Threshold Effects of Exchange Rate Depreciation and Money Growth on Inflation Rate

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APPROVAL SHEET

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بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

In the Name of Allāh, the Most Gracious, the Most Merciful

DEDICATION

To My Dear Husband
"Chaudhary Muhammad Aslam Uddin"

Declaration

I hereby declare that this thesis, neither as a whole nor as a part thereof, has been copied out from any source. It is further declared that I have carried out this research by myself and have completed this thesis on the basis of my personal efforts under the guidance and help of my supervisors. If any part of this thesis is proven to be copied out or earlier submitted, I shall stand by the consequences. No portion of work presented in this thesis has been submitted in support of any application for any other degree or qualification in International Islamic University or any other university or institute of learning.

Zahida Siddiqui

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Zahida Siddiqui

Table of Contents

List of tables

List of figures

List of Abbreviations

The following table describes the significance of various abbreviations and acronyms used throughout the thesis.

Abbreviation	Meaning
B Inflation	Backward looking inflation expectation
F Inflation	Forward looking inflation expectation
ER	Exchange rate
TER	Threshold of exchange rate
MG	Money growth
TMG	Threshold of money growth
GDP	Gross domestic product
CPI	Consumer price index
ERPT	Exchange rate pass-through
SBP	State Bank of Pakistan
ESP	Economics Survey of Pakistan
SBP	Statistics Bureau of Pakistan
FRB	Fractional Reserve Banking
M2	Broad money
OECD	Organizations for Economic Cooperation and Development
SSR	Sum of squared residuals
GMM	Generalized Method of Moments

Abstract

The study follows Hansen (1997, 2000) methodology for the analysis of the data from 1982:Q1 to 2012:Q4. By using the exchange rate depreciation and the money growth as the threshold variable the study find out the numbers of threshold, which have generally imposed as one. We have applied most sophisticated and inclusive method called GMM to estimate the model.

The econometric evidence shows that there is indeed threshold effect of money growth on inflation rate, but no threshold effect of exchange rate depreciation on inflation rate. However the threshold value for exchange rate depreciation is found at 1.46%, and there is no significant difference between the coefficient both below and above the threshold value. Meanwhile, the threshold value is found for money growth, i.e. 7.67%, and it is statistically different. The impact of money growth on inflation rate is low when money grows up to threshold value and it is high when it grows above the threshold value. It means that the effect of money growth on inflation rate is not liner. Moreover, our study proves that the month of Ramzan has positive impact on inflation rate. From the results of study we can conclude that inflation rate increases by 0.65% in the month of Ramzan in Pakistan.

CHAPTER 1

1. INTRODUCTION

1.1 Background of the study

Inflation rate, money growth and exchange rate are three most significant macroeconomics variables. Inflation has been a universal macroeconomic problem for most of the nations in the world. It is the burning issue of macroeconomics owing its suggestions for income distribution and economic development. The inflation has also been a grave problem in Pakistan due to many reasons. Inflation is influenced by many variables such as money supply growth, inflation expectations, exchange rate depreciation and output gap.

Inflation has always posed complications and dilemmas for policy makers as tight monetary policy used to control inflation which can lead to unemployment and recessions, making worse than a disease. One of the main objectives of macroeconomic policy is to reduce social and economic cost of inflation and to stabilize prices which lead an economy towards growth [Čuvak & Kalinauskas (2009)]. Inflation is generally measured by calculating the growth of price index, commonly called consumer price index (CPI) , which calculates price fluctuations of a basket of goods (with specific period of time) purchased by an urban consumer. Inflation caused by an increase in demand is called demand-pull inflation whereas supply shocks are supposed to cause

"cost-push inflation". It is supposed that inflation has positive relationship with output gap. However gross domestic product (GDP), exchange rate, money growth, government budget deficit, import prices, interest rates and increase in oil prices are the major determinants of inflation.

Inflation is explained through these aspects: monetary policy, fiscal policy, and the balance of payments. From the aspect of monetary policy, rise in supply of money is the cause of inflation. From the fiscal aspect, budget deficit is the cause of inflation. However, fiscal aspect is directly related to the monetary aspect of inflation as budget deficit is mostly financed by increasing money supply in the developing countries. Exchange rate acquires the vital position with respect to balance of payments. Basically, increase in exchange rate brings inflation through rise in the inflationary expectations and high import prices [Akinbobola (2012)].

Threshold models are special case of statistical frameworks such as smooth transition threshold model, switching model and Markov-switching model [Hansen, (2000)]. The common idea behind threshold models is that the process may behave differently when the values of a variable exceed a "threshold value".

Effect of exchange rate on inflation in Pakistan has been noted negative in the empirical literature [Ahmad & Ram (1991), Hasan et al. (1995) and Khan et al. (1996)]. Pakistani rupee started depreciating continuously from early 1980s[1]. In empirical literature, exchange rate depreciation is connected to domestic prices, current account balance and

[1] State Bank of Pakistan espoused managed floating exchange rate system in Jan 1982.

trade patterns. However Meier (1984) said "...exchange rate depreciation for a less developed country would be ineffective as an adjustment mechanism to the extent that domestic inflation persists..." [see Siddiqui & Akhtar (1999)]. The facts also show that the main objective of the adjustment mechanism is to sustain a competitive exchange rate which mostly causes the domestic inflation [Burney et al. (1992) and Mahmood et al. (2011)].

According to Nzotta (2004) exchange rate is defined as the price of currency in terms of another currency in the international market. A powerful economic system is necessary for macroeconomic stability. But how we make an economic system stable, it is depends upon monetary policy. In monetary policy, policy makers' use different instruments i.e. cash reserves, bank rate and the open market operations to achieve the desirable goals i.e. price stability, economic development, exchange rate stability and trade surplus. Exchange rate is the one of main factor of macroeconomic variables which joins the country with globe market. In contrast, a deprived policy of exchange rate creates risks for trade opportunities.

Various studies have focused on exchange rate pass-through (ERPT) and it is defined as the impact of 1% of exchange rate depreciation on domestic inflation rate. It determines the relative prices of domestic and foreign commodities, as well as the power of external sector participation in the global trade. However it is also disputed that under floating exchange rate system, the currency value is decided by supply and demand of foreign exchange.

Money growth has strong impact on all economic activities as money supply growth is life wire of all economic activities and so has powerful effects on the economic life of any nation. Money supply procedure in Pakistan depends upon the monetary base and money multiplier [Chaudhary and Khan (1997)]. The main objective of monetary policy is to stabilize internal and external level of currency and to prop up the economic development. Pakistan has faced inflationary episodes in last three decades [Malik & Khawaja (2006)]. In 1970s, inflation rate increased significantly and reached to the average 11.9% per year that is almost 2.9% higher than threshold value which was estimated by Mubarik & Riazuddin (2005). This increase in inflation rate was due to breakdown of country and main oil shocks. Increase in oil prices has major impact on the CPI. High inflation rate is an obstacle in the way of economic growth due to the bad effect on efficient distribution of resources by changing relative prices [Fisher et al. (1993)]. Oil prices also main reason behind inflation rate in Pakistan [Khan et al. (1996) and Khalid (2006)]. The oil prices have been noted to rise since 2003. Furthermore, the data shows the increase of oil prices to be doubled within the time span of two years, i.e. from 2004 to 2006, worldwide. In June 2008, we saw the highest rise in the price of oil ($140 per barrel) during the study period. In the global market this trend of perpetually heightening oil prices has badly affected the economy of many countries around the world, including Pakistan. If high inflation is harmful to the economy and low inflation is useful, then it is natural to inquire the determinants of inflation rate. If money supply growth and exchange rate are causative factor of inflation then an interesting policy issue is that what exchange rate and money supply growth is suitable for low inflation rate. It means that what is the threshold level of money growth and exchange rate. A common

observation is that the continuous currency depreciation is the reason behind inflation in Pakistan while policy-makers believe that currency depreciation is necessary to maintain competitive power in the world market because rate of inflation in Pakistan is high as compare to the world inflation rate.

This study has some advantages over many earlier threshold studies in which they allocates data to decide location of threshold value rather than the imposing break randomly. Additionally, it allows data to find out numbers of threshold values, which has been generally imposed. If we imposed one threshold but in reality there are more than one threshold values, then resulting coefficients could be under or over estimated.

Inflation is one of the most researched topics in economics because it has serious implications for growth. What factors determine the inflation rates has also been widely debated all over the world. In the light of above background, the aim of this study is to investigate the effects of threshold values of exchange rate depreciation and money supply growth and other control variables i.e. backward looking expectations, forward looking expectation, oil prices and the month of Ramzan, on inflation rate in Pakistan. The study also explores the nature of relationship between inflation rate and exchange rate and money supply growth. If it is linear; it means that the impact of exchange rate and money supply growth on inflation rate is constant irrespective of their values.

Summing up, inflation is a phenomenon that has come to stay in virtually all economies of the world. The causes of inflation rate are controversial. Inflation is one of the grave problems faced by Pakistan.

Money growth has strong impact on all economic activities as money supply growth is life wire of all economic activities and so has powerful effects on the economic life of any nation. Theory describes that tight monetary policy can applied to control inflation which can lead to unemployment and recessions, making worse than disease. Inflation rate in Pakistan was high. According to economic survey of Pakistan 2009-10, inflation rate was 13.3% while it was 22.3% in the last year. According to economic survey of Pakistan 2011-12, inflation rate was 10.8%. High rate of inflation is connected with upward price variation, which creates insecurity about profitability of investment which leads to low investment and low economic development.

Exchange rate depreciation and money growth also cause inflation. Depreciation of exchange rate may scare off international investors. It makes investors less willing to hold government debt because it effectively decreases the value of their holdings. It is a cause of low production because of the decline in incentives. The oil prices have been noted to rise since 2003. In June 2008, we saw the highest rise in the price of oil ($140 per barrel) during the study period. This study assumes that the impact of exchange rate depreciation and money growth is linear, meaning that their impact is constant for each level of exchange rate depreciation and money supply growth. The study aims to consider the whole situation in context of Pakistan's economy. This study allows data to find out the numbers of threshold, which has generally imposed as one. If we imposed one threshold on data when there are in reality more, then resulting coefficient estimates could be under or over estimate. It propounds to show the threshold effects of exchange rate depreciation and money growth on inflation rate simultaneously in Pakistan's economy.

1.2 Objectives of the study

The objectives of study are:

1. To examine the impact of exchange rate depreciation and money supply growth on inflation rate is linear or not
2. To find out the threshold value of exchange rate and money supply growth.
3. To examine which variable has more threshold level i.e. exchange rate or money growth on inflation rate.

1.3 Research questions

The following questions are concentrating in the study.

