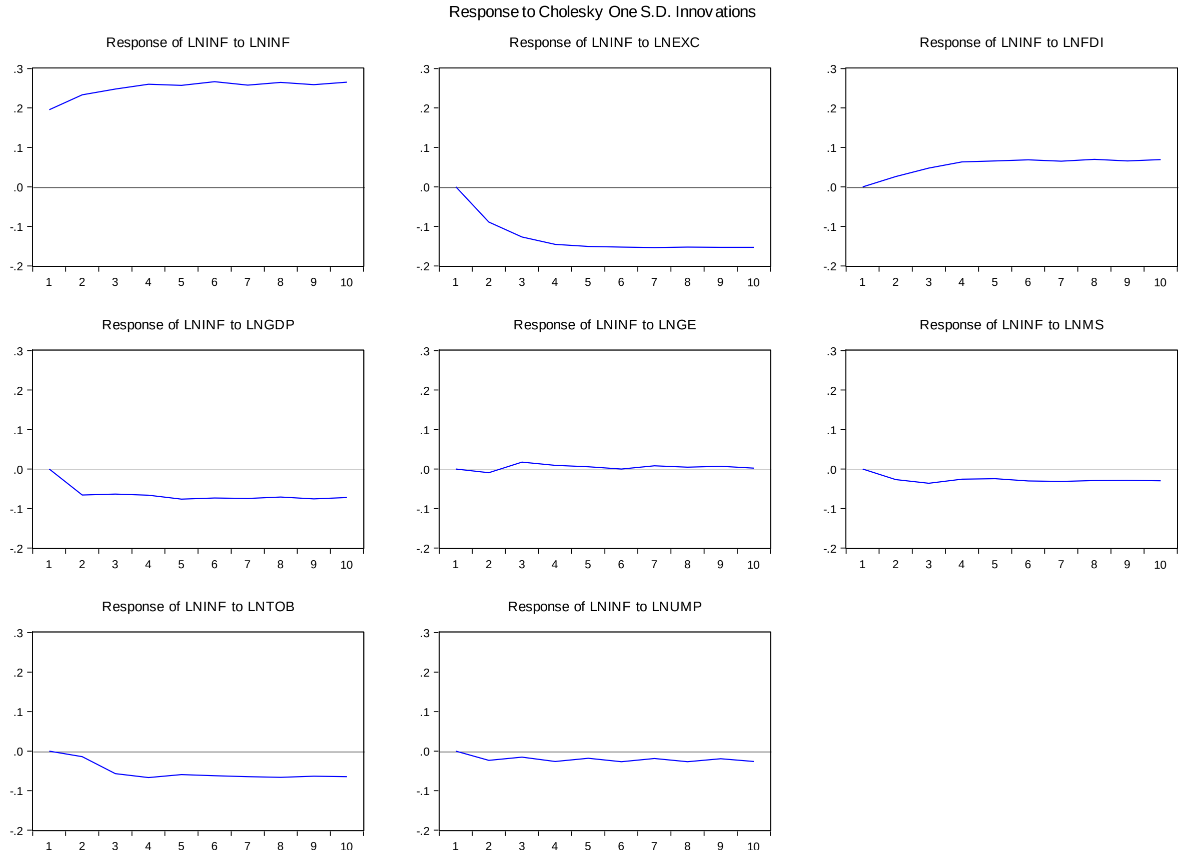

Figure 5.8: Impulse Responses for periods 4

Impulse response at figure 5.8 shows that there is a positive reaction of inflation to the shock of inflation rate, exchange rate and foreign direct investment. There is a negative reaction of inflation to the shock of trade of balance, gross domestic product, money supply, exchange rate and unemployment rate. There are both negative and positive responses of inflation rate to government expenditure.

5.6 Summary of Chapter 5

The factors influence on the inflation rate on long term basis for the four periods are as follows.

Table 5.42: Summary of Significant Variables (Long Term) during Four Periods

Period	Significant Variables
Period 1	LNINF(-1) , LNEXC(-1), LNFDI(-1), LNGDP(-1), LNGE(-1) , LNMS(-1), LNTOB(-1) , LNUMP(-1)
Period 2	LNINF(-1) , LNEXC(-1), LNFDI(-1), LNGDP(-1), LNGE(-1) , LNMS(-1), LNTOB(-1), LNUMP(-1)
Period 3	LNINF(-1) , LNEXC(-1), LNFDI(-1), LNGE(-1) , LNMS(-1), LNTOB(-1) , LNUMP(-1)
Period 4	LNFDI(-1), LNGDP(-1), LNGE(-1) , LNMS(-1), LNTOB(-1), LNUMP(-1)

Nature of the relationship of significant factors with inflation rate is shown in table 5.43.

Table 5.43: Summary of Positively and Negatively Influenced Variables during Four Periods

Period	Positively influenced	Negatively influenced
Period 1	LNINF(-1) , LNEXC(-1), LNGDP(-1), LNUMP(-1)	LNFDI(-1), LNGE(-1) , LNMS(-1), LNTOB(-1)
Period 2	LNINF(-1) , LNMS(-1), LNTOB(-1)	LNEXC(-1), LNFDI(-1), LNGDP(-1), LNGE(-1) , LNUMP(-1)
Period 3	LNGE(-1) , LNMS(-1), LNTOB(-1)	LNINF(-1) , LNEXC(-1), LNFDI(-1), , LNUMP(-1)
Period 4	LNUMP(-1)	LNFDI(-1), LNGDP(-1), LNGE(-1) , LNMS(-1), LNTOB(-1)

The factors influence on the inflation rate on short term basis for the four periods are as follows.

Table 5.44: Summary of Significant Variables (Long Term) during Four Periods

Period	**Significant Variables**
Period 1	EXC , GE, TOB
Period 2	None
Period 3	None
Period 4	MS

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The following conclusions are made based on results of data analysis. Foreign direct investment is affecting negatively on inflation rate during four periods. The concept of higher foreign direct investment influence higher inflation rate cannot be applied to the given four periods. Money supply which accelerates the growth of economy is supposed to have a positive relationship along with inflation rate. But it gives both positive and negative influence on inflation rate according to the study. Gross domestic product has positive influence on inflation rate during first period and negative influence on inflation rate during second and fourth periods. Government expenditure on the other hand has negative effect on influence rate during all four periods except third period. Unemployment rate shows a positive effect on inflation rate during first and fourth periods. Likewise all the seven variables selected for the study have questionable influence on influence rate which sometimes are not in accordance with the inflation theories. Furthermore it is unable to examine a pattern on positive or negative effect of economical factors on inflation.

