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'Impact of Dollarization on Inflation in Pakistan'

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By

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Quaid-i-Azam University Islamabad Pakistan

February 2015

Impact of Dollarization on Inflation in Pakistan

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DISSERTATION

Presented to the faculty of School of Economics in partial fulfillment of the requirement for the degree of Master of Philosophy in Economics.

School of Economics

Quaid-i-Azam University Islamabad Pakistan

February 2015

BISMILLAH IR-RAHMAN IR-RAHIM

"(I START) IN THE NAME OF GOD, MOST GRACIOUS, MOST MERCIFUL"

Declaration by Researcher

I declared that the main content of this dissertation accounts for my own research and has not been previously been submitted for a degree at any educational institution. Further it is submitted that material taken from other sources has been properly acknowledged.

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Abstract

Controlling inflation is one of the important issues that macroeconomic policymakers face. The objective of this study is to analyze the demand-side, supply-side and external factors that affect inflation in Pakistan. Money supply and fiscal deficits account for demand-pull inflation, oil prices account for cost-push inflation and dollarization account for imported inflation. We have analyzed their long-run relationship using an autoregressive distributed lag model for the period 1991– 2013. Our results indicate that the most significant variable affecting inflation in both long and short run is money supply. Fiscal deficit and oil prices also have positive effect on inflation in Pakistan. Dollarization measured by foreign currency deposits in domestic banks does not have significant effect on inflation while dollarization measured by external debt has significant long run relationship with inflation. The reason for insignificant sign for dollarization measured by FCD is probably due to unexpected trend in data after nuclear explosions in Pakistan. Just after these explosions Pak rupee depreciated significantly. Moreover due to sanctions imposed on the country, freezing of FCD accounts by the government and expectations of further depreciation were ripe. In spite of these alarming factors, data shows almost no increase in dollarization from 1998 to onward. The models pass through the usual diagnostic tests of normality, serial correlation, heteroschedasticity, functional form and stability.

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Introduction

1.1 Background of the Study

Inflation has serious implications for living standard of every citizen; for economic growth of the country and income distribution among different segments of the society. That is why it has been widely debated all over the world. Inflation is caused mainly for three different reasons; an increase in aggregate demand that is called demand-pull inflation, an increase in input prices that is called cost-push inflation and an increase in the price of imported goods and services that is called imported inflation which occurs in developing countries mostly due to frequent depreciation of domestic currencies.

The demand pull inflation arises due to an increase in aggregate demand. Aggregate demand comprises of consumption expenditure, investment, government expenditures and net exports. Increase in consumption in a country occurs for many reasons, for example due to an increase in population, due to a change in preferences of citizens in favor of more consumption expenditures in the current period, due to an increase in money supply and government expenditures. Similarly investment in the country may increase either due to a decrease in interest rate, an increase in productivity of capital, an increase in foreign direct investment and so on. Out of these so many factors we consider in this research only those factors which are under the control of government; an increase in money supply and an increase in fiscal deficit.

An increase in money supply, on one side, reduces equilibrium interest rate and thus boosts investment demand in the country. On the other side, having excess cash holdings people spend more on almost the same number of goods and services in the short-run. Thus their price level is pushed up. That is why Friedman (1968) popularized the concept that: "*Inflation is always and everywhere a monetary phenomenon*". Inflation can persist only if the quantity of money increases continuously and proportionally greater than the increase in output. So monetarists view monetary policy as an instrument to fight against inflation.In Pakistan, many studies like (Qayyum 2006; Kemal 2006) empirically validate monetarists view.

Fiscal deficit is another major cause of inflation. (Sargent and Wallace 1981; Catao and Terrones 2003). Rising budget deficit means excess of government expenditures over tax revenues for a particular time period, typically a year. It pushes up aggregate demand directly. Furthermore, a government can finance its deficits either by borrowing that could be internal or external or by printing more money. If the government finances its deficit by borrowing, then aggregate demand increases only by the amount of increase in the government expenditures. Consequently inflation increases mildly as money supply remains constant only its velocity accelerates. On the other hand, if the government decides to finance its deficit by printing more money then it raises up the other components of aggregate demand; consumption etc as explained above. Keynesian economists usually prefer fiscal over monetary policy because of the direct impact of the former on aggregate demand and because of the indirect impact of the latter and in case of liquidity trap even no effect.

Cost push inflation occurs when there is an increase in the production cost of firms. Being profit-maximizing entities, firms have to pass on any increase in their costs to consumers of their products by increasing the prices of their products. Cost push inflation occurs due to an increase in the prices of either primary inputs like wages of workers, oil prices and energy prices or due to an increase in the cost of intermediate inputs like machinery and equipment etc. Any change in wages and other input prices is usually gradual but any change in oil prices for an oil importing country is usually abrupt and exogenous. Therefore, we have focused only on oil prices to capture the cost push inflation.

Moreover, if a country has inelastic demand for imports then imported inflation occurs due to an increase in foreign prices of the imported goods and services or due to a depreciation of the local currency. As a matter of fact, the local currency depreciates either due to current account deficit or due to capital account deficit. After the breakdown of Bretton Woods System in 1971, dollarization, a new reason for capital account to be in deficit, became a widespread phenomenon in many developing countries. Pakistan abandoned fixed exchange rate in 1982, therefore, dollarization started since then. However, it remained unofficial until 1991 when residents were allowed to open foreign currency accounts in the domestic banks.

Generally speaking dollarization means holding of foreign currency by general public. However, holding and borrowing of foreign currency by business firms and government may also be termed as dollarization. If local currency depreciates frequently, then fearing its further depreciation, general public gradually prefers to convert their savings and wealth in foreign currency. Due to high inflation, business firms cannot borrow sufficient

funds in local currency so they have to raise funds denominated in foreign currencies. Similarly, due to expectations of continuous depreciation of local currency, foreign governments and world agencies prefer to deal with local governments in foreign currency. Therefore, in such a difficult situation, local government has to increase its external borrowing. As the first type of imported inflation is not in the control of domestic government, so in this study, we try to focus on dollarization measured by FCD in domestic banks as our proxy for imported inflation in Pakistan.

Previous studies on inflation in Pakistan have focused mostly on demand-pull and cost push factors. However, for a developing country like Pakistan where demand for imports is quite inelastic, imported inflation particularly dollarization is also very crucial. Therefore, in this research, we include growth in money supply and fiscal deficit as demand side variables, oil prices as a cost push factor and dollarization as the major factor for imported inflation.

Although several studies have investigated the dynamics of inflation in Pakistan, existing empirical studies have not explored the role of dollarization in the inflation process of Pakistan. This paper attempts to fill this gap in the literature on Pakistan by empirically investigating the importance of dollarization in the dynamics of inflation. This study tries to identify to what extent dollarization "a phenomenon of imported inflation" along with general demand and supply side variables affecting inflation in Pakistan. For estimation of our model, we have used vector auto-regressive (VAR) framework, particularly we have used co-integration technique auto regressive distributed lag (ARDL) model. The data we have used is for the period of 1991 to 2013.

1.2 Objectives of the Study

Specifically, the objectives of this study are:

- To investigate the determinants of demand pull, cost push and imported inflation in Pakistan
- To explore whether dollarization, that causes imported inflation, is a significant determinant of inflation in Pakistan
- To find out short run and long run relationship between inflation and its determinants particularly dollarization in Pakistan.

1.3 Organization of the Study

This study is organized in six chapters; chapter two summarizes the literature on inflation. In chapter three, theoretical framework and descriptive analysis is presented. In chapter four, methodology and construction of variables is discussed. Chapter five presents empirical results and their discussion. The final chapter concludes the study.