1. Does exchange rate and money growth explain inflation rate?
2. Whether the relationship of money growth and the exchange rate with inflation rate is linear or not?
3. Whether exchange rate or money growth has a more threshold impact on inflation rate?

1.4 Research hypothesis

H_a^{ER} Exchange rate depreciation has no effect on inflation rate.

H_a^{M} Money growth has no effect on inflation rate.

H_b^{ER} Exchange rate depreciation has no threshold effect on inflation rate.

H_b^{M} Money growth has no threshold effect on inflation rate.

1.5 Significance of the study

Numbers of studies have been conducted on exchange rate depreciation, money growth and inflation rate, but no attempt has yet been made to study the threshold effect of these variables. The present study attempts to fill this gap in literature. The study is helpful for consumers who are affected by the exchange rate depreciation and growth in money supply, and for foreign investors and policy makers to improve their business and economy respectively because information plays a significant role to change business scenario. The findings of the study are helpful in ensuring that suitable actions are taken. Moreover it would also provide as a future reference for researchers on the subject of threshold impact of exchange rate and money supply growth on inflation rate.

1.6 Organization of the study

The study has six chapters. The present chapter is related to the introduction of the study. Second chapter provides an overview of inflation rate, exchange rate and money growth in Pakistan. Third chapter provides a comprehensive review of the empirical and theoretical literature on exchange rate, money growth and inflation rate. Empirical model, estimation technique and sources of data are discussed in fourth chapter. Interpretation of results and major finding of the study which have cardinal position in the research are discussed in fifth chapter. As usual, last chapter is dedicated to conclusions and policy recommendations.

CHAPTER 2

2 AN OVERVIEW OF INFLATION RATE, EXCHANGE RATE AND MONEY GROWTH IN PAKISTAN

2.1 Inflation rate in Pakistan

Inflation describes an economic condition where continuous increase in prices of goods and services is occurred. Inflation rate is mostly calculated by growth rate in consumer price index. People express inflation as a situation where a lot of money is chasing too few goods. When we discuss about inflation[2], it is clear that an overall rise in prices of goods and services in a basket. Generally it is believed that stable and low inflation rate promote economic development by making wages and prices more flexible [Lucas (1973)].

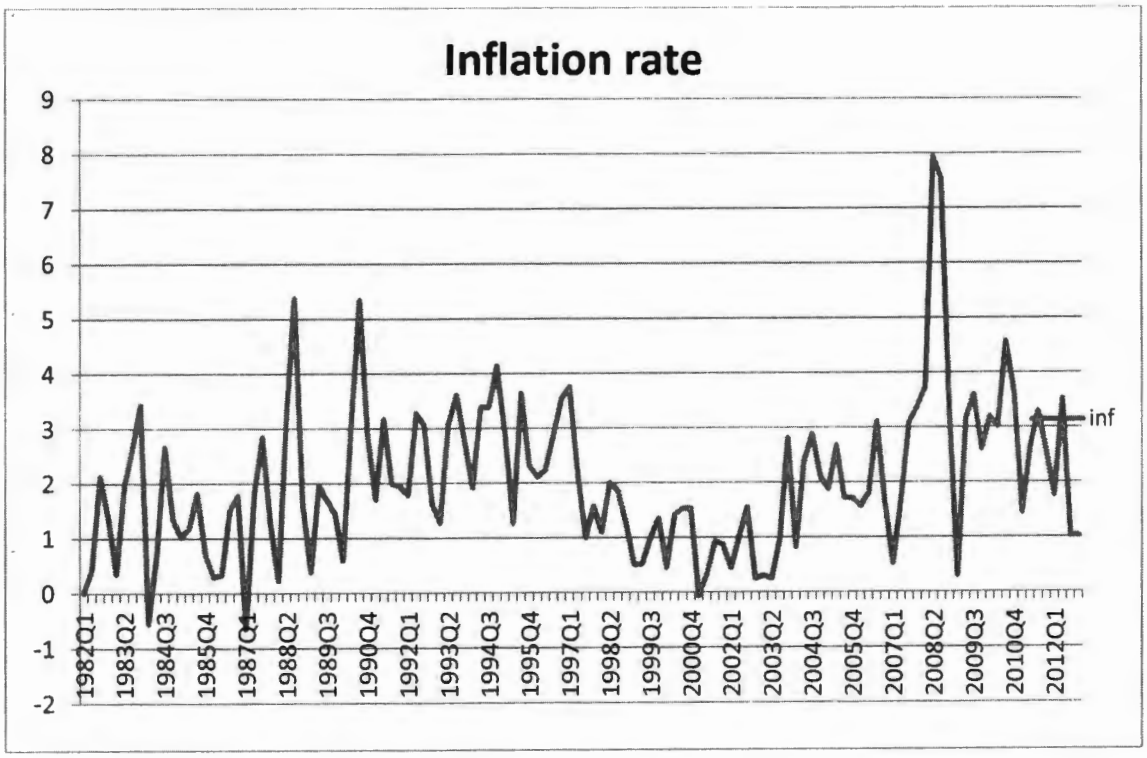
Inflation is originated by some demand side issues i.e. increase nominal supply of money, deficit financing policy, increase in the disposable income, black money spending, increasing public expenditures and repayment of public debts and some supply side issues i.e. industrial disputes, natural calamities, lack of factor of production, rise in exports, artificial shortages, ignoring production of customer goods and use of diminishing law of returns.

Finance experts and economists give different reasons as causative agents of inflation. According to them exchange rate, money supply, interest rate, import prices and

[2] Inflation is generally perceived by calculating the growth rate of a price index commonly consumers price index, which measures price changes of a basket of goods and services (with specific period of time) purchased by a consumer.

government budget deficits are mostly responsible factors for inflation. Inflation rate negatively affect the economic development including the real sector growth, induces uncertainty, and discourages savings of a country.

Figure 2.1: Inflation rate in Pakistan during 1982 to 2012



Source: Plotted quarterly data of inflation rate taken from IMF (2014)

In the third quarter of 1982 inflation rate stood at 2.13% and it decreased to 0.35% in first quarter of 1983 with an annual decrease of 49.55%. During the first quarters of 1984 and 1987 inflation rate decreased to -0.55% and -0.65% respectively. Inflation rate show increasing trend after 1987. In the third quarter of 1988 inflation rate reached to 5.37% which was the second highest point of inflation rate in Pakistan during 1982 to 2012. The above figure shows that during the year of 1991, rate of inflation attained the point of 12.66% which showing rise of 109.60% as compared to the last year. The major cause

was the Gulf war. Inflation rate from the year 1991 to the year 1995 remained 9.25% to 13.02%. High rate of monetary increase, low level of economic development in 3 out of 5 years and change in prices lead to an economy towards high rate of inflation. Increase in worldwide prices (in dollar terms) has been modest or negative. Except for in 1995 when price of tradable goods (in rupee terms) increased by 19%. During first eight years of 1990, Pakistan observed inflation rate from 10.0% to 13.0%. The general accord is that rise in money supply, the supply side blockage, the change in government administered prices; rise in indirect taxes; inflationary expectations and imported inflation are the main reasons for the double-digit inflation in the year 1990s. Food inflation was also the main reason for double-digit inflation in Pakistan. During first eight years of 1990s, the average food and non-food inflation was 11.6% and 10.3% respectively. However, in 2001 inflation decreased and stroked its low level 3.1% with the decrease of 12.42% again 3.54% in the year 2002. During the fiscal year 2005-06, there was a major rise in inflation rate due to increase in prices of different commodities. Inflation from the first 10 months from July to April was estimated 8.0% again 9.3% in the same period of the last year [Pakistan economic survey (2009-10)].

During the year of 2008, inflation again went up to 12% with a rise of 54.44% as compared to 7.7% in 2007. The major reason behind this quick shoot up of inflation was increase in import prices [Khan and Gill (2010)]. Rise in the price level was extra ordinary in Pakistan during 2008 and 2009. The inflation rate measured by the CPI increased to 22.3% during the months of July to April of the year 2008-09 over the corresponding increase of 10.3%. However in 2011-12 there was a down trend in

inflation rate, the everyday expenditure of civilian government were cut off and it was 10% lesser as compared to last year [Pakistan economic survey (2009-10)].

Summing up, inflation is one of the most researched topics in economics because it has serious implications for growth and income distribution. What factors determine the inflation rates has also been widely debated all over the world. Inflation rate showed fluctuation from 1982 to 2012. The average inflation rate from 1982 to 2012 was 8.42%. During the year 1991, rate of inflation attained the point of 12.66% which showing rise of 109.60% as compared to the year 1990. The major cause was the Gulf war. Inflation rate from the year 1991 to the year 1995 remained 9.25% to 13.02%. High rate of monetary increase, low level of economic development in 3 out of 5 years and change in prices lead to an economy towards high rate of inflation. According to Economic Survey of Pakistan (2008-09), there was an increasing trend in inflation rate during the year 2008-09. The inflation rate was increased to 22.3% during 2008-09. However in 2011-12 there is a down trend in inflation rate due to cut off the everyday expenditure of civilian government.

2.2 Exchange rate in Pakistan

Rate of exchange is the price – precisely the same as other prices-which is the sum we give up to obtain something else. In this case we give number of Pakistani rupees to get other currency, say dollar or pound. Layi (1998) said "exchange rate is the rate at which one currency will be exchanged for another". He added that in dependent countries, "the exchange rate will be the important price in that it determines virtually all other prices". Nzotta (2004) has the same opinion and adds that exchange rate is the rate of transformation of one currency to another or the rate at which one currency is exchanged for another. Depreciation of the currency means decrease in the worth of home currency in terms of the foreign currency or gold.

Although the role of exchange rate was minimum during the fixed exchange rate era, however in the wake of speedy process of trade liberalization and financial integration of the economies, the role of exchange rate has increased significantly in the conduct of monetary policy and overall macroeconomic performance. Although fluctuations in exchange rate can be beneficial for an economy, a large number of studies showed that these positive impacts of the exchange rate become doubtful when it is studied for the developing countries like Pakistan where agriculture fulfils most of the needs of domestic and foreign sectors and looking to their heavy dependence on foreign countries for its exports and imports.

A powerful economic system is necessary for macroeconomic stability. But how we make an economic system stable, it is depends upon monetary policy. In monetary policy, policy makers' use different instruments i.e. cash reserves, bank rate and the open market

operations to achieve the desirable goals i.e. price stability, economic development, exchange rate stability and trade surplus.

Exchange rate is the one of main factor of macroeconomic variables which joins the country with globe market. In contrast, a deprived policy of exchange rate creates risks for trade opportunities.

Nominal depreciation in Pakistan was almost on average 8.84% per annum for the period of 1982 to 2012 whereas the real devaluation was insignificant. Domestic inflation rate seemed to be high than the foreign rate of inflation. Pakistan is a small size economy which is evident from its GDP which were 224.4 billion dollar of which the money supply was 40% for the years 2012. The rate of exchange of Pakistani rupee is usually calculated in terms of dollar. The USA is one of the main trading partners of Pakistan, so the most dealing currency in international exchange markets is the US dollar.