6.2 Recommendations

This study is revealing information about the behaviors of the economical indicators towards inflation rate in U.S.A during the given four periods. Therefore this study can be used as a foundation to study on the underlying factors to keep inflation rate lower in U.S.A. Identifying the relationship between economical indicators and inflation will assist fiscal policy makers and decision makers of central bank on balancing the economical activities in a country. Furthermore this study can be used as a base for the studies on political condition of U.S.A and its effect of inflation rate of the country.

6.3 Future Studies

Applicability of inflation theories may vary according to the nature of the economy. Therefore researchers can study the inflation rate of U.S.A thoroughly to identify if the theories of inflation are not applicable in special situations of the economy of U.S.A and what the factors are which effects the direction of the relationship of the economical variables and inflation rate. Furthermore studies can be conducted to identify if the political decisions and its policies of each ruling party effects the inflation and what are such decisions which can be harmful for the stability of inflation rate. Studies can be conducted examining the comparable economies to find out if the theories of inflation applicable in those economies during specially defined time periods. Validity of inflation theories may differ in developed economies and in developing economies, therefore studied can be done using the economical indicators identified from both developed and developing economies to examine their behavior towards the inflation rate and if both economical situations are in accordance with theories of inflation. Most importantly a prolonged study can be used as a base to generate a new inflation theory which fits modern globalized economies.

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Appendix 1

Results of Dicky Fuller and Phillips Perron Test for the Period 1

Appendix 1.1: Results for LNEXC

Null Hypothesis: LNEXC has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.653430	0.8483
Test critical values:	1% level	-3.577723	
	5% level	-2.925169	
	10% level	-2.600658	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.035820	0.7329
Test critical values:	1% level	-3.577723	
	5% level	-2.925169	
	10% level	-2.600658	

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

Appendix 1.2: Results for D(LNEXC)

Null Hypothesis: D(LNEXC) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.018600	0.0001
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.963938	0.0002
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

Appendix 1.3: Results for LNFDI

Null Hypothesis: LNFDI has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.017614	0.2785
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

Null Hypothesis: LNFDI has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.569287	0.0102
Test critical values:	1% level	-3.577723	
	5% level	-2.925169	
	10% level	-2.600658	

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

Appendix 1.4: Results for D(LNFDI)

Null Hypothesis: D(LNFDI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.84969	0.0000
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

Null Hypothesis: D(LNFDI) has a unit root
Exogenous: Constant
Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-14.70619	0.0000
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

Appendix 1.5: Results for LNGDP

Null Hypothesis: LNGDP has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.736735	0.8270
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.275785	0.9206
Test critical values:	1% level	-3.577723	
	5% level	-2.925169	
	10% level	-2.600658	

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

Appendix 1.6: Results for D(LNGDP)

Null Hypothesis: D(LNGDP) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.508793	0.1202
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

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

Null Hypothesis: D(LNGDP) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.122456	0.0022
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

Appendix 1.7: Results for LNGE

Null Hypothesis: LNGE has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.194851	0.9694
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

Null Hypothesis: LNGE has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.158704	0.9364
Test critical values:	1% level	-3.577723	
	5% level	-2.925169	
	10% level	-2.600658	

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

Appendix 1.8: Results for D(LNGE)

Null Hypothesis: D(LNGE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.12667	0.0000
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

Null Hypothesis: D(LNGE) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.874918	0.0000
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

Appendix 1.9: Results for LNINF

Null Hypothesis: LNINF has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.671635	0.0867
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

Null Hypothesis: LNINF has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.601495	0.0998
Test critical values:	1% level	-3.577723	
	5% level	-2.925169	
	10% level	-2.600658	

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

Appendix 1.10: Results for D(LNINF)

Null Hypothesis: D(LNINF) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.533814	0.0007
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: D(LNINF) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.929202	0.0002
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

Appendix 1.11: Results for LNMS

Null Hypothesis: LNMS has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.325665	0.0001
Test critical values:	1% level	-3.577723	
	5% level	-2.925169	
	10% level	-2.600658	

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

Null Hypothesis: LNMS has a unit root
Exogenous: Constant
Bandwidth: 12 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-8.193074	0.0000
Test critical values:	1% level	-3.577723	
	5% level	-2.925169	
	10% level	-2.600658	

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

Appendix 1.12: Results for D(LNMS)

Null Hypothesis: D(LNMS) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.547394	0.0006
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

Null Hypothesis: D(LNMS) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.476397	0.0008
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

Appendix 1.13: Results for LNTOB

Null Hypothesis: LNTOB has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.130869	0.2340
Test critical values:	1% level	-3.588509	
	5% level	-2.929734	
	10% level	-2.603064	

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

Null Hypothesis: LNTOB has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.527915	0.1155
Test critical values:	1% level	-3.577723	
	5% level	-2.925169	
	10% level	-2.600658	

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

Appendix 1.14: Results for D(LNTOB)

Null Hypothesis: D(LNTOB) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.514052	0.0000
Test critical values:	1% level	-3.588509	
	5% level	-2.929734	
	10% level	-2.603064	

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

Null Hypothesis: D(LNTOB) has a unit root
Exogenous: Constant
Bandwidth: 12 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-8.603885	0.0000
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

Appendix 1.15: Results for LNUMP

Null Hypothesis: LNUMP has a unit root
Exogenous: Constant
Lag Length: 5 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.159880	0.2234
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: LNUMP has a unit root
Exogenous: Constant
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.615898	0.4667
Test critical values:	1% level	-3.577723	
	5% level	-2.925169	
	10% level	-2.600658	

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

Appendix 1.16: Results for D(LNUMP)

Null Hypothesis: D(LNUMP) has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.530682	0.0119
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.836546	0.0000
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

Appendix 2

Statistical Tests for the Period 2

Appendix 2.1: Results for LNEXC

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.136335	0.9635
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Null Hypothesis: LNEXC has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.136335	0.9635
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 2.2: Results for D(LNEXC)

Null Hypothesis: D(LNEXC) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.366976	0.0001
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Null Hypothesis: D(LNEXC) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.367147	0.0001
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 2.3: Results for LNFDI