Chapter 02

Literature Review

This chapter comprises of three sections. In the first section we review those studies that focus on demand side determinants of inflation. In the second section, literature on cost push determinants of inflation is discussed. In section three, literature on imported inflation is presented.

2.1 Demand-Pull Inflation

Fisher (1911) examines a link between the quantity of money in the economy and inflation in his famous theory known as Quantity Theory of Money (QTM). According to QTM, fluctuations in the price level result from changes in money supply in the economy. Fisher's famous equation of exchange is MV=PT, where M denotes the stock of money, V indicates velocity of circulation of money, P denotes the general price level and T indicates the total number of transactions taking place in an economy over a given year. Assuming velocity of circulation of money (V) that is used as proxy for transactions and by total real output (Y) as fixed in a given year; he argues that an increase in the stock of money immediately leads to a proportional rise in the price level. On same lines, Friedman (1968) in his restatement of QTM: "*Inflation is always and everywhere a monetary phenomenon*". Monetarists link aggregate demand with total nominal spending on goods and services.

In the view of monetarist the only reason of inflation is high growth rate of money. For Pakistan too, many papers advocate that inflation in Pakistan is a monetary phenomenon. Jones and Khilji (1988) investigate the association between inflation and growth in money supply in Pakistan by using Granger direct test for the time span of 1973 to 1985. The empirical findings of the test indicate that growth rate of money supply has a significant effect on inflation during this time period.

Chaudhary and Ahmed (1996) analyze the main determinants of inflation. Their research includes both the structural and monetary variables used for the yearly data from 1972 to 1992. Their empirical results reveal that inflation is not purely a monetary phenomenon in case of Pakistan; instead they point out that public debt, growth in services sector and import prices are the major causal factors of inflation in Pakistan. The study uses simple Ordinary Least Square method and does not consider the time series property of data and hence result of the study can be misleading.

Khan and Schimmelpfenning (2006) analyze the factors that explain inflation in Pakistan. In the study money supply and credit to the private sector, real GDP, the interest rate, the exchange rate, and the wheat support price are used as explanatory variables. The findings of the study indicate that there is a long-run relationship between inflation and private sector credit. Due to changes in credit to private sector, the price level at first falls, but gradually increases after 4 months. However, no long run relationship exists broad money and inflation. The empirical results are consistent with a monetary transmission channel that works through the credit to private sector.

Malik (2006) investigates the effects of monetary policy actions on inflation applying Near-VAR approach for quarterly data from 1975:03 to 2003:02.The results show that an expansionary monetary policy transmits into inflation with a lag of six months and then takes another year to reach its peak. The study identifies the variables that are most important in determining inflation in Pakistan by considering monetary variables, supply side variables and imported inflation.

Similarly, Qayyum (2006) investigates the linkage between growth rate of money supply and inflation for the time span of 1960 to 2005 using auto regressive distributed lags model and general to specific methodology. The results of the study validate the monetarist view that inflation is a monetary phenomenon as the empirical results of the study reveals that a strong correlation between money growth and inflation. Similarly high growth in money supply has been the central contributor towards inflation in Pakistan in the related time period.

Kemal (2006) in his paper investigates the hypothesis whether the inflation is essentially a monetary phenomenon in Pakistan by using quarterly data from 1975 to 2003 and utilizing co integration approach. The results reveal an increase in the variation of money supply leads to an increase in inflation and fluctuation in growth rate of GDP. The study concludes that inflation has a positive long-run relationship with money supply and a negative relationship with Gross domestic Product. The negative relationship between inflation and GDP implies that any increase in GDP in the short results in a decline in the GDP. The empirical estimates from the VAR model indicate that inflation is associated with the changes in the money supply. An increase in money supply increases inflation

rate with a lag of three quarters. The impulse response function (IRF) show that money and GDP adjust in response to exogenous shocks in inflation.

Khan *et al.* (2009) explain the major determinants of inflation in Pakistan by using data from 1972 to 2006 and utilizing the Ordinary Least Square (OLS) approach. The research study incorporates all important demand side and supply side variables. The quantitative analysis indicates that the important factors of inflation are inflationary expectations, private sector borrowing, government debt, high import prices, exchange rate depreciation, and wheat support prices.

Bashir *et al.* (2011) investigate the causal factors of inflation in Pakistan using Johansen's co-integration approach on time series data for the period of 1972 to 2010. The study investigates the demand and supply side factors of inflation and relationship among macroeconomic variables in Pakistan. The study finds that growth in money supply; imports, gross domestic product and government spending have positive impact on consumer price index inflation.

Various models have been presented to empirically investigate the long-run relationship between fiscal deficit, money supply and inflation. However, evidence from the empirical literature is unsettled and mixed. Catao and Terrones (2003) empirically find that there is a strong and positive association between fiscal deficits and inflation among those developing countries that have high inflation rate. But there is no long run relationship between fiscal deficit and inflation among advanced economies with low inflation. The study also provides estimates for a panel of 23 emerging market economies for the time period of 1970 to 2000. The results of the study show that if there is one percentage change in fiscal deficit to GDP lowers long-run inflation by 1.5 to 6.0 percentage points

depending on the size of the inflation tax base. De Silva (1977) develops a simultaneous equation model to empirically estimate the main equations separately with OLS method.

Cevdet et al. (2001) determines long-run relationship between inflation rate, fiscal deficit, and real gross domestic product and concludes that changes in the fiscal deficit have no long run relationship or effect on the inflation rate. The results also show that public sector borrowing (PSBR) from banks has a long-run relationship with inflation rate in an economy.

Vieira (2000) investigates the fiscal deficit and inflation association for six European countries. The empirical findings reveal that fiscal deficit is an important determinant of inflation in these economies over the last 45 years. Haan and Zelhorst (1990) investigate the long run relationship between government fiscal deficit and money growth in the developing countries. The main finding of this study does not provide support for the hypothesis that fiscal deficit effects monetary expansion and, therefore, results in inflation.

The fiscal deficit in Pakistan has been quite high during the last two decades. However, the empirical studies on Pakistan conducted to investigate the role of fiscal deficit as a major determinant of inflation also provide unsettled results. Bilquees (1988) tries to empirically investigate the relationship between fiscal deficit and inflation but finds no long run association between fiscal deficit and inflation. Agha and Khan (2006) investigate the long-run association between inflation and fiscal indicators in Pakistan using data series from 1973 to2003. The Johansen co-integration results suggest that in the long-run inflation is not only related to fiscal deficits but also to the sources of

financing those fiscal deficits Inflation has significant error correction coefficients that implies that inflation is affected by public bank borrowing and fiscal deficits.

Shabbir and Ahmed (1994) investigate the impact of fiscal deficit on money supply, Inflation rate, GDP, balance of payments and international reserves of Pakistan. The study finds a positive association between fiscal deficit and inflation. The empirical evidence reveals that fiscal and monetary variables are crucial to determine economic stability in the foreign sector of Pakistan. Money supply has positive relationship between foreign reserves, bank credit and public sector borrowing to finance its deficit and negatively related to interest rate. The results indicate that a one percent change in fiscal deficit results in six to seven percent change in the inflation rate. Neyapti's (1998) empirically analyze the impact of fiscal deficit on inflation on the panel data set of 44 developing and less developed countries. The results indicate that positive association between fiscal deficits and inflation is not significant for a number of countries including Pakistan.

2.2 Cost-Push Inflation

Hasan et al (1995) in their study investigate the determinants of inflation in Pakistan by using ordinary least square method of estimation for the time period of 1972 to 1994. Their study includes supply shock, monetary policy shocks, external shocks, tax policy shocks, pricing policy shocks and inflationary expectations. The empirical results of their study show that increase in money supply, increase in taxes and increase in excise duties have significant impact on the wholesale price index (WPI) for manufactured goods.