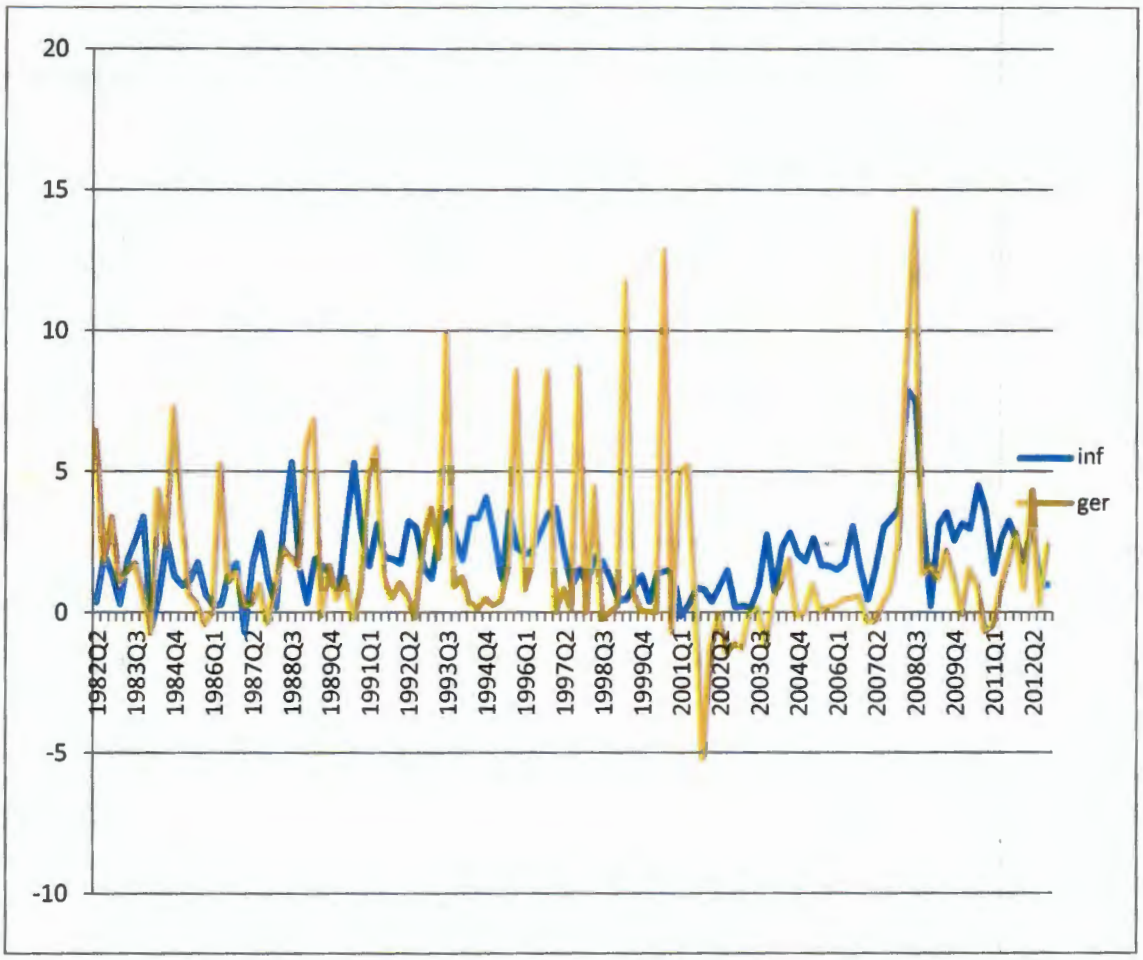
Monetary policy in Pakistan, like other developing economies, has to go through many stages before its approval during last some decades. In the year of 1971, rupee was disconnected from pound and connected with dollar. Exchange rate remained fixed against dollar for about 9 years from the year of 1973 to the year of 1981. However, at the starting of the year 1980s the US nation faced a huge budget deficit which required government to increase interest rate. This rise in the US interest rate resulted in a huge massive inflow of money from overseas. As rupee was connected with dollar, it was also overrated because of market force. This made Pakistan's imports cheaper and exports costly in the global market and resulted in worsening trade balance. Hence, to keep exports competitiveness in the global market and trade balance, the State Bank of Pakistan disconnected rupee with the US dollar and shifted towards managed floating

exchange rate system in 1982. With this shift, the nominal exchange rate of Pakistani currency raised from 9.9 to 12.84 i.e. it diminished by 24.74% in the real terms and 29.69% in the nominal terms. State Bank of Pakistan espoused a market based exchange rate system in 2000.

A strong and competitive financial system is considered as a pre requisite for the macroeconomic stability. But how to make a financial system stable, this largely depends on the conduct of the monetary policy. Whereas, monetary policy refers to the use of different instruments such as bank rate, cash reserves requirements and open market operations for the achievement of desired goals i.e. higher economic growth, price stability, trade surplus and exchange rate stability.

The real exchange rate is concerned beside nominal exchange rate; inflation was another major factor that contributed significantly to the fluctuations in it. During the period 1973-1981, when the nominal exchange rate was kept fixed against the US dollar, even than the real exchange rate showed large fluctuations. However, these fluctuations were only because of the movements in inflation. Similarly, during 1982-2008 although the nominal exchange rate showed fluctuations as the SBP was following flexible exchange rate systems, inflation remained an important factor responsible for the movements in the real exchange rate of rupee.

Figure 2.2 Relationship between Inflation rate and nominal exchange rate dep. in Pakistan from 1982 to 2012



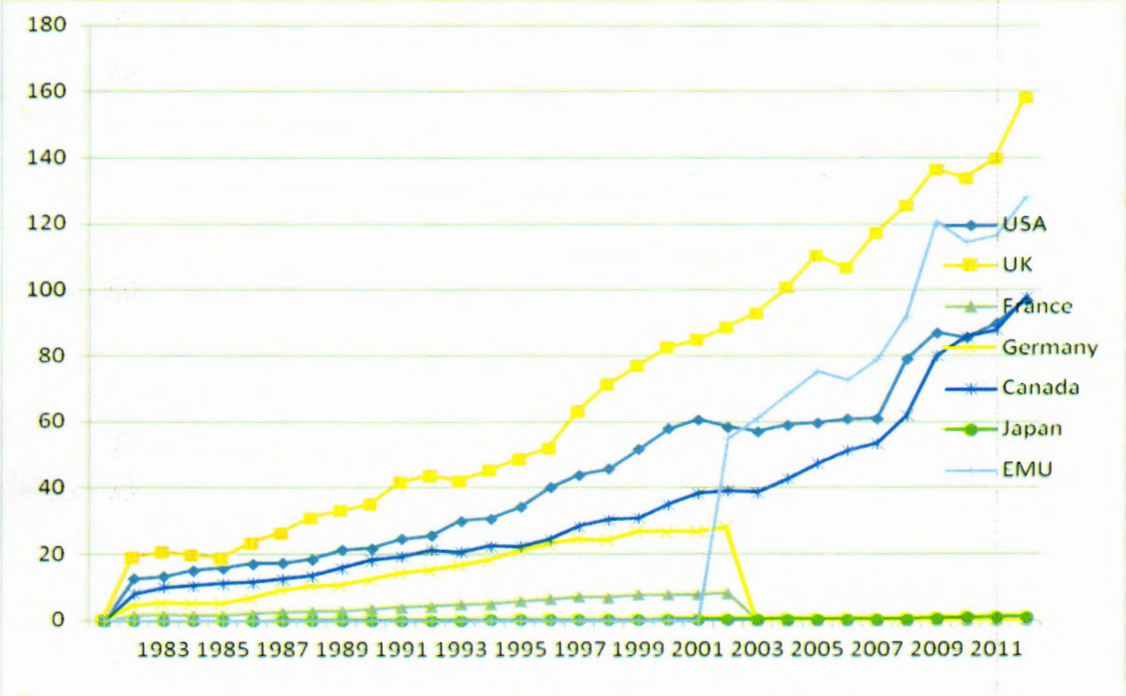
Source: Plotted quarterly data of inflation rate and exchange rate taken from IMF (2014)

The figure 2.2 shows the relation between nominal exchange rate depreciation and inflation rate. In the fourth quarter 1984 the exchange rate was depreciated by 7.26%. The above figure also shows the increasing trends in the exchange rate depreciation from 1993 to 2001. However in the fourth quarter of 2001, exchange rate depreciation was recorded -5.20%. This was the lowest value of exchange rate depreciation from the period of 1982 to 2012. Exchange rate of Pakistani rupee persistently goes downward (annually) as nominal exchange rate diminishes 11.87 % in the real terms and 12.07% in the nominal terms respectively in 2000. The highest depreciation in rupee was recorded

14.29% in the third quarter of 2008 whereas inflation rate was also high at that point. In the year of 2008 the nominal rate of exchange was stood at 62.55 which viewing a depreciation of almost 2.18% in the nominal terms which increased inflation rate up to 7.94%. However, Pak-rupee showed appreciation of almost 6.03%. The tendency of both real and nominal rate of exchange most of the time remained downward. From 1973 to 1981, when nominal rate of exchange was fixed again dollar, even then real rate of exchange showed large variations. However, these variations were due to the variation in inflation rate.

The nominal exchange rate showed variations from 1982 to 2012 because State Bank of Pakistan was following the flexible exchange rate whereas rate of inflation remained a significant cause for the movements in real exchange rate of Pakistani currency i.e. rupee. Whatever the causes for these big variations in both the real and the nominal exchange rate, these factors powerfully pushed the purchasing power of rupee downward in contrast to majority of the world main currencies.

Figure 2.3: Pakistani rupee exchange rates against some of the world currencies (1982-2012)



Source: Plotted the data of exchange rates against some of world currencies taken from SBP.

The figure 2.3 shows that except Yen, all the currencies remained powerful against Pak-rupee. It shows that Pakistani rupee persistently went downward as nominal exchange rate diminishes. From 1982 to 2012 nominal exchange rate showed variations as the state bank of Pakistan was following the flexible exchange rate systems. One notable thing is that rupee is the only currency amongst all currencies which showed constant downward tendency. However due to the internal reasons of these countries, rupee showed appreciation beside these currencies except dollar for the year 2006 and 2007.

Summing up, rate of exchange is the price – precisely the same as other prices-which is the sum we give up to obtain something else. It is precisely the same as goods' prices

which are the sum we give up to obtain something else. In this case we give number of Pakistani rupees to get other currency, say dollar or pound.