Null Hypothesis: LNFDI has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.979277	0.7476
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.059750	0.2614
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 2.4: Results for D(LNFDI)

Null Hypothesis: D(LNFDI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.30639	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Null Hypothesis: D(LNFDI) has a unit root
Exogenous: Constant
Bandwidth: 15 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-25.15037	0.0001
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 2.5 : Results for LNGDP

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.698386	0.9902
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.831192	0.9930
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 2.6: Results for D(LNGDP)

Null Hypothesis: D(LNGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.367676	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Null Hypothesis: D(LNGDP) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.382924	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 2.7: Results for LNGE

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.227083	0.6498
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Null Hypothesis: LNGE has a unit root
Exogenous: Constant
Bandwidth: 25 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.433394	0.0173
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 2.8: Results for D(LNGE)

Null Hypothesis: D(LNGE) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.986314	0.0047
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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

Null Hypothesis: D(LNGE) has a unit root
Exogenous: Constant
Bandwidth: 15 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-13.73521	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 2.9: Results for LNINF

Null Hypothesis: LNINF has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.280876	0.0256
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.743069	0.4006
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 2.10: Results for D(LNINF)

Null Hypothesis: D(LNINF) has a unit root
Exogenous: Constant
Lag Length: 7 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.797595	0.0742
Test critical values:	1% level	-3.752946	
	5% level	-2.998064	
	10% level	-2.638752	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.238616	0.0024
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 2.11: Results for LNMS

Null Hypothesis: LNMS has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.050052	0.9554
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		2.875632	1.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 2.12: Results for D(LNMS)

Null Hypothesis: D(LNMS) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.331168	0.6001
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

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

Null Hypothesis: D(LNMS) has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.966318	0.0048
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 2.13: Results for LNTOB

Null Hypothesis: LNTOB has a unit root
Exogenous: Constant
Lag Length: 5 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.996965	0.9952
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

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

Null Hypothesis: LNTOB has a unit root
Exogenous: Constant
Bandwidth: 21 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.010888	0.7369
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 2.14 : Results for D(LNTOB)

Null Hypothesis: D(LNTOB) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.705180	0.4174
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

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

Null Hypothesis: D(LNTOB) has a unit root
Exogenous: Constant
Bandwidth: 10 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.760272	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 2.15: Results for LNUMP

Null Hypothesis: LNUMP has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.781854	0.8082
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

*MacKinnon (1996) one-sided p-values.
Null Hypothesis: LNUMP has a unit root
Exogenous: Constant
Bandwidth: 13 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.354033	0.5915
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 2.16: Results for D(LNUMP)

Null Hypothesis: D(LNUMP) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.313188	0.1752
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

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

Null Hypothesis: D(LNUMP) has a unit root
Exogenous: Constant
Bandwidth: 11 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-26.72077	0.0001
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 3

Statistical Tests for the Period 3

Appendix 3.1: Results for LNEXC

Null Hypothesis: LNEXC has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.941533	0.3098
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Null Hypothesis: LNEXC has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.238140	0.6449
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 3.2: Results for D(LNEXC)

Null Hypothesis: D(LNEXC) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.567112	0.1108
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Null Hypothesis: D(LNEXC) has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.567112	0.1108
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 3.3 : Results for LNFDI

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.052825	0.0003
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Null Hypothesis: LNFDI has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.050870	0.0003
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 3.4 : Results for D(LNFDI)

Null Hypothesis: D(LNFDI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.111472	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Null Hypothesis: D(LNFDI) has a unit root
Exogenous: Constant
Bandwidth: 23 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-21.62863	0.0001
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 3.5 : Results for LNGDP

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.673335	0.4344
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Null Hypothesis: LNGDP has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.459665	0.5403
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 3.6: Results for D(LNGDP)

Null Hypothesis: D(LNGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.647493	0.4467
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.429470	0.5546
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 3.7 : Results for LNGE

Null Hypothesis: LNGE has a unit root
Exogenous: Constant
Lag Length: 7 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.332858	0.1704
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.035691	0.7278
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 3.8 : Results for D(LNGE)

Null Hypothesis: D(LNGE) has a unit root
Exogenous: Constant
Lag Length: 6 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.399510	0.8943
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.479974	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 3.9 : Results for LNINF

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.559970	0.1119
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Null Hypothesis: LNINF has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.623161	0.0992
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 3.10: Results for D(LNINF)

Null Hypothesis: D(LNINF) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.301221	0.0002
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

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

Null Hypothesis: D(LNINF) has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.104457	0.0034
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 3.11: Results for LNMS

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.349549	0.9772
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Null Hypothesis: LNMS has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.441105	0.9816
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Null Hypothesis: D(LNMS) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.219064	0.0002
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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

Appendix 3.12 : Results for D(LNMS)

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.622872	0.0112
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 3.13 :Results for LNTOB

Null Hypothesis: LNTOB has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.618640	0.4606
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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

Null Hypothesis: LNTOB has a unit root
Exogenous: Constant
Bandwidth: 18 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.693868	0.4244
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 3.14 : Results for D(LNTOB)

Null Hypothesis: D(LNTOB) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.663455	0.0000
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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

Null Hypothesis: D(LNTOB) has a unit root
Exogenous: Constant
Bandwidth: 29 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.861895	0.0005
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 3.15: Results for LNUMP

Null Hypothesis: LNUMP has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.674093	0.0915
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

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

Null Hypothesis: LNUMP has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.007969	0.0452
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 3.16 : Results for D(LNUMP)

Null Hypothesis: D(LNUMP) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.098297	0.2468
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

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

Null Hypothesis: D(LNUMP) has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-8.591867	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 4

Statistical Tests for the Period 4

Appendix 4.1: Results for LNEXC

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.209739	0.9688
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.232880	0.9239
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 4.2 : Results for D(LNEXC)

Null Hypothesis: D(LNEXC) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.544567	0.0135
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Null Hypothesis: D(LNEXC) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.425550	0.0179
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 4.3: Results for LNFDI

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.254141	0.0262
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.170387	0.0316
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 4.4: Results for D(LNFDI)

Null Hypothesis: D(LNFDI) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.411444	0.0000
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

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

Null Hypothesis: D(LNFDI) has a unit root
Exogenous: Constant
Bandwidth: 16 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-12.01072	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 4.5 : Results for LNGDP