Expectations of wholesale price index (WPI) also significantly contribute to raise inflation in Pakistan.

Khan and Qasim (1996) empirically find that food inflation in Pakistan is mainly driven by increase in money supply, in increase in value-added in manufacturing, and the wheat support price. However the non non-food inflation is mainly driven by increase in money supply, real GDP, increase in import prices, and increase in electricity prices.

2.3 Imported Inflation

Pakistan's inflation rate is not immune to international factors. Being a small open economy, Pakistan has to take its import prices as given. Therefore, high foreign prices are supposed to have a direct impact on domestic inflation in Pakistan. Exchange rate depreciation, actual or expected, puts upward pressure on domestic inflation.

Siddiqui and Akhtar (1999) empirically examine the impact of import prices and money supply on domestic inflation. The study finds no uni-directional or bi-directional causal relationship between variation in the exchange rate and inflation rate. So the case of imported inflation affecting domestic inflation is not valid in case of Pakistan. The results show that money supply is the major determinants of inflation in Pakistan.

Chaudhary *et al* (1996) analyze the major sources of inflation in Pakistan. Their study includes monetary and structural variables for the annual data for the period of 1972 to 1992. Their empirical results show that inflation is not purely a monetary phenomenon in Pakistan rather they point out that growth of services sector, public borrowings and prices of imported goods are the major causes of inflation in Pakistan. The study uses simple

Ordinary Least Square method and does not consider the time series property of data and hence result of the study can be misleading.

Akbari and Rankaduwa (2006) investigate the important determinants of the general inflation in Pakistan by using data for the period of 1982 to 2004. The empirical results indicate that the foreign price level of imported goods, money supply, and domestic gross product are crucial determinants of the general inflation in Pakistan.

Choudhri and Khan (2002) empirically investigate exchange rate pass-through in a small VAR analysis but do not find evidence of exchange rate pass through to domestic price level, While, Hyder and Shah (2004) investigate the degree to which the changes in exchange rate influence domestic wholesale prices and consumer prices in Pakistan by using data from 1988 to 2003 by utilizing recursive VAR technique. The empirical results show that the changes in exchange rate have a moderate impact on domestic inflation. In other words, exchange rate pass-through to domestic whole sale and consumer prices is low. The study also finds out that the exchange rate pass-through is stronger for wholesale price index (WPI) as compared to consumer's price index (CPI).

Asghar et al (2013) investigate determinants of inflation in Pakistan using domestic and external variables. The study uses ARDL approach to cointegration for the estimation of the long-run and short-run relationship among the selected variables by using yearly data series for the time period of 1972to 2010. The empirical results reveal that money supply, foreign inflation, lagged inflation, and dummy variable for Global financial crises 2008 have positive and significant long run impact on inflation in Pakistan. However, except money supply all the other variables of the study affect inflation in the short-run. The

significant and negative coefficient of lagged error correction term is an sign of the adjustment towards long-run equilibrium.

Suarez (1992) analyze the role of dollarization in the dynamics of inflation in Peru from January 1978 to December 1990. By using monthly data, he finds that a long-run relationship exists between the expected rate of depreciation in the parallel exchange rate and the behavior of the demand for domestic currency relative to that for foreign currency. In his study, he estimates a dynamic equation for inflation for Peruvian economy, using a VAR representation which includes the lagged ratio of domestic to foreign currency as an explanatory variable and finds that currency substitution or dollarization as a transmission mechanism through which monetary and domestic fiscal policies affects inflation strengthened during high inflation periods.

Reinhart et al (2014) propose a new composite measure of dollarization in their paper for partially dollarized developing countries. In their composite dollarization index, they combine the asset dollarization index and liability dollarization index i.e., sum of foreign currency deposits in domestic banks as a share of broad money, external debt as a share of GNP, and public debt denominated in a foreign currency as a share of total public debt. Each of these three components of dollarization is first transformed into an index that can take a value from 0 to 10.

The inclusion of government debt in foreign currency in the composite index takes into account a form of dollarization that has become increasingly important in many countries and which has, so far, been ignored by studies on dollarization. Using these measures, a higher degree of dollarization does not seem to be an obstacle to monetary control or to

disinflation. However, higher degree of dollarization does appear to increase exchange rate pass-through, reinforcing the claim that "fear of floating" is a greater problem for developing economies. The average inflation rate is consistently higher and more variable in countries with a high degree of dollarization then that in countries with a low degree of dollarization.

Karakaplan (2014) investigates the relationship between external debt and inflation in 121 countries for the period of 1960 to 2004.The main variables employed in the study are inflation, external debt, growth of gross domestic product and growth of money supply. The ratio of external debt to GDP is taken as dollarization liability measure. The effects of past inflation on current inflation are controlled by taking the first lag of inflation, as an explanatory variable. Besides this, the study also uses three financial market development indicators: These indicators include share of total claims of money deposited in GDP; and share of claims of deposited money on private sector in GDP. These indicators indicate the extent to which the financial market is developed and the higher values of these indicators mean better financial market conditions.

Moreover, the effects of all variables are controlled for heterogeneity across countries. Latin American countries (LA), European Union (EU) countries, high inflation countries (HI) and transition countries (TR) are grouped, and the effects of all variables are checked for country groups in separate models. By using generalized methods of moments (GMM) two hypotheses are tested in this paper: The first hypothesis is that the external debt is less inflationary if financial markets are well developed; the second hypothesis is that the effects of the determinants of inflation are heterogeneous across countries in extent and in sign. When the effects of determinants are assumed to be

homogenous across countries, the results support the first hypothesis proposing that the external debt is less inflationary in economies with well-developed financial markets. Also, the results present that the coefficients of variables differ in country groups, which support the second hypothesis suggesting that the relationships are heterogeneous across countries.

Rashid and Husain (2010) empirically investigate the effects of capital inflows on domestic price level, monetary expansion and exchange rate volatility using linear and nonlinear cointegration and Granger causality tests. The results of their study indicate that there is a significant inflationary impact of capital inflows, in particular during the last seven years. The findings also suggest that there is a need to manage the capital inflows in such a way that they should neither create an inflationary pressure in the economy nor fuel the exchange rate volatility.

Nazir *et al* (2012) analyze the impact of capital inflows on inflation in Pakistan. The variables incorporated in this study are export, foreign direct investment, remittances, and inflation rate. Co-integration test and error correction mechanism (ECM) are used to check the long run and short run relationship of foreign direct investment, remittances, exports and inflation by using the data from 1980-2010. The results show that there is positive relationship between foreign direct investment, remittances, exports and inflation. The results of co-integrating equation show that there is long run and significant relationship.

There has been vast literature on inflation. Since inflation has become an important issue in Pakistan, which creates economic problems for the common people. A lot of literature

is available on the subject matter, highlighting various causes and consequences regarding increasing rate of inflation. Many studies have investigated determinants of inflation. So, basically inflation can be viewed in different aspects depending upon what the researcher wants to focus on. So, after reviewing the literature on inflation in Pakistan, money supply, fiscal deficit, exchange rate depreciation, oil prices, etc. are the main factors responsible for the upward trend of inflation in Pakistan.

Summarizing the literature on inflation in Pakistan, numerous studies have been carried out to check whether inflation is predominantly a monetary phenomenon in Pakistan or some other factors that give rise to inflation. Khan and Qasim(1996),Hossain (1990), Qayyum (2006) and Kemal (2006) show that inflation is mostly a monetary phenomenon. However, other studies such as Hossain (1986, 1990) Bilquees (1985), Naqvi et al (1994) and Hasan et al (1995) relate inflation to supply side bottlenecks, escalation in indirect taxes, inflationary expectations, exchange rate, inflation rate in US economy, fiscal deficits and government administrative prices. However, not a single study have used dollarization as a possible factor for imported inflation in Pakistan. So, in this research we try to find this aspect of imported inflation as possible determinant of inflation in Pakistan along with other demand-pull and cost-push factors.