Although the role of exchange rate was minimum during the fixed exchange rate era, however in the wake of speedy process of trade liberalization and financial integration of the economies, the role of exchange rate has increased significantly in the conduct of monetary policy and overall macroeconomic performance. Although fluctuations in exchange rate can be beneficial for an economy, a large number of studies showed that these positive impacts of the exchange rate become doubtful when it is studied for the developing countries like Pakistan where agriculture fulfils most of the needs of domestic and foreign sectors and looking to their heavy dependence on foreign countries for its exports and imports.

A strong and competitive financial system is considered as a pre requisite for the macroeconomic stability. A powerful economic system is necessary for macroeconomic stability. But how we make an economic system stable, it is totally depends upon monetary policy. In monetary policy, policy makers' use different instruments i.e. cash reserves, bank rate and the open market operations to achieve the desirable goals i.e. price stability, economic development, exchange rate stability and trade surplus.

State Bank of Pakistan espoused managed floating exchange rate in Jan 1982 and market based exchange rate system in the year of 2000. There is positive relation between nominal rate of exchange and the inflation rate. Generally countries commence depreciation to decrease the deficit of balance of payment. Rupee persistently went downward as nominal exchange rate diminishes. Except Yen, all the currencies remained powerful against rupee.

2.3 Money supply in Pakistan

Money growth has strong impact on all economic activities as money supply growth is life wire of all economic activities and so has powerful effects on the economic life of any nation. An increase in money supply puts more money in the hands of producers and consumers and thereby stimulating increased investment and consumption. Consumers increase purchases and business firms respond to increased sales by ordering for more raw materials and other resources to achieve more production, the spread of business and capital goods. As the economy goes buoyant, stock market prices rise and firms issue more equity and debt instruments. As the money supply expands, prices begin to rise, especially if output growth reaches full capacity. Lenders insist on higher interest rates to offset expected decline in purchasing power over the life span of their loans. Opposite effects occur when the money supply falls or when there is decline in its growth rate, economic activities decline and disinflation (reduced inflation) or deflation (falling price) results [Akinbobola (2012)].

Broad money is less volatile than the other monetary aggregates. Pushpa's (1990) point of view is that broad money is more important in determining money supply. Our study uses M2 because the volatility of M2 is 2.5 times less than the volatility of M1 [Chaudhary & Khan (1997)]. According to World Bank Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. This definition is commonly known as M2. 'Broad money (M2) growth in Pakistan was calculated 14.73 during 2012-13.

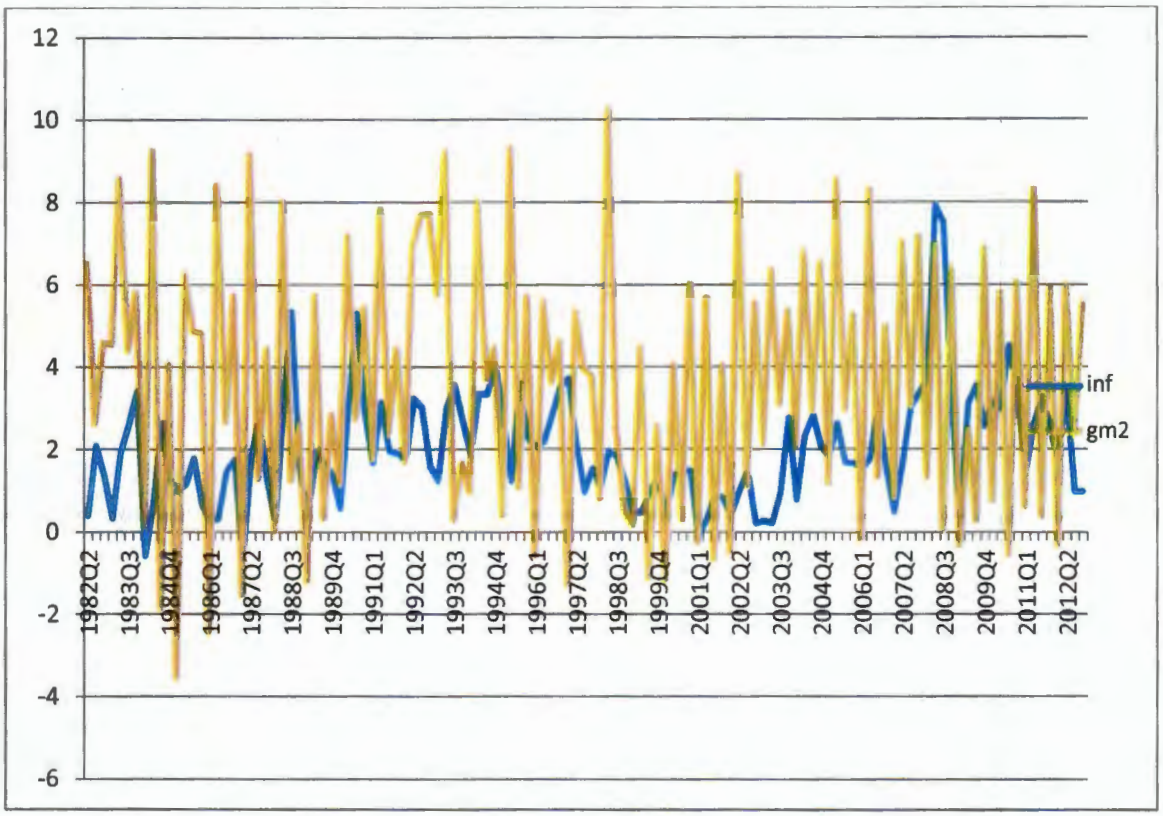
The economic growth, which had privileged during 1989-90 measured strongly in next 2 years. Monetary growth which had decreased to 4.6% in the year 1989 increased to 12.6% in the year 1990 and seeing as it has been in range of 16% to 18% except in the year 1992. The reason of monetary expansion was high budget deficits during these years. In the year of 1994 monetary growth rate was stood at 16%, while the budget deficit was carried down 5.8% of the GDP. Money growth in 1994 was mostly on account of increase of net foreign resources rather than the domestic credit formation. An increase of foreign assets had become essential because of the drawdown of assets in last year. Thus the cause for the increase in money growth in the year of 1994 was different from the last three years. The pressure on foreign assets and appreciation of exchange rate required depreciation in the year of 1994. Pressure on exchange rate and foreign assets was reasoned of the monetary and fiscal disorderliness during the years 1991-93. This period was also marked as the main thrust in the liberalization of an economy.

The SBP and private and public forecasters show interest in money supply growth because it affects real economic growth and general price level. Money supply is considered as a major tool for controlling inflation rate. Economists think that money supply growth leads to inflation if the demand for money is constant so that rise in money supply is not met by equal rise in demand. Money supply in Pakistan averaged Rs. 6957205.78 Million from 2008 to 2012. The lowest amount of money supply was recorded Rs. 4431502 million in July 2008.

Central bank's monetary policy is approved by Fractional Reserve Banking which allows commercial banks to generate money through credit. Pakistan is a developing country so it is more concerned with the accessibility of money for economic development. In order

to fulfill the developmental requirements of the country, SBP adopted expansionary monetary policy. Expansionary monetary policy did not create inflation up to 1960. However, after 1960 expansionary monetary policy contributed to inflation and negatively affected the supply and production side of economy [(Janjua 2005)].

Figure 2.4: Relationship between inflation rate and money supply growth in Pakistan from 1982 to 2012



Source: Plotted quarterly data of inflation rate and money growth taken from IMF (2014)

The figure 2.4 shows the relationship between the money supply growth and rate of inflation from 1982 to 2012. MG stood at 6.53% in the second quarter of 1982 while the inflation rate at this point was at 2.13%. Money supply growth and inflation rate show increasing trends during 1983. Inflation rate and money growth since 1989 to 1998 varied between -1.21% and 10.2%. The rate of monetary growth which had decreased to the

point of 4.6% (annual) in the year of 1989 increased up to 12.6% (annual) in the year of 1990 and since then it has been in range of 16% to 18% except in the year of 1992 when it attained an unusual growth level. The reason of monetary expansion was high budget deficits during these years. The growth rate of money supply shows a downward trend for the period of 1998 to 2003. Rate of inflation and money growth increased drastically in the third quarter of 2008. Money growth and rate of inflation since 2009 to 2012 varied between -0.33% and 8.31%. The inflation rate in Pakistan averaged 8.42% from 1982 to 2012 [Pakistan Bureau of Statistics (2014)].

Summing up, M2 is equal to M1 plus time, savings, and foreign currency deposits of resident sectors other than the central government. Money supply has strong impact on all economic activities as money supply is life wire of all activities. Money growth has strong impact on all economic activities as money supply growth is life wire of all economic activities and so has powerful effects on the economic life of any nation. An increase in Money Supply puts more money in the hands of producers and consumers and thereby stimulating increased investment and consumption. Consumers increase purchases and business firms respond to increased sales by ordering for more raw materials and other resources to achieve more production, the spread of business and capital goods. As the economy goes buoyant, Stock Market prices rise and firms issue more equity and debt instruments. Our study uses M2 because the volatility of M2 is 2.5 times less than the volatility of M1 [Chaudhary & Khan (1997)]. There is positive association between money growth and the rate of inflation. The growth rate of money supply shows a downward trend for the period of 1998 to 2003. Rate of inflation and money growth increased drastically in the third quarter of 2008. Money growth and rate

of inflation since 2009 to 2012 varied between -0.33% and 8.31%. The inflation rate in Pakistan averaged 8.42% from 1982 to 2012 [Pakistan Bureau of Statistics (2014)].