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.010138	0.9525
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.087393	0.9595
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 4.6: Results for D(LNGDP)

Null Hypothesis: D(LNGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.415112	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.518990	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 4.7: Results for LNGE

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.377698	0.5802
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Null Hypothesis: LNGE has a unit root
Exogenous: Constant
Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.559976	0.4905
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 4.8 : Results for D(LNGE)

Null Hypothesis: D(LNGE) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.300154	0.0022
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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

Null Hypothesis: D(LNGE) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.724486	0.0007
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 4.9 : Results for LNINF

Null Hypothesis: LNINF has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.289819	0.0002
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Null Hypothesis: LNINF has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.977217	0.0482
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 4.10 : Results for D(LNINF)

Null Hypothesis: D(LNINF) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.795515	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Null Hypothesis: D(LNINF) has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-8.795515	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 4.11: Results for LNMS

Null Hypothesis: LNMS has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.601093	0.9873
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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

Null Hypothesis: LNMS has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		1.168038	0.9972
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 4.12: Results for D(LNMS)

Null Hypothesis: D(LNMS) has a unit root
Exogenous: Constant
Lag Length: 5 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.406272	0.0204
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

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

Null Hypothesis: D(LNMS) has a unit root
Exogenous: Constant
Bandwidth: 13 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.895141	0.0004
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 4.13: Results for LNTOB

Null Hypothesis: LNTOB has a unit root
Exogenous: Constant
Lag Length: 7 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.317689	0.0253
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

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

Null Hypothesis: LNTOB has a unit root
Exogenous: Constant
Bandwidth: 17 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.165998	0.0028
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 4.14 : Results for D(LNTOB)

Null Hypothesis: D(LNTOB) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.17731	0.0000
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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

Null Hypothesis: D(LNTOB) has a unit root
Exogenous: Constant
Bandwidth: 14 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.846132	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 4.15 :Results for LNUMP

Null Hypothesis: LNUMP has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.295160	0.9133
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

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

Null Hypothesis: LNUMP has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.091190	0.9419
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 4.16: Results for D(LNUMP)

Null Hypothesis: D(LNUMP) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.656584	0.0001
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

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

Null Hypothesis: D(LNUMP) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.51916	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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

Appendix 5

Vector Autoregressive Estimates for the Period 1

Vector Autoregression Estimates
Date: 04/21/19 Time: 10:46
Sample (adjusted): 1981Q4 1992Q4
Included observations: 45 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LNINF	LNEXC	LNFDI	LNGDP	LNGE	LNMS	LNTOB	LNUMP
LNINF(-1)	0.991143	0.096888	0.640253	-0.010463	0.038988	-0.008674	0.243476	-0.101130
	(0.24717)	(0.06591)	(0.61540)	(0.01067)	(0.05887)	(0.01596)	(0.27385)	(0.08229)
	[4.00997]	[1.47010]	[1.04039]	[-0.98082]	[0.66228]	[-0.54335]	[0.88910]	[-1.22896]
LNINF(-2)	-0.387480	-0.017762	0.248616	0.014422	-0.090507	0.012116	-0.712310	0.223627
	(0.33836)	(0.09022)	(0.84244)	(0.01460)	(0.08059)	(0.02185)	(0.37488)	(0.11265)
	[-1.14517]	[-0.19688]	[0.29511]	[0.98757]	[-1.12308]	[0.55443]	[-1.90012]	[1.98518]
LNINF(-3)	-0.222009	0.031754	-1.462593	-0.011021	-0.027620	0.006381	-0.121166	-0.212685
	(0.26111)	(0.06962)	(0.65011)	(0.01127)	(0.06219)	(0.01686)	(0.28929)	(0.08693)
	[-0.85025]	[0.45608]	[-2.24975]	[-0.97791]	[-0.44412]	[0.37837]	[-0.41884]	[-2.44661]
LNEXC(-1)	1.078041	0.964062	2.849674	0.071936	-0.096803	0.068842	-0.563603	-0.502844
	(0.93195)	(0.24850)	(2.32036)	(0.04022)	(0.22197)	(0.06019)	(1.03253)	(0.31027)
	[1.15676]	[3.87959]	[1.22812]	[1.78845]	[-0.43612]	[1.14369]	[-0.54585]	[-1.62067]
LNEXC(-2)	-0.795196	-0.064923	-7.404736	-0.085386	0.295767	-0.051774	2.661289	0.833638
	(1.52567)	(0.40681)	(3.79860)	(0.06585)	(0.36338)	(0.09854)	(1.69033)	(0.50793)
	[-0.52121]	[-0.15959]	[-1.94933]	[-1.29672]	[0.81394]	[-0.52542]	[1.57442]	[1.64123]
LNEXC(-3)	-0.062343	-0.349404	-0.622871	0.004227	-0.372299	-0.031877	-1.556690	-0.302232
	(1.23964)	(0.33054)	(3.08643)	(0.05350)	(0.29525)	(0.08007)	(1.37343)	(0.41271)
	[-0.05029]	[-1.05708]	[-0.20181]	[0.07901]	[-1.26096]	[-0.39814]	[-1.13343]	[-0.73232]
LNFDI(-1)	0.028639	-0.028419	-0.207220	-0.004376	-0.014316	-0.004037	0.087562	-0.072900
	(0.06491)	(0.01731)	(0.16161)	(0.00280)	(0.01546)	(0.00419)	(0.07191)	(0.02161)
	[0.44123]	[-1.64205]	[-1.28226]	[-1.56215]	[-0.92602]	[-0.96285]	[1.21762]	[-3.37355]
LNFDI(-2)	0.073465	0.002332	0.022018	0.001341	0.006060	0.000328	-0.113853	-0.005301
	(0.04983)	(0.01329)	(0.12406)	(0.00215)	(0.01187)	(0.00322)	(0.05520)	(0.01659)
	[1.47444]	[0.17556]	[0.17749]	[0.62363]	[0.51069]	[0.10201]	[-2.06244]	[-0.31954]
LNFDI(-3)	0.024486	-0.008636	0.053456	0.002872	0.005649	0.004386	0.033035	-0.020204
	(0.05387)	(0.01436)	(0.13412)	(0.00232)	(0.01283)	(0.00348)	(0.05968)	(0.01793)
	[0.45457]	[-0.60130]	[0.39858]	[1.23525]	[0.44028]	[1.26058]	[0.55353]	[-1.12660]
LNGDP(-1)	-1.717306	-0.069386	35.58694	1.324123	0.802629	0.153673	16.23262	-3.498130
	(4.15716)	(1.10847)	(10.3504)	(0.17942)	(0.99013)	(0.26850)	(4.60583)	(1.38402)
	[-0.41310]	[-0.06260]	[3.43821]	[7.37993]	[0.81063]	[0.57234]	[3.52437]	[-2.52751]
LNGDP(-2)	5.939174	2.096540	-37.55535	-0.400784	-0.945869	-0.263650	3.089733	0.899166
	(6.84074)	(1.82402)	(17.0320)	(0.29525)	(1.62929)	(0.44183)	(7.57903)	(2.27745)
	[0.86821]	[1.14941]	[-2.20499]	[-1.35746]	[-0.58054]	[-0.59673]	[0.40767]	[0.39481]
LNGDP(-3)	-3.674453	-1.651685	16.83691	-0.080196	0.246997	0.241789	-15.96305	2.526168
	(4.30286)	(1.14732)	(10.7132)	(0.18571)	(1.02483)	(0.27791)	(4.76725)	(1.43253)
	[-0.85396]	[-1.43961]	[1.57160]	[-0.43183]	[0.24101]	[0.87002]	[-3.34848]	[1.76343]
LNGE(-1)	-0.028503	-0.050633	-3.481810	-0.054697	0.059502	-0.057289	0.341474	-0.065112
	(0.86497)	(0.23064)	(2.15359)	(0.03733)	(0.20601)	(0.05587)	(0.95832)	(0.28797)
	[-0.03295]	[-0.21954]	[-1.61674]	[-1.46515]	[0.28882]	[-1.02547]	[0.35632]	[-0.22611]
LNGE(-2)	-0.116469	-0.311711	-3.742715	0.058999	0.330444	-0.003879	-0.817575	0.106238
	(0.81353)	(0.21692)	(2.02552)	(0.03511)	(0.19376)	(0.05254)	(0.90133)	(0.27085)
	[-0.14316]	[-1.43698]	[-1.84778]	[1.68030]	[1.70541]	[-0.07383]	[-0.90707]	[0.39225]
LNGE(-3)	0.647983	-0.235367	-1.106496	-0.022158	0.170256	0.009328	-0.152002	-0.314238
	(0.95859)	(0.25560)	(2.38669)	(0.04137)	(0.22831)	(0.06191)	(1.06205)	(0.31914)