Chapter 03

Theoretical Framework and Descriptive Analysis

This chapter is divided into three sections. In the first section theoretical background is given. It explains definition and types of inflation. In the second section a brief profile of inflation in Pakistan is described. In the third section descriptive analysis of each explanatory variable vis-a-vis inflation is drawn.

3.1 Theoretical Background

Inflation is a sustained increase in the general price level of goods and services in an economy over a period of time. When the general price level rises, each unit of currency buys fewer goods and services. Consequently, inflation reflects a reduction in the purchasing power of money, a loss of real value in the medium of exchange and unit of account within the economy. That is why inflation is termed as a tax on all citizens of a country who hold local currency either for transaction purposes or as an asset.

Inflation is of three kinds; demand-pull, cost-push and imported inflation. Demand-pull inflation is caused by an increase in aggregate demand. According to monetarists view, an increase in money supply leads to increase in nominal income of people. So, they increase their demand for goods and services whose supply does not change much in the short run and thus inflation rate increases. To highlight this effect which was first conceived by Fisher (1911) known as Quantity Theory of Money (QTM) Friedman (1968) made a historic statement, : "*Inflation is always and everywhere a monetary*

phenomenon". According to classical view a lot of money chasing too few goods is the most important reason of inflation.

On the other hand, according to Keynesian view, an increase in money supply reduces equilibrium interest rate. As a result, investment demand and purchase of interest-elastic consumer durables in the country goes up. On the other side, having excess cash holdings people spend more money on the same goods and services which do not change much in the short run. Consequently the price level is pushed up (Kemal 2006).

Fiscal deficit is another important determinant of inflation. Fiscal deficit means excess of expenditures over tax revenues over a given period of time usually a year. It increases aggregate demand immediately and directly while aggregate supply increases slowly. Government finances its deficit either through money creation or through internal and external borrowing. Since government expenditures are usually not financed by a proportional increase in tax revenue, therefore they create excess demand in the economy and thus create inflation. Theoretically, it is established that governments running persistent fiscal deficits have to finance them, sooner or later, by printing more money. It further ignites inflation and inflationary expectations in the country.

Cost-push inflation, also called supply shock inflation, occurs due to an increase in the prices of either primary inputs or intermediate inputs. Primary inputs include workers, raw material and energy sources like oil, gas and electricity, whereas intermediate inputs include machinery and equipment and commercial buildings. An increase in the prices of inputs decreases profit rate. Therefore, to maintain their profit level, businesses pass on rising production costs to consumers by raising prices of their products in the market. So

whenever there is an increase in the production cost of firms, they pass it on to consumers. As increase in wages and prices of other inputs is endogenous and gradual but an increase in oil prices for an oil importing country like Pakistan is exogenous and abrupt. Therefore, in this study, we concentrate on oil prices only to capture cost-push component of inflation.

Imported inflation occurs either due to increase in the foreign prices of imported goods and services or due to depreciation of the local currency that is a result of deterioration either in the current account deficit or in the capital account deficit. Current account is mainly due to deficit in trade balance while deficit in capital account is mainly due to dollarization. Dollarization hardly existed under Bretton Woods System. As all other major currencies were tied to US dollar at fixed exchange rates, while US dollar was tied to gold at the rate of $35 per ounce. The Bretton Woods system broke down in 1971. Consequently exchange rate among major currencies started floating as per market forces.

Since then a new phenomenon of imported inflation has emerged that is known as dollarization. In simple words, dollarization means replacement of local currency with a single or many foreign currencies by local people. When a currency of a country becomes weak in the sense that either it actually depreciates frequently or it is feared to depreciate in near future, then its residents no more want to keep their savings and wealth in it in cash form or in financial assets denominated in local currency. They switch to other foreign currencies. It works like self-fulfilling prophecy. That is, as soon as, residents start holding foreign currency in order to protect themselves against wealth losses due to

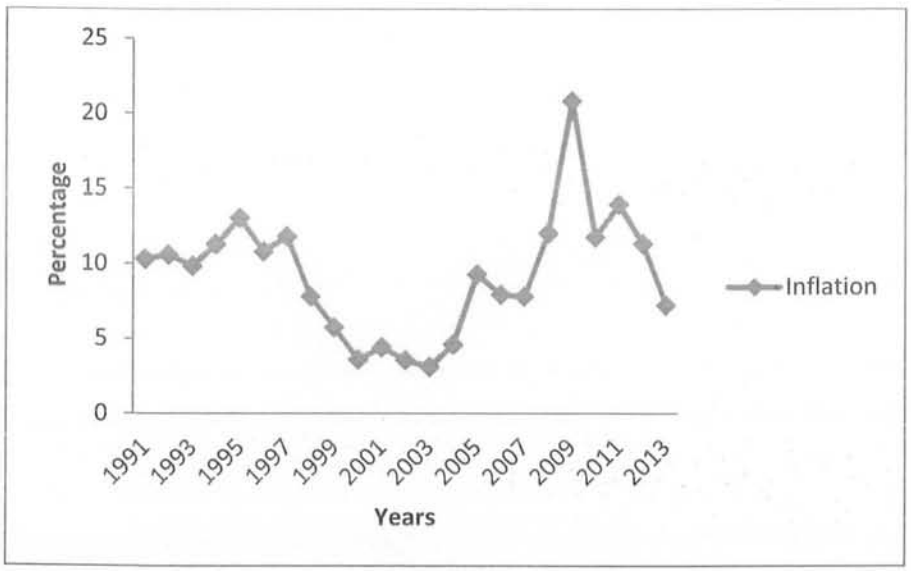
expected inflation in the country and expected depreciation of the domestic currency local currency actually depreciates (Savastano 1992).

In Pakistan, dollarization started in 1982 when Pakistan delinked Pak rupee with US dollar but it remained unofficial until 1991 residents were allowed to open foreign currency deposits in domestic banks.

3.2 Profile of Inflation

Rising inflation has severe consequences for an economy. Unfortunately, inflation in Pakistan has been quite high as can be seen from figure 01.

Figure 01: Profile of Inflation



In 1991 inflation rate was 11.8 percent, it remained same in 92 and 93. In 94 it slightly decreased to about 9 percent but went up to 13 percent in 1995. In 1996 it decreased to almost 11 percent. In 1997 it remained at 12 percent. However, inflation declined to 7

percent in 1998. it further declined to about 5 percent in 1999.The decline in inflation rate continued until it reached at 4 percent in 2000. It can be said that 1990s decade was a period of high price volatility. In 1990s, average rate of inflation in Pakistan rose to 9.47 percent. Furthermore, the increase in prices threatened to reduce the rates of return on financial assets and posed a problem for financial intermediation and alarmed capital outflow from country.

The first three years of 2000s exhibited low inflation of about 5 percent. But CPI shot up in 2004 to 9 percent and onwards as country's law and order situation deteriorated. Inflation reached to 9.8 percent in 2005. In 2006 and 2007. The inflation rates were at 7 and 7.3 percent. The inflation rose in 2008 and reached to its historical high level at 20 percent. However, after inflation rate showed downward trend in 2009 to 12 percent and in 2010 to about 14 percent. During this decade the average inflation rate is 8.5. Decade of 2000s was also a period of price volatility. From 2011 to 2013, the average inflation rate is 10.8.

So, taking theses monetary and fiscal as demand side variables, and oil prices as a supply side variable, we have included dollarization, our focal variable, as we want to see after liberalization of capital account to what extent the dollarization, a form of imported inflation has affected inflation in Pakistan. So, in the following we give brief description of the selected variables.