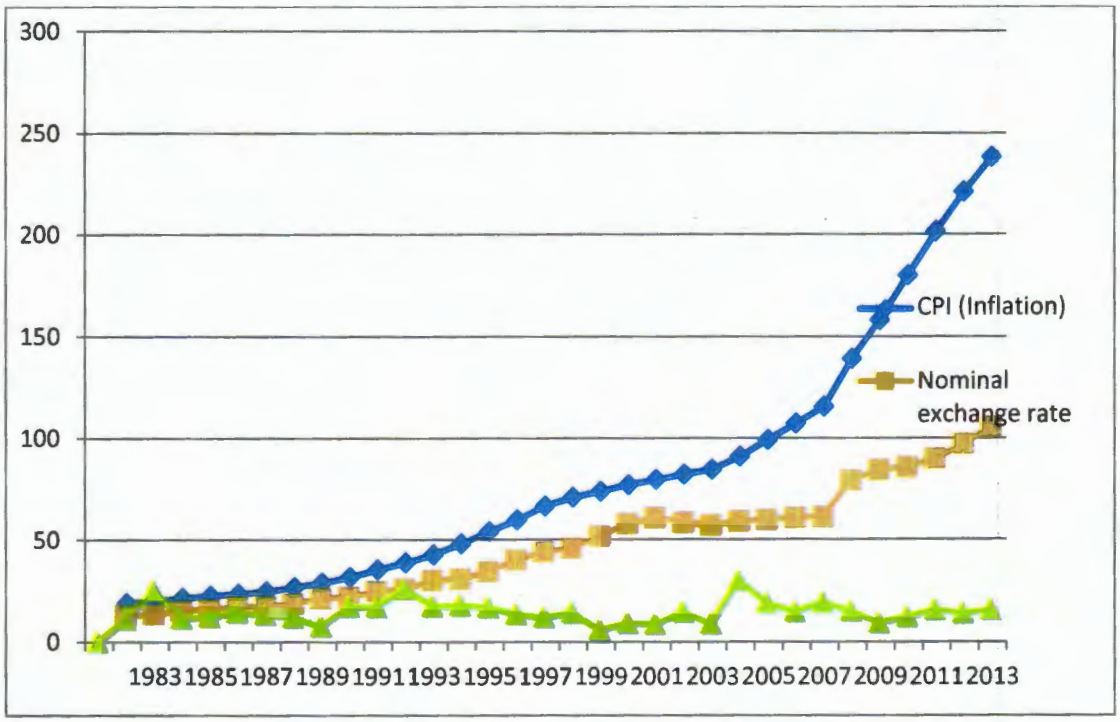
Notwithstanding Pakistan is Muslim country, there has been drastic increase in prices of consumer goods specially vegetables and fruits in the Holy month of Ramzan. The prices go spiraling high. The prices of commodities such as fruits, vegetables, rice, flour, pulses, sugar, chicken, mutton and beef increase drastically in local markets before starting the Holy month of Ramzan every year. Like past, in 2012 government try to control the flood of inflation before Ramzan but in vain. The prices of vegetables and fruits are sky-high and beyond the approach of a common man. In this month even a low middle class person tries to eat nutritional food but how can he afford such high prices? There is a dramatically increase in the prices of commodities in this month [Federal Bureau of Statistics (2011)].

There is also a positive relationship between increase in oil prices and inflation rate. Oil prices are happening to be one of the major causes of inflation. Throughout the world including Pakistan, the oil prices have been noted to rise since 2003. Furthermore, the data shows the increase of oil prices to be doubled within the time span of two years, i.e. from 2004 to 2006, worldwide. At the end of 2007 we saw the high rise in the price of oil ($100 per barrel). In June 2008, we saw the highest rise in the price of oil ($140 per barrel) during the study period. In the global market this trend of perpetually heightening oil prices has badly affected the economy of many countries around the world, including Pakistan. The extent to which any country's economy is proving to fluctuation of oil prices depends upon its oil demand. High prices of oil may result in high costs of

production of output; thus causing a negative impact upon the economy of any country Khan et al. (1996) and Khalid (2006).

Summing up, money supply in Pakistan averaged Rs. 6957205.78 Million from 2008 to 2012. Money supply has strong impact on all economic activities as money supply is life wire of all activities. The growth rate of money supply shows a downward trend for the period of 1998 to 2003 Rate of inflation and money growth increased drastically in the third quarter of 2008. Money growth and rate of inflation since 2009 to 2012 varied between -0.33% and 8.31%. The inflation rate in Pakistan averaged 8.42% from 1982 to 2012 [Pakistan Bureau of Statistics (2014)].

Figure 2.6: Inflation rate, Exchange rate and Money growth from 1982 to 2012



Source: Plotted annual data of inflation rate and exchange rate money growth taken from IMF (2014)

The figure 2.6 shows the relationship among inflation rate, money growth and exchange rate. Exchange rate is the one of main factor of macroeconomic variables which joins the country with globe market.

If exchange rate depreciated, we need more money for imported goods. For this purpose central bank prints more money which leads to inflation. Inflation rate in Pakistan is significantly high. In the third quarter of 2008 money growth, exchange rate and inflation rate showed increasing trend. The average inflation rate in Pakistan during 1982 to 2012 was 8.36%. From 1982 to 2012 Pak-rupee showed downward trend against different major world currencies except for a few years. We have used M2 because the volatility of M2 is 2.5 times less than the volatility of M1 [see Chaudhary & Khan (1997)]. The lowest amount of money supply was recorded Rs. 4431502 million in July 2008. Oil prices are one of the major causes of inflation. High prices of oil may result in high costs of production of output; thus causing a negative impact upon the economy of any country. The oil prices have been noted to rise since 2003. Furthermore, the data shows the increase of oil prices to be doubled within the time span of two years, i.e. from 2004 to 2006, worldwide. At the end of 2007 we saw the high rise in the price of oil ($100 per barrel). In June 2008, we saw the highest rise in the price of oil ($140 per barrel) during the study period. In the global market this trend of perpetually heightening oil prices has badly affected the economy of many countries around the world, including Pakistan. There is significantly increased in the prices of various commodities in the month of Ramzan in Pakistan. The prices of commodities such as fruits, vegetables, rice, flour, pulses, sugar, chicken, mutton and beef increase drastically in local markets before starting the Holy month of Ramzan every year.

Chapter 3

3 REVIEW OF THE LITERATURE

3.1 Opening Remarks

Inflation is one of the most researched topics in economics because it has serious implications for growth. What factors determine the inflation rates has also been widely debated all over the world. Inflation is also considered to be one of the most important areas of research in macroeconomics literature. Particularly research in the area is very important in order to prepare fiscal, monetary and exchange rate policies.

Numbers of studies have been conducted to estimate the impact of inflation on economic performance. Different studies used different determinants, such as GDP, import prices, exchange rate and money growth, to investigate their impact on inflation rate separately. This chapter is focuses on three major sections. In first section we review those studies which applied the threshold models. The literature related to pass-through of the exchange rate and inflation rate is put under section two. In third section, we review the studies in which the relationship between money growth and inflation rate is discussed.

3.2 Review of studies which applied threshold model

Threshold[3] models are special case of statistical frameworks such as smooth transition threshold model, switching model and Markov-switching model [Hansen, (2000)]. The common idea behind threshold models is that the process may behave differently when the values of a variable exceed a "threshold value". Threshold model is used in number of cases, for instance; Galbraith (1996) found that money had a powerful control on output for Canada and the US when the rate of money growth was less than a certain threshold level. The result indicated that the monetary policy had small or no impact at all on output when money growth is high. He did not explain the reason that why high money supply growth had less impact on output after its threshold value.

Khan & Ssnhadji (2001) examined the relationship between the economic growth and inflation rate in one hundred and forty countries for the period of 1960 to 1998. They showed that inflation rate had strong impact on the economy when inflation rate was above then threshold value. In contrast, inflation rate had low impact on economy when inflation rate was less than threshold value. They showed that the threshold value for the developed economy was 1% to 3%, and about 11% to 12% for the developing countries.

Papageorgiou (2002) also used threshold model to check the openness of economy. He concluded that openness of economy might not be crucial in the process of growth of low and high income economies.

[3] Threshold value of money growth means the rate of money growth beyond which its effect on inflation rate start to change

Falvey et al. (2006) estimated the relationship between economic growth and export for African countries. They concluded that intellectual property rights (IPR) protection supported to innovation in high income economies, and technology flew to low income economies. Middle income economies might have compensating losses from reduced scope for reproduction. The valuation of fiscal deficit was also completed by using threshold model, for instance, see Bajo-Rubio et al. (2004)) for Spain and Arestis et al. (2004) for the USA.

3.3 Review of studies on pass-through of the exchange rate (ERPT) and inflation rate

The exchange rate pass through can be defined as the impact of 1% exchange rate depreciation on the domestic inflation rate. The enormous theoretical literature is available on pass-through of the exchange rate from depreciation to inflation rate for instance Fisher (1989), Klein (1990), Feenstra et al. (1994) and Goldberg et al. (1997).

There are also a few empirical studies on the ERPT for OECD, for instance, Campa & Goldberg (2002), Ihrig et al. (2006). A few studies examined the pass-through of exchange rate in many countries, for instance, Borensztein and De Gregorio (1999).

However the literature on ERPT can be divided into three main groups. The first group measures the ERPT on import prices of specific industries; for instance, Campa & Goldberg (2002) and Bernhofen & Xu (2000). The second group measures the effect of ERPT on aggregate import prices; for instance, Campa & Goldberg (2002) and Hooper and Mann (1989). The third group measures the ERPT on the inflation rate measured by

growth of the wholesale price index or consumer price index; for instance, Choudhri & Hakura (2006) and McCarthy (2007).

A number of studies have focused on the industrialized economies. According to the survey of literature made by Menon (1995), forty-eight studies of ERPT are conducted, but most of them are for Japan and the USA. Alba and Papell (1998) estimated the link between the inflation rate and the exchange rate, the value of coefficient was 0.090, -0.082 and 0.165 for Malaysia, Singapore and Philippines respectively. Wimanda (2014) found that the rate of inflation in Indonesia was influenced by inflation expectations, exchange rate, output gap, and money growth. The study showed that backward-looking inflation expectations were dominated. Moreover he explained that the nominal exchange rate affected inflation rate which was asymmetric around the value of threshold. Below the threshold, an effect of change in the nominal exchange rate on inflation was insignificant whereas above the value of threshold the effect was significant.

To prop up the opinion of "fear of floating", Calvo and Reinhart (2000) empirically estimated the ERPT on consumer price index (CPI) for many developed and developing countries, by using monthly data. They found that ERPT for Malaysia and Indonesia was 0.02 and 0.062 respectively. Wimanda (2014) found that there was certainly threshold effect of money supply on rate of inflation, but there was no threshold effects of exchange rate on inflation rate in Indonesia.

A considerable research has also been conducted to examine the relation between inflation rate and exchange rate for Pakistan. Ahmad & Ali (1999) investigated simultaneous function of exchange rate and general price level in Pakistan. Their study

found that the rate of change of exchange rate and price level was sluggish to internal and external impulses. Moreover the expected counteract impact of inflation on the exchange rate could not be delayed for an indefinite period. They highlighted that "recent empirical work in Pakistan provided consistent evidence that the domestic price level responded significantly but gradually to exchange rate devaluation" (p. 237). Kashif (2012) also find insignificant relationship between inflation and exchange rate of US $ and Pakistani Rupee.

Mubarik & Riazuddin (2005) suggested that 9% was threshold inflation rate for Pakistan which means inflation rate below 9% would be less harmful. Ayyoub et al. (2011) took annual data from the period of 1972-73 to 2009-10 and used OLS method to analyze data. A significant and negative inflation and growth relation has found in Pakistan. The results of study revealed that inflation would be dangerous to GDP growth after threshold level. On the basis of the results, they suggested to policy makers and State Bank of Pakistan to control the inflation rate below 7% level and to keep it secure.