Appendix 5 : (Continued)

	[0.67597]	[-0.92084]	[-0.46361]	[-0.53558]	[0.74572]	[0.15067]	[-0.14312]	[-0.98464]
LNMS(-1)	3.047296	0.727224	29.19581	0.125704	0.184109	0.910331	0.704129	-1.423086
	(3.19967)	(0.85316)	(7.96649)	(0.13810)	(0.76208)	(0.20666)	(3.54500)	(1.06525)
	[0.95238]	[0.85239]	[3.66483]	[0.91025]	[0.24159]	[4.40499]	[0.19863]	[-1.33592]
LNMS(-2)	-4.913066	0.170264	-23.31066	0.120787	-0.286493	0.110597	-9.828457	5.749930
	(4.98883)	(1.33022)	(12.4211)	(0.21532)	(1.18821)	(0.32222)	(5.52725)	(1.66090)
	[-0.98481]	[0.12800]	[-1.87670]	[0.56097]	[-0.24111]	[0.34324]	[-1.77818]	[3.46193]
LNMS(-3)	1.195712	-0.728096	-9.055689	-0.141521	0.278965	-0.085152	7.410210	-3.972100
	(3.58472)	(0.95583)	(8.92519)	(0.15472)	(0.85379)	(0.23153)	(3.97161)	(1.19344)
	[0.33356]	[-0.76174]	[-1.01462]	[-0.91472]	[0.32674]	[-0.36778]	[1.86580]	[-3.32827]
LNTOB(-1)	-0.147126	-0.003945	0.547129	0.002426	0.016844	0.014636	-0.037836	-0.146261
	(0.11096)	(0.02959)	(0.27626)	(0.00479)	(0.02643)	(0.00717)	(0.12293)	(0.03694)
	[-1.32595]	[-0.13335]	[1.98046]	[0.50655]	[0.63736]	[2.04230]	[-0.30778]	[-3.95933]
LNTOB(-2)	-0.038586	0.073435	-0.273414	0.004184	-0.006492	0.015040	0.206605	-0.013038
	(0.13096)	(0.03492)	(0.32606)	(0.00565)	(0.03119)	(0.00846)	(0.14509)	(0.04360)
	[-0.29465]	[2.10302]	[-0.83854]	[0.74020]	[-0.20813]	[1.77818]	[1.42396]	[-0.29904]
LNTOB(-3)	-0.030456	-0.011127	0.214848	-0.006567	-0.004962	-0.012559	0.380243	0.017510
	(0.10693)	(0.02851)	(0.26623)	(0.00462)	(0.02547)	(0.00691)	(0.11847)	(0.03560)
	[-0.28482]	[-0.39025]	[0.80699]	[-1.42293]	[-0.19483]	[-1.81844]	[3.20959]	[0.49186]
LNUMP(-1)	-0.305709	0.246482	-1.926443	0.005017	-0.027225	0.020825	0.885933	0.175991
	(0.49103)	(0.13093)	(1.22257)	(0.02119)	(0.11695)	(0.03171)	(0.54403)	(0.16348)
	[-0.62258]	[1.88256]	[-1.57574]	[0.23671]	[-0.23279]	[0.65665]	[1.62847]	[1.07655]
LNUMP(-2)	0.117128	-0.154018	1.693210	-0.016502	-0.039874	0.029900	1.087058	0.224494
	(0.46978)	(0.12526)	(1.16965)	(0.02028)	(0.11189)	(0.03034)	(0.52048)	(0.15640)
	[0.24932]	[-1.22956]	[1.44762]	[-0.81387]	[-0.35637]	[0.98543]	[2.08856]	[1.43537]
LNUMP(-3)	0.105755	-0.083308	-3.118794	0.011888	-0.047120	-0.041099	-2.485840	0.155838
	(0.37937)	(0.10116)	(0.94455)	(0.01637)	(0.09036)	(0.02450)	(0.42031)	(0.12630)
	[0.27876]	[-0.82356]	[-3.30188]	[0.72607]	[-0.52149]	[-1.67732]	[-5.91425]	[1.23386]
R-squared	0.892735	0.973324	0.918119	0.999033	0.990176	0.999309	0.971562	0.981598
Adj. R-squared	0.775255	0.944107	0.828440	0.997973	0.979417	0.998552	0.940416	0.961443
Sum sq. resids	0.311266	0.022130	1.929543	0.000580	0.017657	0.001298	0.382078	0.034500
S.E. equation	0.121746	0.032462	0.303122	0.005255	0.028997	0.007863	0.134886	0.040532
F-statistic	7.599018	33.31354	10.23783	943.0991	92.03100	1319.946	31.19370	48.70334
Log likelihood	48.05762	107.5411	7.008806	189.4857	112.6215	171.3456	43.44563	97.55044
Akaike AIC	-1.069228	-3.712937	0.755164	-7.354920	-3.938736	-6.548694	-0.864250	-3.268909
Schwarz SC	-0.105674	-2.749383	1.718718	-6.391366	-2.975182	-5.585141	0.099303	-2.305355
Mean dependent	-2.883371	4.769476	10.23658	9.028753	6.212392	14.79248	9.990288	1.939892
S.D. dependent	0.256809	0.137310	0.731829	0.116724	0.202115	0.206619	0.552589	0.206420