3.3 Descriptive Analysis of the Selected Variables

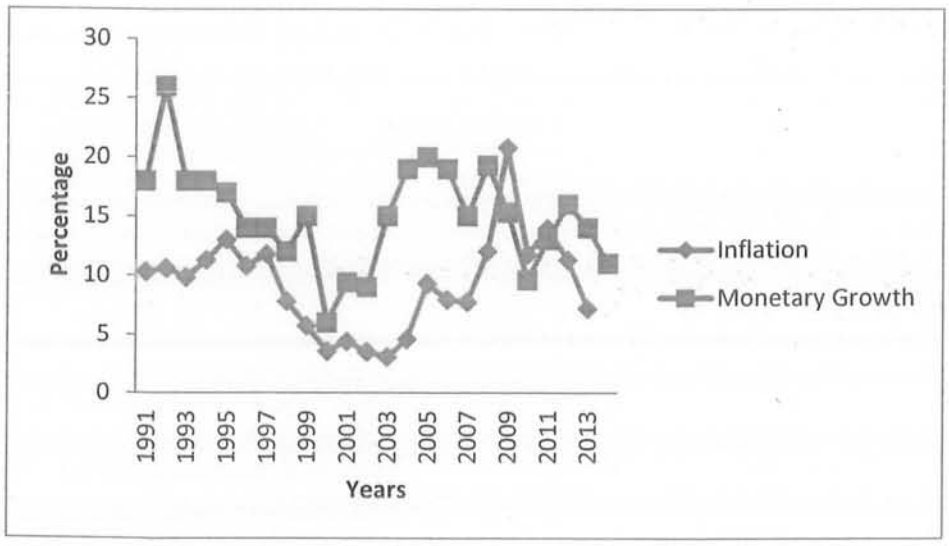
The literature identifies the following main determinants of inflation: monetary expansion, fiscal deficits, exchange rate depreciation, high import prices, wheat

procurement prices, high oil prices and other supply side constraints. However, we have focused in our model of inflation on money supply, fiscal deficit and oil prices. We have also used dollarization, a relatively new phenomenon of imported inflation, in our model of inflation to account for imported inflation in Pakistan.To support our model specification, relationship of each of our selected variables and inflation graphically in the following manner.

a) Money Supply and Inflation

As per Quantity Theory of Money (QTM) by Fisher (1911) and restatement of QTM by Friedman (1968), inflation is purely a monetary phenomenon in the long run, Pakistan's experience matches with the theory to a great extent.(Haque & Qayyum, 2006; Qayyum 2006);Kemal, 2006).Whenever money grows faster than the growth rate of real economy, it causes inflation in that economy. In Pakistan, money supply has positive relationship with inflation as can be seen from figure 02.

Figure 02: Monetary Growth and Inflation



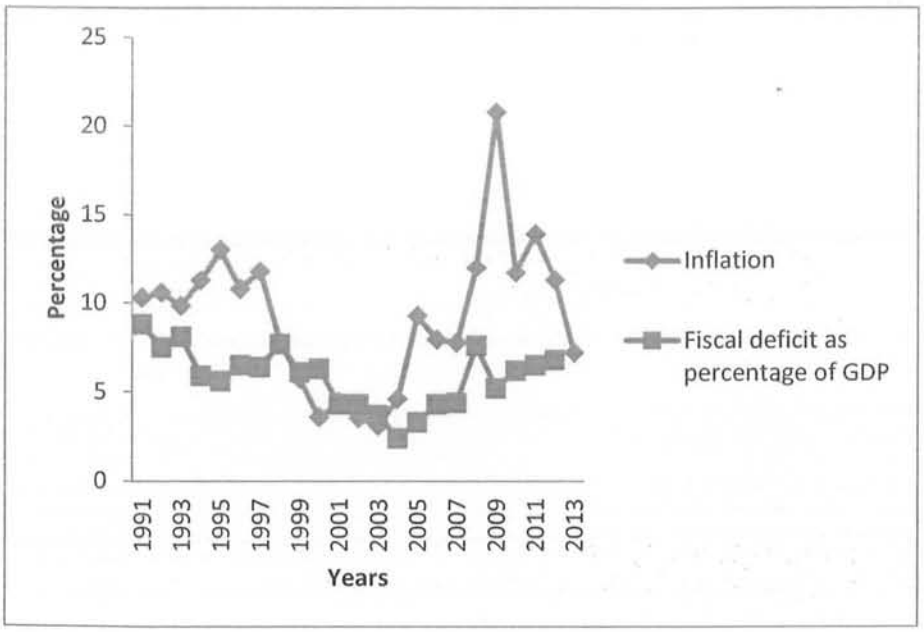
The figure 02 shows that monetary assets rose sharply 1990s. In 1991 money supply grew at a rate of 18 percent which further increased in the next year 1992 percent. Growth rate of money supply was about 18 percent in the following two years. In 1998, growth rate of money supply was 15 percent. During this decade money supply grew at an average rate 21.7 percent. Consequently, inflation also increased at an annual average rate of 9.47 percent as is evident from figure 02.

In 2001, money supply growth rate was about 0.9 percent. From 2002 to 2008, growth rate of money supply was in double digits. Inflation rate followed the same trend as that of monetary growth during this period. During 2000, monetary growth showed volatile trend with average rate of 15 percent. Figure 02 shows a long-run association between money supply and inflation.

b) Fiscal Deficit and Inflation

Fiscal deficits also play an important role in explaining price fluctuation. Expansionary fiscal policy fuels domestic demand and puts pressure on the current account deficit. Pakistan's fiscal policy has remained expansionary in the last two decades as can be seen from figure 03.

Figure 03: Fiscal Deficit and Inflation



In 1991 the fiscal deficit was 8.8 percent of GDP which rose to about 8 percent in 1993. In the next few years it declined to about 6 percent, however after nuclear explosions in 1998 it rose to 7.7 percent. It stood at 7.6 percent which further grew to 8.2 percent of GDP in 2013.The average fiscal deficit during this decade is about 6.89.

During the first five years of 2000s fiscal deficit was relatively low, the reason may be an increase in capital inflows as Pakistan was an ally on war on terror. However, after 2005 it continued to increase as due to heavy government expenditures and low tax collections. The correlation coefficient between inflation and fiscal deficit is 0.33. Average budget deficit during this decade is 4.57. So, in our model we have also included fiscal deficit as a possible determinant of inflation and it is expected to have a positive sign.

c) Oil Prices and Inflation

Oil in general is used in the production of so many goods and services. If oil is used as an input in the manufacturing of a good then with an increase in oil price cost of production of that good increases, which will result in the increase in the price of that good. Oil prices affect transportation costs which in turn affect the prices of a variety of goods and services, as producers may pass this burden on to the consumers by raising prices of their products in order to maintain their profit. Similarly, an increase in prices of oil can cause cost-push inflation in an oil importing economy.

Pakistan being a small oil importing country has little control on oil prices so an increase in prices petrol and petroleum products makes Pakistan's imports costlier and hence increases the overall cost of production in Pakistan. High oil price cause an increase in prices of almost all other commodities of the consumer bundle. (Haque& Qayyum; 2006). Figure 04 illustrates oil prices and inflation relationship graphically.