According to Khan and Saqib (2009) political instability also contributes to inflation in Pakistan. Jaffri (2010) examined the effect of exchange rate changes on CPI for era of 1995 to 2009 in Pakistan. The study estimated ERPT in Pakistan. The results suggested that exchange rate pass through to CPI inflation in Pakistan was low. The effect of previous periods' misalignment on the rate of inflation was found significant in managed exchange rate. However, the overall model misalignment did not affect inflation rate. The effect of foreign inflation on domestic inflation rate was significant and positive. Asad et al. (2012) investigated the effect of exchange rate on the rate of inflation. They used the

significantly lag of about nine months. While study showed that the supply of money worked through a system in the year showed that rise in money growth increased the rate of inflation in the long run. His findings supported quantity theory of money.

Galbraith (1996)'s study on the association between money and output for Canada and the US, found that money had a powerful control on output when the rate of money growth was less than a certain threshold level. The results supported that the monetary policy has small or no impact at all on output when money growth is very high. Cecchetti et al. (2000) investigated that even modest level of inflation rate was harmful for an economy.

Hasan et al. (1995), Khan and Qasim (1996), M.A. Chaudhary et al. (1995), Agha & Khan (2006) and Haider et al.(2008) demonstrated that money growth was a reason of the inflation in developing countries (Pakistan). Causes of the inflation rate in Pakistan examined by many researchers especially Bilquees (1988), Khan and Qasim (1996) and Khan et al. (2006). The results of the studies showed that monetarist's point that monetary factors play major role on inflation was valid.

A number of investigators of developed and developing countries tried to investigate statistical association between money growth and inflation rate but unfortunately results are varied and uncertain.

Niskanen (1978), Fischer et al. (1981), Dwyer (1982), Jones & Manuelli (1995), and De Haan (1995) found statistically insignificant results, whereas Laney & Willett (1983) found significant monetization effect of money growth on inflation rate. Dwyer and

Hafer (1999) showed proportional and positive relation of quantity of money and the price level for America, Japan, Britain, Brazil, and Chile during the 20th century.

Moreover Lucas (1980), Friedman (1994), McCandless and Weber (1995), Rolnick and Weber (1997) and others concluded that the changes in the price level and nominal amount of money were closely related with each other. Friedman (1968) argued that "Inflation is always and everywhere a monetary phenomenon". Qayyum (2006) examined the relation of money growth and the inflation rate. The findings of study point out that there was a positive relation of money growth and the rate of inflation. According to him, in Pakistan money growth firstly affected the real GDP growth and secondly money growth affected the inflation rate. The significant finding of the study was that continues increase in money growth had been a main contributor to create the inflation in Pakistan, thus Bilquees (1988) and Qayyum (2006)'s studies supported the monetarist point that "Inflation is a monetary phenomenon".

De Grauwe and Polan (2005) examined the relationship of the rate of inflation and the growth in money supply (M1 & M2). They used last thirty years panel data of one hundred and sixty countries. They found out that the relationship between money growth and inflation still held. They concluded that countries with low inflation rate (below 10%) had weak relationship and the countries with high inflation rate had strong relationship.

Oil prices also main reason behind inflation rate in Pakistan. there is positive relation of oil prices and the rate of inflation in Pakistan [Khan et al. (1996) and Khalid (2006)]. Throughout the world including Pakistan, the oil prices have been noted to rise since 2003. Furthermore, the data shows that the increase of oil prices to be doubled within the

time span of two years, i.e. from 2004 to 2006, worldwide. In June 2008, we saw the highest price of oil ($140 per barrel). The extent to which any country's economy is proving to fluctuation of oil prices depends upon its oil demand. High prices of oil may result in high costs of production of output; thus causing a negative impact upon the economy of any country.

Summing up, inflation is considered to be one of the most important areas of research in macroeconomic literature. Inflation rate negatively affects overall economic growth of an economy. Considering such negative effects of inflation rate on economy, economists are agree on the point that price stability should be main objective of the monetary policy of central banks of all countries [Hasan, et al. (1995)]. Some of the studies found significant and some of them found insignificant results same is the case with Pakistan. Hasan et al. (1995), M.A. Chaudhary et al. (1995), Agha & Khan (2006) and Haider et al.(2008) demonstrated that money growth was a reason of the inflation in developing countries (Pakistan). It is evident from the literature review that number of studies has been conducted on money growth, exchange rate and inflation rate in developed and developing countries' including Pakistan but no attempt has yet been made to study the threshold effect of exchange rate depreciation and money growth on inflation rate. The literature review also indicates that most of the research conducted for Pakistan investigated the impact of exchange rate depreciation and money growth on inflation rate separately. The present study is an attempt to fill this gap. Hence our study's aim is to investigate the threshold impact of exchange rate and money growth on the rate of inflation simultaneously.

CHAPTER 4

4 MODEL SPECIFICATION, METHODOLOGY AND DATA SOURCES

4.1 Chapter Outline

This chapter deals with the development of model, the discussion of the methodological and analytical framework employed in this study to carry out estimation of the model. This chapter is divided into four main sections. In section one, we discuss the model specification. In section two, we discuss econometric technique which is used for estimation. In section three we focus on the descriptive statistic. Data description and its sources are discussed under section four.

4.2 Model Specification

Different economists (Fisher, Keynes, Marx etc) have been proposed various theories to explain the inflation. Inflation is a difficult phenomenon and not yet completely understood. According to monetarists approach inflation is always a monetary phenomenon and it is caused by the raise in money supply. It dates back to Quantity Theory of Money (QTM), according to (QTM) there is direct relationship between prices and money supply. Basically Quantity Theory was declared as:

$$P = X\,M$$

Where

P = is general price level

X=is constant by which money supply changes

M=is money stock.

Irving Fisher in 1911 reformulated theory and called it Equation of Exchange. Theory was written as:

MV = PY

Where

M = money in stock

V = velocity of money in circulation

P = general price level

Y = real national output

Fisher said that M times V shows overall spending and P times Y shows money value of national output. The impact of money supply does not depend on its supply; it would also depend on how many times each unit of money is used. However, monetarists and Friedman argue that money supply has great effect on prices. Another economist Keynes described that increased in demand and costs are the main reason of inflation. These are known as Demand-Pull Inflation and Cost-Push Inflation. Demand-Pull is where aggregate demand exceeds to aggregate supply whereas Cost-Push inflation refers to increase in costs of production i.e. on the supply side. Increased costs of productions are recycled back in the form of high prices.

Structural theory is another theory of the inflation and it is originated from developing countries. The theory acquires a solid look at the dependency of lower developing

countries (LDCs) like Pakistan. It is opined that LDCs have weak infrastructure and have high-dependency on the developed countries such that local productions are highly dependent on external economies. Due to this, it is the burden and some effects of Britton Wood institutions of IMF and World Bank; for example not considering extreme devaluation that Pak-rupee has experiences over the decades.

Inflation is caused by a number of factors including money supply, exchange rate, fuel price, political instability, inflation expectations, interest rate, non-productive expenditures, corruption, deficit financing, consumption trend, indirect taxes and many others. Most of the studies on inflation rate in Pakistan mostly agree on the key factors which influence the inflation rate, are oil prices, growth in money supply and exchange rate. Khan et al. (1996) and Rehman & Zaman (2010) are of the point of view that main determinant of inflation in Pakistan are money growth, exchange rate depreciation, oil prices, inflation expectations and output gap. That's why the present study focuses on these variables i.e. exchange rate, money growth, fuel price, inflation expectations and output gap. To incorporate these variables within a framework of the study, threshold model is used. In order to estimate threshold level of exchange rate depreciation and money growth, we use Generalized Method of Movements (GMM) estimation technique because it removes potential endogeniety problems in the data.

Threshold model[4] has been employed by a number of researchers in the field of economics such as Bacchiocchi & Fanelli (2005), Balakrishnan & Ouliaris (2006) and Wimanda (2014).

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[4] Threshold model is a particular case of complex statistical framework, such as mixture models, Markov-switching models, switching models and smooth transition threshold models.

The general form of threshold model is presented as below:

$$y_t = \beta_j x_t + \delta_1 z_t I(th_t \leq \lambda) + \delta_2 z_t I(th_t \leq \lambda) + \mu_t \quad (1)$$

Where:

y_t = inflation rate

x_t = vector of explanatory variables

β_j = vector of coefficients

z_t = function indicator

th_t = threshold variable

λ = threshold value

μ_t = error term.

There are large numbers of variables which affect inflation rate. We consider only output gap, month of Ramzan and fuel price in addition to exchange rate depreciation and growth rate of money supply. It is expected that these variables have a positive effect on the inflation rate. The model also considers a lag and lead value of inflation rate to include time varying effect of the inflation rate.

Oil prices are one of the major causes of inflation because it serves as a factor of production, and if it is too expensive for a country to afford it, that creates a gap in supply side of an economy. The gap caused by the high oil prices in the supply side channel transforms itself into an inflationary force in the process of economic production. Moreover, the expensive nature of petroleum products and the imported goods in the

consumption basset creates a considerable increase in the consumer price index. That's why; oil price has been included in the model of present study.

In Pakistan, there is also an increasing trend in prices in the month of Ramzan because in this month everyone wants to take nutritional diet. According to Federal Bureau of Statistics (2012) prices go spiraling high in the month of Ramzan. It is used as a dummy variable in the model.

Hence in our study inflation rate is dependent variable whereas growth in money supply, exchange rate (ER) and oil prices act as independent variables. The lag and lead values of inflation rate are used as proxies for backward looking and forward looking inflation expectations. All the variables are taken in the growth form except month of Ramzan which is a dummy variable.

To check the existence of a threshold effect of exchange rate on the rate of inflation, threshold model can be written as:

$$Inf_t = c + \beta_0 inf_{t-1} + \beta_1 inf_{t+1} + \beta_2 gap_t + \tau_1 d_t[(ER_t)I(ER_t \leq ER_t^*)] + \tau_2(1 - d_t)[(ER_t)I(ER_t > ER_t^*)] + + \theta M_t + \beta_3 P_{oil} + \delta\, Ram + \mu_t \quad (2)$$

Where:

inf_t = inflation rate in the period't'

inf_{t-1} = backward looking inflation expectation

inf_{t+1} = forward looking inflation expectation

gap_t = output gap in the period't'

ER_t= exchange rate depreciation in the period't'

ER_t^* = threshold value of exchange rate

M_t= money supply growth rate in period't'

P_{oil} = growth in oil prices in period't'

Ram = month of Ramzan

μ_t = disturbance term

$$d_t = \begin{bmatrix} 1\ if ER_t \leq ER_t^* \\ 0\ \ if ER_t > ER_t^* \end{bmatrix}$$

4.3 Estimation Methodology

This study follows Hansen (1997, 2000) methodology for the analysis of the data by using the exchange rate and the money growth. The method which is based on the asymptotic distribution tests the significance of the data. This study has some advantage over threshold studies in that it allocates data to decide the position of threshold rather than imposing break randomly. Additionally, this technique allows data to find out numbers of thresholds, which has been generally imposed as one. If we imposed one threshold on data when there are in reality more than one, then resulting coefficients could be under or over estimated.