Determinant resid covariance (dof adj.)	6.56E-24
Determinant resid covariance	1.48E-26
Log likelihood	827.4316
Akaike information criterion	-28.24140
Schwarz criterion	-20.53298

Appendix 6

VAR Residual Portmanteau Tests for Autocorrelations for the Period 1

VAR Residual Portmanteau Tests for Autocorrelations
Null Hypothesis: no residual autocorrelations up to lag h
Date: 04/21/19 Time: 10:48
Sample: 1981Q1 1992Q4
Included observations: 45

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
1	60.25832	NA*	61.62783	NA*	NA*
2	113.1054	NA*	116.9329	NA*	NA*
3	166.7757	NA*	174.4368	NA*	NA*
4	221.6719	0.0000	234.6887	0.0000	64
5	297.9185	0.0000	320.4661	0.0000	128
6	347.8609	0.0000	378.0920	0.0000	192
7	408.5936	0.0000	450.0123	0.0000	256
8	492.0874	0.0000	551.5588	0.0000	320
9	540.5746	0.0000	612.1678	0.0000	384
10	593.0024	0.0000	679.5750	0.0000	448
11	643.9941	0.0001	747.0640	0.0000	512
12	689.0297	0.0008	808.4761	0.0000	576

*The test is valid only for lags larger than the VAR lag order.
df is degrees of freedom for (approximate) chi-square distribution

Appendix 7

Vector Autoregression Estimates for period 2

Vector Autoregression Estimates
Date: 04/20/19 Time: 13:30
Sample (adjusted): 1993Q2 2000Q4
Included observations: 31 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LNINF	LNEXC	LNFDI	LNGDP	LNGE	LNMS	LNTOB	LNUMP
LNINF(-1)	0.879940	-0.025940	-0.279115	-0.007990	0.019958	-0.007485	0.408035	0.206144
	(0.12306)	(0.03111)	(0.72483)	(0.00796)	(0.03280)	(0.01338)	(0.28517)	(0.07628)
	[7.15054]	[-0.83379]	[-0.38508]	[-1.00400]	[0.60839]	[-0.55946]	[1.43083]	[2.70248]
LNEXC(-1)	0.057367	0.544233	-2.770073	-0.028547	0.119075	0.032643	2.210898	0.129379
	(0.61198)	(0.15472)	(3.60461)	(0.03958)	(0.16314)	(0.06653)	(1.41818)	(0.37934)
	[0.09374]	[3.51759]	[-0.76848]	[-0.72131]	[0.72991]	[0.49062]	[1.55897]	[0.34106]
LNFDI(-1)	0.001538	-0.001016	-0.299448	-0.001724	0.004446	-0.002691	-0.044631	-0.068285
	(0.03222)	(0.00815)	(0.18978)	(0.00208)	(0.00859)	(0.00350)	(0.07467)	(0.01997)
	[0.04772]	[-0.12471]	[-1.57784]	[-0.82738]	[0.51766]	[-0.76823]	[-0.59772]	[-3.41895]
LNGDP(-1)	0.404046	-1.288283	-22.90989	0.775007	0.514633	0.221319	-0.704990	-1.921265
	(2.14917)	(0.54334)	(12.6587)	(0.13898)	(0.57290)	(0.23366)	(4.98040)	(1.33218)
	[0.18800]	[-2.37104]	[-1.80981]	[5.57625]	[0.89829]	[0.94720]	[-0.14155]	[-1.44219]
LNGE(-1)	-0.359494	0.330314	4.109762	0.040693	0.787731	-0.022149	1.937346	-0.572966
	(0.47805)	(0.12086)	(2.81576)	(0.03091)	(0.12743)	(0.05197)	(1.10782)	(0.29632)
	[-0.75200]	[2.73307]	[1.45956]	[1.31629]	[6.18149]	[-0.42616]	[1.74879]	[-1.93357]
LNMS(-1)	-0.198092	0.768754	13.24820	0.131210	-0.233926	0.855730	-0.711724	1.769662
	(1.26536)	(0.31990)	(7.45304)	(0.08183)	(0.33731)	(0.13757)	(2.93229)	(0.78434)
	[-0.15655]	[2.40310]	[1.77756]	[1.60347]	[-0.69351]	[6.22039]	[-0.24272]	[2.25623]
LNTOB(-1)	0.114073	0.005627	1.304872	-0.001957	-0.015698	0.013140	0.495271	-0.198948
	(0.07531)	(0.01904)	(0.44359)	(0.00487)	(0.02008)	(0.00819)	(0.17453)	(0.04668)
	[1.51468]	[0.29554]	[2.94160]	[-0.40186]	[-0.78193]	[1.60487]	[2.83782]	[-4.26169]
LNUMP(-1)	-0.119539	0.055513	-1.520472	-0.007515	-0.090218	0.000653	0.663395	-0.233291
	(0.18760)	(0.04743)	(1.10496)	(0.01213)	(0.05001)	(0.02040)	(0.43473)	(0.11628)
	[-0.63721]	[1.17048]	[-1.37604]	[-0.61948]	[-1.80408]	[0.03204]	[1.52598]	[-2.00622]
R-squared	0.818652	0.939787	0.804592	0.998066	0.993033	0.996747	0.888481	0.958246
Adj. R-squared	0.763459	0.921462	0.745120	0.997477	0.990912	0.995757	0.854540	0.945539
Sum sq. resids	0.116050	0.007417	4.026106	0.000485	0.008246	0.001372	0.623208	0.044589
S.E. equation	0.071033	0.017958	0.418387	0.004594	0.018935	0.007723	0.164609	0.044030
F-statistic	14.83256	51.28262	13.52895	1695.613	468.3161	1006.683	26.17752	75.40688
Log likelihood	42.62260	85.25072	-12.34869	127.5155	83.60838	111.4112	16.56928	57.44874
Akaike AIC	-2.233716	-4.983917	1.312818	-7.710678	-4.877960	-6.671693	-0.552857	-3.190241
Schwarz SC	-1.863655	-4.613856	1.682880	-7.340617	-4.507899	-6.301631	-0.182796	-2.820180
Mean dependent	-3.181372	4.675428	11.53621	9.342438	6.871194	15.19338	10.84623	1.642552
S.D. dependent	0.146051	0.064079	0.828726	0.091458	0.198630	0.118551	0.431600	0.188672