Figure 04: Oil Prices and Inflation

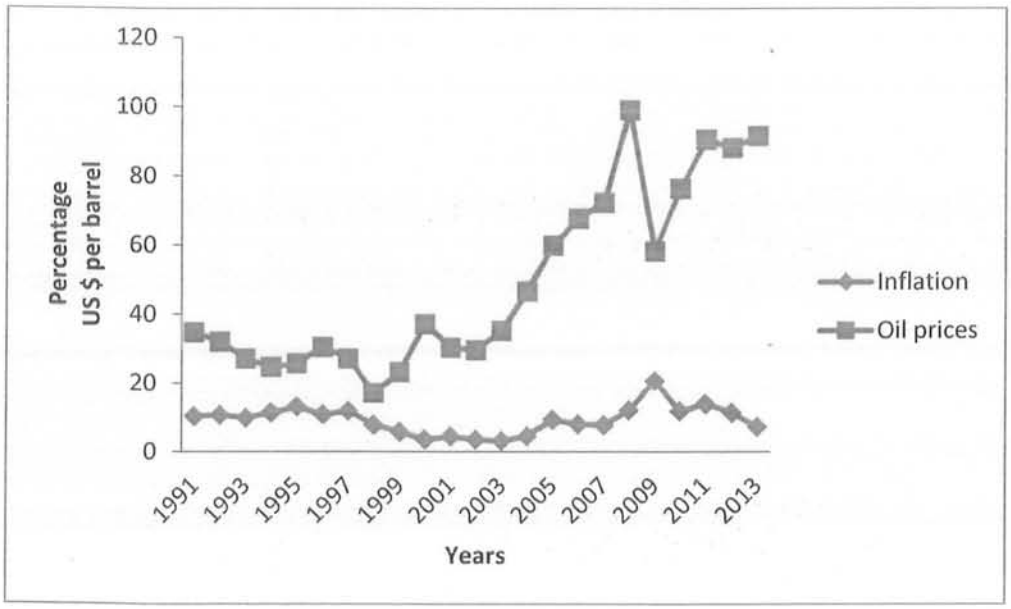


Figure 04 shows that there is a positive relationship between oil prices and inflation. In 1990s average rate of oil prices is 27.91. In 2000s average rate of oil prices is 57.53 and from 2012 to 2013 average rate is 90.05. Inflation is high when oil prices are high as oil prices affect the entire basket of CPI as is evident in 1995, 2005 and 2008. The correlation coefficient between oil prices and inflation is 0.28. The coefficient of this variable is also expected to have a positive value.

d) Dollarization and Inflation

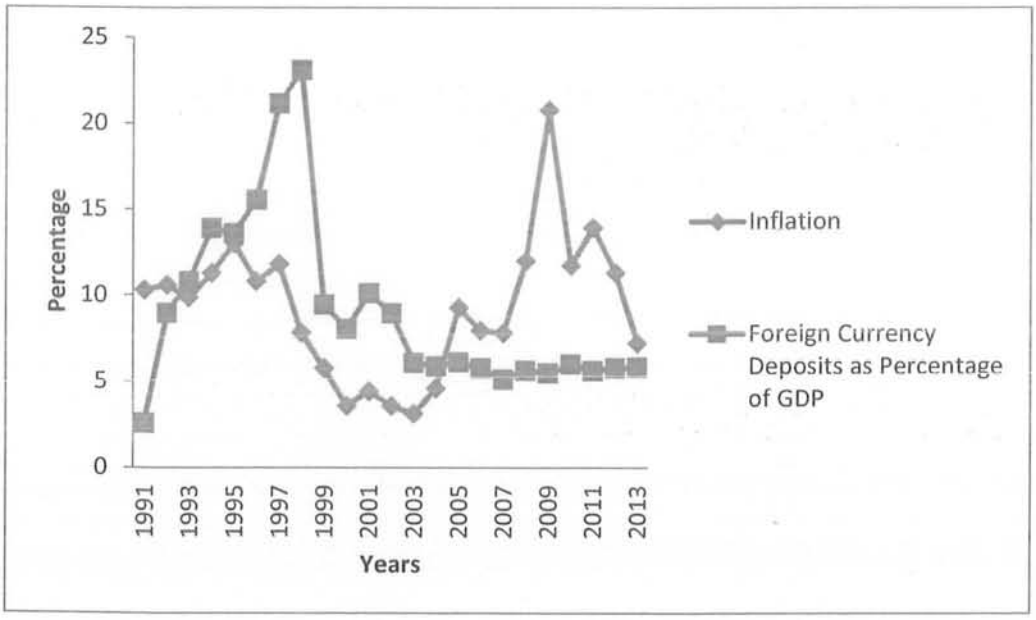
The importance of foreign currency holdings as a hedge against inflation emerged after collapse of the Bretton Woods System in1971when the liberal exchange rates among major currencies is no more fixed. They were allowed to vary against one another. Individuals and investors in each country in general and in developing countries with weak currencies in particular responded to this change by increasing their holdings of strong foreign currencies and decreasing their holdings of local weak currencies. Strong currencies are known as safe haven. These currencies mainly include US dollar, UK pound sterling, Japanese yen and Euro.

In Pakistan, unofficial dollarization started when Pakistan finally delinked Pak rupee with US dollar in 1982. However, official dollarization started in 1991 when local people were permitted to open their accounts in foreign currency in the domestic banks. The high and variable rates of inflation and exchange rate depreciation together with the limited flexibility in rates of return on bank deposits denominated in rupees made foreign currencies and financial assets denominated in foreign currencies more attractive as stores of value.

These foreign currency deposits contributed a large proportion of the growth in money supply in the mid-1990s.One main source of inflows are remittances of Pakistani workers working abroad. Therefore an increase in foreign currency deposits are closely linked to earnings of Pakistanis working abroad

Depositors are attracted to foreign currencies primarily denominated in US dollars because they offer a safe haven against domestic inflation and depreciation. Since Pakistani rupee has experienced frequent depreciations, therefore conversion of one's savings and wealth in these foreign currency deposits was very favorable; especially for those whose consumption bundle contained many imported goods.

Figure 05: Dollarization and Inflation



In 1991dollarization increased to a significant extent until it reached at 23percent in 1998. If we look at the graph in Figure 05 then it shows a positive relationship between dollarization and inflation from 1991 to 1998. The average dollarization during 1990s

is12.7 while it declined to about 6.5 during 2000s. Dollarization in Pakistan started in and it reached at its peak point in 1998 at about 23 percent. However the scenario changed drastically when Pakistan conducted nuclear tests in May 1998 in response to Indian nuclear tests. Economic sanctions were imposed on Pakistan which weakened our currency further. Moreover, government's decision to freeze foreign currency accounts further shattered the confidence of local people about security of their deposits in domestic banks. It resulted in massive capital flight witnessed never before so dollarization decreased to about 9 percent. As a result, dollarization must have increased in subsequent years but data showed it constant. The reason for this doubtful trend of dollarization may be that after 1998, people lost trust on domestic banks and preferred to keep their foreign currency either in foreign banks which is a substitute of capital flight or retained their savings in foreign currency cash. The correlation coefficient between inflation and dollarization is 0.08.