There is a problem of potential endogeniety due to the presence of money growth and exchange rate on the right side of the model. To handle this problem of potential endogeniety Generalized Method of Movements (GMM) technique is used. It is commonly used in empirical research work which involves time series or cross section data and considered the most suitable technique for controlling potential endogeniety.

Threshold value of exchange rate and money growth are unknown so we need to estimate them. To ensure that the number of observations in each regime is sufficient, the model is estimated for all the threshold values from the threshold variable between the 10th and 90th percentile.

For each threshold value of exchange rate depreciation, the model is estimated by GMM to obtain the sum of squared residuals (SSR) of exchange rate depreciation. Threshold value of exchange rate depreciation is obtained by choosing the threshold value of exchange rate depreciation which has the minimum value of SSR. To test for no threshold effect, the null hypothesis $H_0: \tau_1 = \tau_2$ is tested.

To check the existence of threshold impact of the money growth on the rate of inflation, the above equation is used after replacing exchange rate (ER_t) with money growth (M_t). The following model is estimated:

$$Inf_t = c + \beta_0 inf_{t-1} + \beta_1 inf_{t+1} + \beta_2 gap_t + \theta_1 d_t[(M_t)I(M_t \leq M_t^*)] + \theta_2(1 - d_t)[(M_t)I(M_t > M_t^*)] + + \tau ER_t + \beta_3 P_{oil} + \delta\, Ram + \mu_t \quad (3)$$

Where:

$$d_t = \begin{bmatrix} 1\ if M_t \leq M_t^* \\ 0\ \ if M_t > M_t^* \end{bmatrix}$$

M_t^* = threshold value of money supply growth

The estimation process for thresholds of money growth is the same as the process of exchange rate depreciation threshold which is explained above.

4.4 Descriptive Statistic

Table 4.1: The descriptive statistic of the data

Variables	Observations	Minimum	Maximum	Std Dev	Mean
CPI (inflation)	125	-0.6504	7.9447	1.4005	2.0370
Exchange rate	125	-5.2025	14.2940	2.9922	1.7949
Money growth	125	-3.5402	10.2411	3.1568	4.6202
Output gap	125	-10.2204	16.669	7.7574	6.5022
Oil prices	125	-52.7014	75.0179	15.4047	10.3598

The above table shows the descriptive statistic of the data. All the values in above table are calculated by the author. These descriptive statistics are calculated from quarterly data. We can get yearly descriptive statistics by multiplying these results by four.

4.5 Data Sources and Description

We use quarterly data series from 1982:Q1 to 2012:Q4. The reason of using this time span is two folds. Quarterly GDP data is not available after 2012. On the other hand; fixed exchange rate system was adopted before 1982 by the Pakistan.

The data construction and their sources are discussed below.

(a) Inflation rate

Inflation rate is dependent variable in the model. It is the percentage rate of change of a price index. We used CPI to calculate the rate of inflation because it is the most suitable measure to calculate inflation rate in Pakistan Rehman & Zaman (2010). Data on CPI is obtained from International Financial Statistics 2014.

(b) Backward looking inflation expectation

We use lag inflation rate as a proxy for backward looking inflation expectation. A backward looking inflation expectation is also known as adoptive expectation. In adoptive expectation people make their decisions on the basis of previous experience Wimanda (2014).

(c) Forward looking inflation expectations

We use lead inflation rate as a proxy for forward looking inflation expectation [Rehman & Zaman (2010)].

(d) Exchange rate depreciation

We use nominal exchange rate as an independent variable which is defined as the number of domestic currency units per foreign currency. Rs/USD is used as Exchange rate. Thus, a higher value of exchange rate indicates depreciation, while its smaller value indicates an appreciation. We use nominal exchange rate data and it is obtained from International Financial Statistics 2014. The growth rate of exchange rate is used in the analysis.

(e) Growth of money supply

We used 'Broad money' in our estimation. 'Broad money' is also known as 'money plus quasi money' or M2. According to state bank of Pakistan "Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government". This definition is commonly known as M2. Data on money supply is obtained from state bank of Pakistan and it is in growth form.

(f) Output gap

Output gap is defined as potential GDP minus actual GDP divided by actual GDP multiply by 100 Rehman & Zaman (2010). Quarterly data on actual GDP is obtained from Hanif et al. (2013). Output gap is in percentage.

(g) Potential output

Potential output means the full utilization of all factors of production under the steady inflation. Therefore potential output is resolute by supply side of an economy. Data on

potential output is not directly available. So economists use different statistical techniques to estimate the potential output. We use adjusted Hodrick-Prescott filter (1997) to calculate the potential GDP with smoothing parameter set as 100[5].

(h) Threshold of money growth

Threshold value of any variable means the point from where the effect of variable start to change. We use Hansen (1997, 2000) methodology to find threshold value of exchange rate depreciation and money growth. For each threshold value of ER_t the model is estimated through GMM to obtain the sum of squared residuals. Threshold value of ER_t is obtained by choosing the threshold value ER which has the minimum value of SSR. To test for no threshold affect the null hypothesis $H_0: \tau_1 = \tau_2$ is tested.

(i) Oil prices

Increase in oil prices is one of the main reasons of creating inflation. Worldwide oil prices have shown increase since 2003. So in our model oil prices is an independent variable, there is positive relation of oil prices and inflation rate that's why this variable is included in our model. Data on oil prices is obtained from International Financial Statistics (2014).

[5] For calculating output gap, first we find potential output through adjusted HP filter (with smoothing parameter 100) and apply growth formula to get output gap. HP filter is two sided filter that minimizes variance of series y around smooth series.

(j) Ramzan

Month of Ramzan is used as dummy variable in the study. In the month of Ramzan prices of commodities increase dramatically which affect on inflation positively. The prices went spiraling high. It takes value 1 in the quarter in which Ramzan occurred and otherwise zero. If the month of Ramzan lies in two quarter that quarter is chosen in which maximum days of Ramzan lie.

CHAPTER 5

4 RESULTS AND THEIR INTERPRETATION

5.1 Structure of the chapter

In this chapter we discuss the results which are obtained by estimating the model. This study follows Hansen (1997, 2000) methodology for the analysis the data by using the exchange rate and the money growth.

The model is estimated for the quarterly data from 1982Q1 to 2012Q4 by employing the modern and comprehensive technique known as Generalized Method of Moments (GMM).

As a first step towards the estimation, we analyze and remove where we find econometric problems which are common mostly in time series data. First of all we estimate equation (2) after dropping the threshold variable of exchange rate to find out the effect of exchange rate on inflation rate. The estimation results of equation (2) without threshold value (by setting $\tau_1 = \tau_2$) of exchange rate are reported in table 5.1.

Table 5.1: Results of equation (2) without threshold value of exchange rate dep. and money growth

Variable	Coefficient	Std. Error	Prob.
Constant	-0.8389***	0.3176	0.0094
B Inflation	0.5689***	0.0877	0.0000
F Inflation	0.1678**	0.0872	0.0569
Output Gap	0.0959***	0.0291	0.0013
Exchange rate dep.	0.0553	0.0417	0.1876
Money growth	0.2683***	0.0607	0.0000
Price of Oil	0.0444*	0.0240	0.0670
Ramzan	0.6466**	0.2900	0.0278

Statistic	Value
J-statistic	0.000000
F-statistic	13.95713
R-squared	0.323070
Sum of squared resid	159.4580

Note: - ***, **, and * indicate significant at 1%, 5%, and 10% level of significance respectively. Lag value of endogenous variables (M2, ER, output gap and CPI) are used as instruments.

The above table shows that the coefficients of all variables except, exchange rate depreciation are significant and their signs are matched with theory.

Exchange rate depreciation is a relevant variable in our model but we do not find it significant. It would appear, therefore, that concerns about the inflationary consequences of devaluation in Pakistan are somewhat misplaced. Stability of the nominal exchange rate may be desirable for many reasons, but not because of fears that exchange rate fluctuations will impose an inflationary cost on the economy. Furthermore, these results are for one foreign currency i.e., Pak Rupee and US Dollar. The exchange rate variation with respect to other major currencies can be different. The coefficient of exchange rate depreciation is insignificant; therefore, we do not reject null hypothesis (H_a^{ER}) that exchange rate depreciation has no effect on inflation rate. Choudhary & Khan (2002) tested and afterward rejected the most accepted vision that depreciation of rupee leads to inflation in Pakistan. Our finding about the effect of exchange rate depreciation on inflation rate is consistent with Choudhary & Khan (2002), Hyder & Shah (2004) and Rehman & Zaman (2010). Whereas our empirical analysis does not support the results of Ahmad and Ali (1999) that devaluation has a significant impact on inflation. We believe that their results differ from ours because they estimate a model that is based on some fairly restrictive assumptions. For example, they believe there is a complete exchange pass-through to import prices. This assumption is may be important for their results.

The impact of backward looking inflation expectation on inflation rate is 0.57%. If CPI has increased by 1% in the past quarter then holding other things constant, CPI would increase by 0.57% in the current quarter. Research carried out by Bank of England (1999) estimated the forward looking inflation expectation Phillips curve and found significant

result [see Batini & Haldane (1999)]. The table reveals that the forward looking inflation expectation also plays a significant role to cause the current inflation rate. If it is expected that inflation rate will increase by 1%, actually inflation rate will increase by 0.17%. Our results of backward and forward looking inflation expectations are in conformity with the results of Rehman & Zaman (2010) and Wimanda (2014). We can safely conclude that inflation in Pakistan is dominated by backward looking inflation expectations.

The coefficient of money supply growth is 0.27% which means that one percent increase in the growth of money supply leads (without considering its threshold value) to increase 0.27% inflation rate. As coefficient of growth of money supply is statistically significant; therefore, we reject our null hypothesis (H_a^M) that money growth has no effect on inflation rate in Pakistan. These results also help us to conclude that the effect of money supply growth on inflation rate is greater than that of the exchange rate in Pakistan. Output gap has not only positive but also significant effect on inflation rate. Oil prices also turns out another a vital determinant of inflation in Pakistan. The effect of oil prices is positive effect and significant. Our results related to oil prices are matched with the finding of Khan and Qasim (1996), Kemal (2006), Khan & Ssnhadji (2001), Rehman & Zaman (2010) and Bawa & Abdullahi (2012).

The findings of the study also support a common man belief that there is drastic increase in prices in the holy month of Ramzan in Pakistan. It is evident from the results of study that the quarter in which month of Ramzan lies, inflation rate increases by 0.65% keeping other things constant.