Determinant resid covariance (dof adj.)	2.80E-25
Determinant resid covariance	2.57E-26
Log likelihood	561.3900
Akaike information criterion	-32.08968
Schwarz criterion	-29.12919

Appendix 8

Vector Autoregression Estimates for Period 3

Vector Autoregression Estimates
Date: 04/20/19 Time: 16:17
Sample (adjusted): 2001Q2 2008Q4
Included observations: 31 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LNINF	LNGE	LNFDI	LNGDP	LNEXC	LNTOB	LNUMP	LNMS
LNINF(-1)	0.350670	-0.013584	1.481602	-0.012529	0.004313	0.097312	0.117326	-0.000577
	(0.25862)	(0.04504)	(2.25426)	(0.00950)	(0.03429)	(0.11422)	(0.08630)	(0.01511)
	[1.35591]	[-0.30159]	[0.65725]	[-1.31908]	[0.12578]	[0.85197]	[1.35951]	[-0.03818]
LNGE(-1)	-0.614256	0.060941	-10.46196	-0.034713	0.161661	-0.433768	-0.884174	0.090144
	(0.87956)	(0.15318)	(7.66656)	(0.03230)	(0.11661)	(0.38845)	(0.29350)	(0.05139)
	[-0.69837]	[0.39783]	[-1.36462]	[-1.07464]	[1.38639]	[-1.11666]	[-3.01251]	[1.75418]
LNFDI(-1)	0.018220	-0.000447	-0.067045	0.000194	0.001046	0.013104	0.004698	-0.000403
	(0.02407)	(0.00419)	(0.20981)	(0.00088)	(0.00319)	(0.01063)	(0.00803)	(0.00141)
	[0.75693]	[-0.10665]	[-0.31955]	[0.21992]	[0.32763]	[1.23267]	[0.58486]	[-0.28664]
LNGDP(-1)	6.874840	3.024589	45.67322	1.164362	-1.291188	9.820949	0.014874	-0.721688
	(5.26419)	(0.91681)	(45.8847)	(0.19333)	(0.69789)	(2.32490)	(1.75662)	(0.30756)
	[1.30596]	[3.29903]	[0.99539]	[6.02271]	[-1.85013]	[4.22425]	[0.00847]	[-2.34651]
LNEXC(-1)	-1.870800	0.294450	8.050639	0.020547	0.523060	0.430648	0.287478	-0.059086
	(1.65028)	(0.28741)	(14.3845)	(0.06061)	(0.21878)	(0.72884)	(0.55069)	(0.09642)
	[-1.13362]	[1.02448]	[0.55967]	[0.33902]	[2.39076]	[0.59087]	[0.52203]	[-0.61282]
LNTOB(-1)	-0.135061	0.139139	0.406629	0.012509	0.080308	-0.061893	-0.315044	0.055403
	(0.51489)	(0.08967)	(4.48799)	(0.01891)	(0.06826)	(0.22740)	(0.17182)	(0.03008)
	[-0.26231]	[1.55162]	[0.09060]	[0.66150]	[1.17649]	[-0.27218]	[-1.83362]	[1.84171]
LNUMP(-1)	-0.143609	-0.466997	-9.415939	-0.011951	0.044484	0.497931	0.066011	0.015878
	(0.52766)	(0.09190)	(4.59932)	(0.01938)	(0.06995)	(0.23304)	(0.17608)	(0.03083)
	[-0.27216]	[-5.08170]	[-2.04725]	[-0.61671]	[0.63590]	[2.13668]	[0.37490]	[0.51503]
LNMS(-1)	-3.150404	-0.643046	-5.895558	-0.068114	0.027187	-2.138030	1.425673	1.119566
	(1.57884)	(0.27497)	(13.7618)	(0.05798)	(0.20931)	(0.69729)	(0.52685)	(0.09224)
	[-1.99539]	[-2.33860]	[-0.42840]	[-1.17471]	[0.12989]	[-3.06622]	[2.70605]	[12.1371]
C	-3.697834	-14.51186	-280.7315	-0.523075	12.00160	-47.46100	-11.88167	4.004498
	(37.7922)	(6.58189)	(329.412)	(1.38793)	(5.01024)	(16.6907)	(12.6110)	(2.20800)
	[-0.09785]	[-2.20482]	[-0.85222]	[-0.37687]	[2.39541]	[-2.84356]	[-0.94217]	[1.81363]
R-squared	0.531666	0.975057	0.357158	0.991652	0.933108	0.939033	0.806329	0.994932
Adj. R-squared	0.361362	0.965987	0.123397	0.988617	0.908784	0.916863	0.735903	0.993088
Sum sq. resids	0.698682	0.021192	53.08264	0.000942	0.012280	0.136278	0.077799	0.002385
S.E. equation	0.178209	0.031037	1.553334	0.006545	0.023626	0.078705	0.059467	0.010412
F-statistic	3.121875	107.5036	1.527878	326.6862	38.36116	42.35634	11.44934	539.8217
Log likelihood	14.79738	68.97858	-52.32397	117.2304	77.43658	40.13214	48.82102	102.8379
Akaike AIC	-0.374025	-3.869586	3.956385	-6.982605	-4.415263	-2.008525	-2.569098	-6.054058
Schwarz SC	0.042294	-3.453267	4.372704	-6.566286	-3.998945	-1.592206	-2.152779	-5.637739
Mean dependent	-3.140124	7.163815	11.71736	9.587553	4.712497	11.99421	1.646301	15.68483
S.D. dependent	0.222998	0.168290	1.659065	0.061343	0.078226	0.272963	0.115716	0.125238