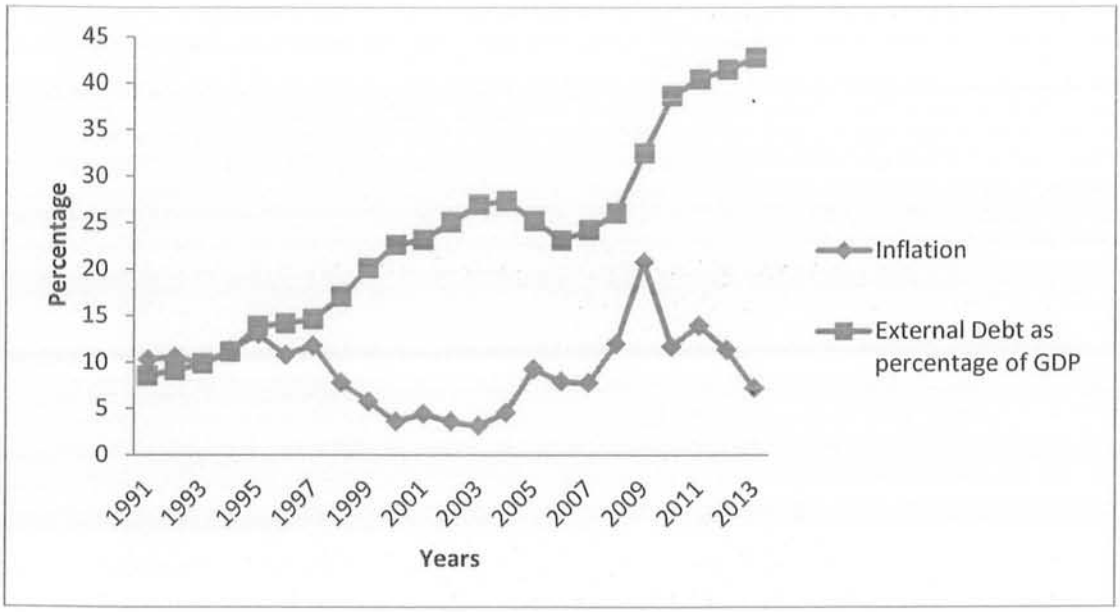
From the late 1990s, dollarized economy was considered as the economy in which the domestic residents in the context of high levels of inflation and expectations or fear of exchange rate depreciation held foreign currency or financial assets denominated in foreign currency to protect the real value of their wealth.

Recently a new strand of literature developed after East Asian Crisis, the concept of liability dollarization. It refers to borrowing of government and private sector denominated in foreign currency effect the economies and makes the countries vulnerable to external shocks. More recently, the concept of *liability dollarization* has stressed the role of foreign currency borrowing by the private and public sectors (Reinhart 2003). In emerging markets, external debt is denominated almost entirely in large, developed

country currencies such as the U.S. dollar, Japanese yen and Euro. Due to dollarization exchange rate depreciation can lead to fluctuations in the economy. For an economy the external sector is also important, which carries through to the balance of payments as the current account exhibits greater flows, and surpluses or deficits must be carried through the capital account.

Pakistan's external balance of payment position is also of great concern due to high external debt obligations. Low levels of tax revenues and large unproductive government expenditures and international prices have created the problem of fiscal deficit in Pakistan. Figure 07 shows that foreign debt and inflation show similar upward trend. It is evident from figure 07 that extrnal debt showed a sharp rise during both the decades. This burden of debt slightly declined during 2004 to 2007 however, after that it again rose shaply. Pakistan's external debt increased substatiall in the last eight years. Apparently extrnal debt and inflation has positive correlation.

Figure 06: Foreign Debt and Inflation



When fiscal deficit is high then external debt may be used to increase government consumption instead of increasing investment expenditures. With deteriorating balance of payment situation in Pakistan, foreign debt also contributes to the increase in inflation as Pak Rupee is depreciating against dollar which increases the debt service burden of Pakistan.

In short, money supply growth, persistent fiscal deficits in Pakistan are responsible for high inflation. Pakistan is also experiencing external imbalances. As graphical representation in these selected variables alone do not provide a complete scenario and further econometric analysis is needed to find out the role of these factors in affecting inflation in Pakistan.

Chapter 04

Data and Methodology

Chapter four consists of three sections. In the first section, we present our model of inflation. In the second section, data and construction of variables are discussed. In the third section, econometric methodology for estimation of the model is discussed. It is further subdivided into six parts: At first, we check stationarity of our time series data by applying two unit root tests namely Augmented Dickey Fuller (ADF) and Phillips Peron (PP) tests. In subsection two, lag selection criterions are discussed. In subsection three, Wald test is explained. In subsection four, estimation method for long run coefficients of the models is presented. In subsection five, error correction model is discussed. In the last sub-section, diagnostic tests which include tests for serial correlation, heteroscedasticity, normality, specification and stability tests are explained.

4.1 The Model

Inflation is caused by demand-pull, cost-push and external factors. There are further many factors to explain each type of inflation. However to keep the model simple and manageable we have included one or two most important factors of each type of inflation in our model. Specifically, in our equation we have included money supply and fiscal deficit to represent demand pull inflation, oil prices to indicate cost push factor of inflation and dollarization to capture imported inflation. Hence, our specific inflation model takes the following form.

$$Inflation = f(MoneySupply, Fiscal\ Deficit, Oil\ Prices, Dollarizan) \quad (1)$$

Symbolically, the above model can be written as:

$$P_t = a_0 + a_1 M_t + a_2 FD_t + a_3 O_t + a_4 D_t + e_t \quad (2)$$

Where P denotes inflation rate, M denotes money supply, FD indicates fiscal deficit, O represents oil prices, D stands for dollarization, e is the error term and subscript t indicates that the data used in our model is time series. Since data on the common measure of dollarization, foreign currency deposits in domestic banks, becomes doubtful after 1998, therefore we have used an alternative measure of dollarization, that is, external debt denominated in foreign currency. As a result, we have estimated two equations each with different definition of dollarization. The detail of each variable is as follows:

4.2 Data and Construction of Variables

4.2.1 Inflation Rate

In our model, inflation is the dependent variable. There are different methods and sources of data to measure inflation for example consumer price index (CPI), GDP deflator, whole sale price index (WPI) and sensitive price index (SPI). Out of them, the first one is the most commonly used method. So in our model, we have measured inflation rate from consumer price index (CPI). Despite the fact that consumer price index has limited coverage, it is the most common measure of inflation and is frequently used in empirical studies (Agha and Khan, 2006). CPI shows the annualized percentage change in the prices of selected consumer goods. In other words, it reflects the costs of acquiring a

fixed basket of goods and services by an average consumer. It covers the retail prices of 374 items in 35 major cities, in 71 markets and for 10 commodity groups. It supposedly reflects the changes in the cost of living of an average consumer.[1] The data on this variable is taken from various issues of Pakistan Economic Survey.

4.2.2 Money Supply

Money supply is an independent variable in our model. Money is measured differently like M_0, M_1, and M□ and so on. M_0 includes currency notes and coins. M_1 is the sum of currency in circulation, demand deposits, traveler's checks and other checkable deposits. M_2 aggregates M_1 plus time deposits and the resident foreign currency deposits. Most of the studies have used M_2 as a measure of money supply (Qayyum; 2006) so in this study also, M_2 is used as the measure of money supply. Transmission channel of money supply to aggregate demand sheds light on the relationship between money supply and inflation. According to the quantity theory of money (QTM), an increase in money supply immediately leads to higher price level, as in this case more money chases few goods. According to Keynesian channel, an increase in money supply reduces interest rate. As a result investment and purchases of consumer durable goods which are usually paid in installments increase which accelerates aggregate demand. Consequently inflation increases. Hence, the sign of M is expected to be positive. The data on this variable is taken from various issues of Pakistan Economic Survey.

[1] Pakistan Bureau of Statistics.

4.2.3 Fiscal Deficit

Fiscal deficit (FD) is another independent variable to measure the excess of government expenditures over its tax revenues. When a developing country like Pakistan runs fiscal deficits, then it must resort either to printing of new money or finances it by borrowing externally or internally. When financed by borrowing, fiscal deficit causes a mild inflation because money supply remains unchanged, only its velocity increases. On the other hand, when financed by printing new money, it causes a high inflation because the resulting increase in money supply puts further pressure on general price level. Therefore, The expected sign of fiscal deficit is positive as it affects inflation positively. The data on this variable is taken from various issues of Pakistan Economic Survey.