5.2 Estimation of the threshold value of exchange rate depreciation

To find the threshold value of exchange rate depreciation, we estimate equation (2) 105 times for 10% to 90% of data. There are 105 candidates for exchange rate depreciation for being evaluated. We find the minimum value of sum of square residual at 1.46% exchange rate depreciation. So 1.46% is the threshold value of exchange rate depreciation.

Table 5.2: Results of equation (2) with threshold effect of exchange rate depreciation

Variable	Coefficient	Std. Error	Prob.
Constant	-0.8484***	0.3212	0.0094
B Inflation	0.5711***	0.0882	0.0000
F Inflation	0.1716*	0.0923	0.0657
Output Gap	0.0958***	0.0294	0.0015
Exchange rate dep.	0.0222	0.1415	0.8754
Threshold ER dep.	0.0338	0.1400	0.8099
Money growth	0.2685***	0.0610	0.0000
Price of Oil	0.0446*	0.0239	0.0643
Ramzan	0.6427**	0.2898	0.0286

Statistic	Value
J-statistic	0.000000
F-statistic	15.93067
R-squared	0.321814
Sum of squared resid	158.7537

Note: - ***, **, and * indicate significant at 1%, 5%, and 10% level of significance respectively.

Lag value of endogenous variables (M2, ER, output gap and CPI) are used as instruments.

The results of estimation of equation (2) with threshold value of the exchange rate are reported in table 5.2. The above table shows that the value of threshold of exchange rate has no significant effect on the rate of inflation in Pakistan. So we cannot reject null hypothesis (H_b^{ER}) that exchange rate depreciation has no threshold effect on inflation rate. We can safely conclude that there is no threshold effect of exchange rate on inflation rate in Pakistan. The effects of other variables in the equation are almost same in size and significance level as in the equation without threshold effect of exchange rate depreciation. The value of "F" statistic shows that the overall model is significant.

5.3 Estimation of the threshold value of money growth

To find the threshold value of money growth, we estimate equation (3) 105 times from 10% to 90% of the data. There are 105 candidates for money growth for being evaluated. We evaluate 105 candidates of money supply growth for threshold and find the minimum value of SSR at 7.67% money supply growth. So the first threshold value of money supply growth is 7.67%. In others words, 7.67% is the point from where the effect of money growth on inflation rate starts to change.

We estimate equation (3) to find out the effect of threshold value of the money growth on inflation rate. The estimation results of the equation are reported in the table 5.3.

Table 5.3: Results of equation (3) with threshold effect of money growth

Variable	Coefficient	Std. Error	Prob.
Constant	-0.8141***	0.3107	0.0100
B Inflation	0.4961***	0.0891	0.0000
F Inflation	0.2256***	0.0723	0.0023
Output Gap	0.0946***	0.0266	0.0006
Exchange rate dep.	0.0584	0.0431	0.1782
Money growth	0.3260***	0.0795	0.0001
Threshold GM	0.1429***	0.0539	0.0091
Price of Oil	0.0457*	0.0251	0.0690
Ramzan	0.5556*	0.3275	0.0926

Statistic	Value
J-statistic	0.000000
F-statistic	15.81003
R-squared	0.382423
Sum squared resid	145.4766

Note: - ***, **, and * indicate significant at 1%, 5%, and 10% level of significance respectively.

Lag value of endogenous variables (M2, ER, output gap and CPI) are used as instruments.

The table 5.3 shows that the results of the regression are fairly robust, that is the coefficients of all variables except exchange rate depreciation are statistically significant. It is clear from the table 5.3 that if the growth rate of money supply is less than or equal to 7.67%, the inflation rate increases by 0.33%. Keeping the other things constant, if the growth of money supply is higher than 7.67%, the effect on inflation rate is (0.33+0.14) 0.47%. The coefficients of both money growth and threshold of money growth are significant at 1% level of significance. Hence we reject null hypothesis (H_0^M) and conclude that there is threshold effect of money supply growth on inflation rate in Pakistan. Moreover, if we compare the results of table 5.1 (model without threshold of money growth) and table 5.3 (model with threshold of money growth) we see that sum of squared residual of threshold model is smaller than the model without threshold. This means that the threshold models are preferable to models without threshold.

Once the threshold value of money supply growth is found, there is possibility of the existence of another threshold value. The above method is inefficient in terms of computation time. Chong (1994) and Bai (1997) conclude that the sequential evaluation is consistent because it avoids the problem of computation. In this technique the 1st value of threshold is fixed and then 2nd threshold value of the variable is searched. Following the Chong (1994) and Bai (1997) technique we fix the 1st threshold value of money growth at 7.67% and search for the 2nd threshold value; all the threshold candidates above 7.67% are evaluated. The minimum SSR is found at 7.83% so the 2nd threshold value of money growth is 7.83% but the effect of this threshold value of money growth on inflation rate is fond insignificant It means that there is no threshold value of money

growth above 7.67%. In other wards we can say that the relationship between money growth and inflation rate is linear above 7.67%.

The next step is to search for 3rd value of threshold of money supply growth below 7.67%. To search the 3rd threshold value, all the threshold candidates below 7.67% are evaluated. The minimum SSR is found at 5.69% so the 3rd threshold value of money growth is 5.69% but the coefficient of this threshold value of money growth is also found insignificant. It means that there is no threshold value of money growth below 7.67%. So 5.69% threshold value does not exist. It means that the relationship between money growth and inflation rate is also linear below 7.67%. As 3rd threshold value is not significant; therefore, no need for further split because it is not possible for the existing of new threshold value. In other words there is no need to search for other threshold value because the effect of threshold values of money supply growth above and below 7.67% is found insignificant.

The above discussion makes us to conclude that the relationship between money growth and inflation rate is linear above and below 7.67%. The size and significance level of coefficients of other variables such as backward looking and forward looking inflation expectations, output gap, price of fuel, exchange rate and month of Ramzan do not change much; as compare to regression coefficients of money growth without threshold value. The value of "F" statistic shows that the overall model is significant. We conclude that there is moderate effect on inflation rate if money supply growth is below the threshold value and if money supply growth above the threshold value, the effect of money supply growth on inflation rate is high. The inflation rate increases dramatically if growth rate of money supply is higher than 7.67%.

Summing up, we estimate threshold model by using Generalized Method of Moments (GMM). We find that money growth, inflation expectations, output gap, fuel prices affect inflation rate positively. Our econometric evidence shows that there is certainly threshold effect of money growth on inflation rate. Though the threshold value for exchange rate depreciation is found at 1.46% but no threshold effect of exchange rate depreciation is produced on inflation rate. It means that there is no significant difference between the coefficients of exchange rate depreciation whether it is below and above its threshold value.

The threshold value for money growth is found at7.67% and its effects on inflation rate is significant. Keeping the others things constant, the impact on inflation rate is low when money growth is equal to or less than threshold value, and the effect is higher when money grows above the threshold value. The other two threshold values are found at 5.69% and 7.83% but their effects on inflation rate are insignificant. In other words the inflation rate increases dramatically if growth rate of money supply is higher than 7.67%.

CHAPTER 6

6 CONCLUSIONS AND POLICY IMPLICATIONS

6.1 Conclusions

This chapter presents the overall summary and conclusions of the study. The study investigates in detail the determination of threshold value of exchange rate and money supply growth and their effects on inflation rate in Pakistan.

Hansen (1997, 2000) technique is employed to determine threshold value of exchange rate and money growth. Compared with the process of threshold determination conducted randomly, this study has some advantages where threshold value can be determined by characteristics of the data itself. Additionally, this method allows detecting other possible threshold values. If we imposed one threshold on data when there are in reality more than one, then resulting coefficients could be under or over estimated.

The main objectives of the study are to explore (1) the nature of relationship among the variables i.e. money growth, exchange rate depreciation and inflation rate, (2) to find out the threshold value of exchange rate and money growth and (3) to examine which variable has more threshold impact i.e. exchange rate or money growth on inflation rate. The study uses the threshold model to analyze quarterly data from 1982:Q1 to 2012:Q4. We apply the most sophisticated and inclusive method called GMM to estimate the model. This technique is widely applied in time series and cross sectional data, where the chance of autocorrelation problem exists.

The findings of the study strongly support evidence that there is threshold effect of money growth on inflation rate whereas no threshold effect of exchange rate depreciation on inflation rate is found. The relationship between money growth and inflation rate is not linear. The threshold value for money growth is found at7.67% and its effects on inflation rate is significant. Keeping the others things constant, the impact on inflation rate is low when money growth is equal to or less than threshold value, and the effect is higher when money grows above the threshold value. The other two threshold values are found at 5.69% and 7.83% but their effects on inflation rate are insignificant. In other words the inflation rate increases dramatically if growth rate of money supply is higher than 7.67%. Our results are consistent with Kemal (2006) that monetary policy has strong impact on inflation rate when money growth rate is very high. Exchange rate does not affect the inflation rate directly in Pakistan.

6.2 Police Recommendations

The important finding of this study is that money growth is one of the major contributors to increase inflation rate in Pakistan. This is due to loose monetary policy implemented by state bank of Pakistan to boost high growth objectives. The effect of money growth on inflation rate is greater than the effect of exchange rate depreciation. The study recommends to the monetary authority of Pakistan should consider money supply growth; consider that the effect of M2 is greater at the time when it is above its threshold value. It should be controlled through strategic planning. Keep in view the business cycle causes. If the inflation is caused by money supply then we suggest for a meaningful tightening of monetary policy. It should be controlled through strategic planning.

There is an insignificant relationship between inflation and exchange rate. This suggests that the argument of imported inflation may not be valid in case of Pakistan, which means that there is no evidence of a significant pass-through of rupee depreciations to consumer prices. This finding is consistent with recent theoretical analysis that suggests that a weak short-run association between exchange rate changes and inflation.

It would appear, therefore, that concerns about the inflationary consequences of devaluation in Pakistan are somewhat misplaced. Stability of the nominal exchange rate may be desirable for many reasons, but not because of fears that exchange rate fluctuations will impose an inflationary cost on the economy. Furthermore, these results are for one foreign currency i.e., Pak Rupee and US Dollar. The exchange rate variation with respect to other major currencies can be different. Although exchange rate depreciation does not affect inflation rate directly, it means that exchange rate depreciation most likely has impact on CPI inflation but the channels are not direct, it does not indicate that, as monetary authority, State Bank of Pakistan can override depreciation rate because of its indirect effect. Exchange rate should be regulated according to change in prices.

6.3 Research Limitation

This study uses the methodology in which threshold value is based on the minimum sum of square residual. The value of SSR varies from model to model. For instance, model which use monthly data will give different results from the model which use quarterly or yearly data. When we use the different data, the results could be different.

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