Determinant resid covariance (dof adj.)	1.07E-22
Determinant resid covariance	6.88E-24
Log likelihood	474.7803
Akaike information criterion	-25.98583
Schwarz criterion	-22.65528

Appendix 9

Vector Autoregression Estimates for period 3

Vector Autoregression Estimates
Date: 04/20/19 Time: 17:54
Sample (adjusted): 2009Q2 2016Q4
Included observations: 31 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LNINF	LNGE	LNGDP	LNFDI	LNEXC	LNMS	LNTOB	LNUMP
LNINF(-1)	0.106473	0.001297	0.002915	-0.009183	0.001012	-0.001306	0.022793	0.050624
	(0.19279)	(0.01023)	(0.00221)	(0.24696)	(0.01161)	(0.00402)	(0.04965)	(0.02878)
	[0.55227]	[0.12677]	[1.31781]	[-0.03718]	[0.08716]	[-0.32533]	[0.45905]	[1.75905]
LNGE(-1)	-3.019257	0.537795	0.041289	0.119976	-0.275274	-0.034014	1.166186	0.274352
	(2.26616)	(0.12026)	(0.02600)	(2.90288)	(0.13646)	(0.04720)	(0.58364)	(0.33828)
	[-1.33233]	[4.47184]	[1.58794]	[0.04133]	[-2.01721]	[-0.72061]	[1.99814]	[0.81101]
LNGDP(-1)	7.738704	2.282238	0.501475	9.320754	1.608826	0.027782	1.861705	-2.373368
	(14.1055)	(0.74857)	(0.16184)	(18.0688)	(0.84941)	(0.29380)	(3.63280)	(2.10562)
	[0.54863]	[3.04881]	[3.09851]	[0.51585]	[1.89406]	[0.09456]	[0.51247]	[-1.12716]
LNFDI(-1)	0.059351	0.007268	0.005390	0.102500	-0.007402	-0.002362	0.008818	-0.012106
	(0.19131)	(0.01015)	(0.00220)	(0.24506)	(0.01152)	(0.00398)	(0.04927)	(0.02856)
	[0.31024]	[0.71588]	[2.45541]	[0.41827]	[-0.64257]	[-0.59285]	[0.17897]	[-0.42391]
LNEXC(-1)	-1.717175	-0.434599	0.073649	-0.010868	0.564202	-0.050158	0.795346	-0.254524
	(3.10605)	(0.16483)	(0.03564)	(3.97876)	(0.18704)	(0.06470)	(0.79995)	(0.46366)
	[-0.55285]	[-2.63657]	[2.06658]	[-0.00273]	[3.01648]	[-0.77529]	[0.99425]	[-0.54895]
LNMS(-1)	5.329234	0.158987	0.104338	-1.606877	-0.002624	0.945495	-1.081720	-0.795396
	(3.53317)	(0.18750)	(0.04054)	(4.52589)	(0.21276)	(0.07359)	(0.90995)	(0.52742)
	[1.50834]	[0.84792]	[2.57379]	[-0.35504]	[-0.01233]	[12.8478]	[-1.18877]	[-1.50809]
LNTOB(-1)	0.278746	-0.083903	0.005562	-0.140641	-0.001205	0.089230	0.003142	-0.088492
	(0.83536)	(0.04433)	(0.00958)	(1.07007)	(0.05030)	(0.01740)	(0.21514)	(0.12470)
	[0.33368]	[-1.89263]	[0.58025]	[-0.13143]	[-0.02395]	[5.12828]	[0.01460]	[-0.70964]
LNUMP(-1)	2.689498	0.106096	0.020770	-0.131701	-0.053891	-0.046733	0.615793	0.171966
	(1.08406)	(0.05753)	(0.01244)	(1.38865)	(0.06528)	(0.02258)	(0.27919)	(0.16182)
	[2.48096]	[1.84419]	[1.66984]	[-0.09484]	[-0.82554]	[-2.06969]	[2.20562]	[1.06267]
C	-143.5299	-18.55474	2.345908	-52.16720	-11.29469	0.152336	-2.126329	38.06879
	(85.2937)	(4.52645)	(0.97864)	(109.259)	(5.13621)	(1.77658)	(21.9669)	(12.7323)
	[-1.68277]	[-4.09918]	[2.39710]	[-0.47746]	[-2.19903]	[0.08575]	[-0.09680]	[2.98993]
R-squared	0.614610	0.994665	0.995807	0.425798	0.950272	0.998436	0.725463	0.971550
Adj. R-squared	0.474468	0.992726	0.994283	0.216998	0.932189	0.997868	0.625631	0.961205
Sum sq. resids	2.313806	0.006516	0.000305	3.796690	0.008390	0.001004	0.153473	0.051560
S.E. equation	0.324304	0.017210	0.003721	0.415424	0.019529	0.006755	0.083523	0.048411
F-statistic	4.385629	512.7618	653.1771	2.039259	52.55064	1755.993	7.266848	93.91104
Log likelihood	-3.763146	87.25791	134.7352	-11.43930	83.34022	116.2507	38.29031	55.19748
Akaike AIC	0.823429	-5.048897	-8.111949	1.318665	-4.796143	-6.919397	-1.889697	-2.980483
Schwarz SC	1.239748	-4.632579	-7.695630	1.734983	-4.379825	-6.503079	-1.473378	-2.564164
Mean dependent	-3.536294	7.395475	9.706985	12.50838	4.636953	16.15954	12.05838	1.992739
S.D. dependent	0.447355	0.201788	0.049212	0.469472	0.074994	0.146287	0.136507	0.245784

Determinant resid covariance (dof adj.)	3.19E-24
Determinant resid covariance	2.05E-25
Log likelihood	529.2165
Akaike information criterion	-29.49784
Schwarz criterion	-26.16729