4.2.4 Oil Prices

Oil prices are also an independent variable in our model. High oil prices significantly affect Pakistan's import bill. Rising oil prices affect the overall consumer price index (CPI) directly by increasing the cost of energy-related items, such as transportation costs, gas, and electricity. An increase in the price of oil also affects the prices of all other goods and services in general and manufacturing goods in particular because oil is a major input in their production process and in their transportation from the place of production to commodity markets.

4.2.5 Dollarization

Dollarization is also an independent variable. Dollarization reduces the inflation tax for general public and lowers the incentive to inflate for government. (Suarez; 1992).

Dollarization contributes to a loss of control over monetary policy because an increase in the supply of local currency is countered by general public as they convert it into foreign currency immediately. Thus monetary policy becomes an ineffective tool of demand management policies. We expect the sign of dollarization index to be positive.

Generally, dollarization indicates holding of foreign currency by local people. They hold foreign currency in three forms: foreign currency in cash, foreign currency deposited in domestic banks, and foreign currency deposited in banks outside the country. Usually no data exist on foreign currency circulating in an economy, or if it exists then it has serious limitations. The amount of foreign currency deposited abroad by local residents is also generally not declared to local authorities

So, the only reliable data source of dollarization is resident foreign currency deposits in domestic banks. However, unusual or doubtful trend in data after nuclear explosion on this measure in case of Pakistan strongly indicates that this measure has understated the actual degree of dollarization in Pakistan. The data on this variable is taken from various issues of Pakistan Economic Survey.

Another measure of dollarization could be debt of private and public sector denominated in foreign currencies. This concept of dollarization got popularity after the East Asia Crisis of the late 1999s which is called "external liability dollarization". Foreign currency borrowing by private sector is usually not made public. Therefore, external debt of the public sector is adopted a coarse measure of dollarization.(Reinhart; 2003). So, due to doubtful trend in the popular definition of dollarization after nuclear explosions and freezing of foreign currency accounts by the government, we have also used this

definition. This variable is supposed to have a positive coefficient because an increase in dollarization whether in the form of resident foreign currency deposits or in the form of external borrowing of public sector causes the local currency to depreciates. The data on this variable is taken from World Development Indicators (WDI).

4.3 Econometric Methodology

Time series data is mostly non-stationary; that is, it has unit roots at levels which implies that the variables are not integrated of order zero or I(0). As a result, Ordinary Least Square (OLS) method of estimation yields spurious results. If the data on some or all variables is non-stationary, then researchers make use of the co integration techniques to estimate any relationship among the variables of a given model.

Of the various co-integration techniques, the most popular techniques are; residual based Engle-Granger single equation approach (Engle & Granger ;1987), Johanson-Juselius approach (JJ) (Johanson & Juselius; 1990) which is the multiple equation approach and the single equation auto regressive distributed lag (ARDL) approach (Pessaran et al 1997, 1991, 2001) to test the long run equilibrium relationship among the variables. This study employs ARDL approach to co-integration.

The ARDL model has three main advantages over the other integration approaches. First, the ARDL technique is more flexible relative to the other two techniques as it can be applied when the order of integration in a model is not same. That is, some variables are integrated of order one or I (1) or integrated of order zero I (0), however this technique is invalid if some of the variables are integrated of order two or I (2).(Pesaran and Pesaran 1997).

Lags of dependent and the independent variables can be introduced in the model. A model is called "Autoregressive" if it includes lags of the dependent variable only. The past values of the dependent variable are allowed to determine its present value. A model is called "distributed lag" if it includes lags of the explanatory variables as well. This is an important characteristic of a good model. It shows that not only the current values but also lag values of independent variables can affect the dependent variable. Relevant past values of each variable may be different depending on various factors.

Second, this technique is comparatively more robust in small or finite samples. As demonstrated by Pesaran and Shin (1999), the small sample properties of the ARDL approach are superior to that of the Johansen co integration approach, which requires a large sample size for the results to be valid. Moreover, results of Engel Granger (1987) and Johansen Juselius (1990) techniques are also not very reliable in case of small sample size data (Mah; 2000). In real world, it is not easy to get large samples size, so some researchers use monthly and quarterly data to increase their observations. But the reliability of their results does not increase as in this way they are merely increasing their number of observations but not the actual time period. (Hakkio and Rush (1991).

Third, the ARDL model applies general to specific framework by taking sufficient number of lags to capture the data generating process. It estimates $(p + 1)K$ number of regressions in order to obtain an optimal lag length for each variable, where p is the maximum lags to be used, and k is the number of variables in the equation. The ARDL approach yields consistent estimates for small span of data.

In short, in face of small sample size, different order of integration and endogeneity, the autoregressive distributed lag (ARDL) approach developed by Pesaran, Shin, and Smith (2001) is used to establish the long-run and short run relationship among the variables. The first step for analysis of time series data is to check its stationarity or unit roots.

4.3.1 Unit Root Tests

Since our data is time series, therefore, we start from checking stationarity of all the variables under consideration. Although ARDL approach does not require same order of integration for all variables of the model, yet we need to apply stationarity test to ensure that none of the variable is integrated of order 2 as ARDL technique is not valid for I(2) variables. We have applied two tests of stationarity, Augmented Dickey Fuller (1979) and Phillips Perron (1988) tests, though some other unit root tests are also available.

4.3.1a Augmented Dickey Fuller (ADF) Test

Let us suppose x_t is an autoregressive data generating process of a data series, then

$$\Delta x_t = \alpha x_{t-1} + e_t \qquad (3)$$

This test is proposed by Dickey and Fuller and it states that the unit roots in the above autoregressive data generating process is exactly the same as in the non-stationary process. The null (the series has unit root) and alternative (the series has no unit root) hypotheses are:

H_0: $\alpha = 1$, H_1: $\alpha < 1$

Then Dickey and Fuller later introduced more lags of the regressand in order to capture the higher order auto correlation problem.

$$\Delta x_t = ax_{t-1} + +u_t \qquad (4)$$

The regression equation (4) is called the ADF where *i* is the number of lags included in this equation. Besides these equations, Dickey and Fuller also suggested equations to check the stationary of the time series data with drift and with a trend (t). These equations are known as Augmented Dickey Fuller Test (ADF) with intercept and ADF test with trend as shown respectively.

$$\Delta x_t = \emptyset_\circ + \alpha x_{t-1} + \sum_{i=1}^{k} \beta \Delta x_{t-1} + u_t \qquad (5)$$

$$\Delta x_t = \emptyset_\circ + \varphi_t + \alpha x_{t-1} + \sum_{i=1}^{k} \beta \Delta x_{t-1} + u_t \qquad (6)$$

The decision whether the time series has unit root or not depend on the acceptance and rejection of the null and alternative hypotheses.

4.3.1b Phillips Perron Test

In the Dickey Fuller Test, the problem of unit root is tested by including different number of lags in the regression equation. Phillips and Perron (1981) modify the ADF test by correcting the "t" values of the parameter in the equation to tackle the auto correlation in the error term.

After checking stationarity the ARDL technique is estimated at four different stages that are lag selection, Wald test, long run estimates and error correction estimates. The Auto Regressive Distributed Lag Model (ARDL) takes the following general form.

$$\Delta P_t = \alpha_0 + \alpha_1 P_{t-1} + \alpha_2 M_{t-1} + \alpha_3 FD_{t-1} + \alpha_4 O_{t-1} + \alpha_5 D_{t-1} + \alpha_6 \sum_{i=1}^{p} \Delta P_{t-i}$$

$$+ \alpha_7 \sum_{i=0}^{p} \Delta M_{t-i} + \alpha_8 \sum_{t=0}^{p} \Delta FD_{t-i} + \alpha_9 \sum_{t=0}^{p} \Delta O_{t-i} + \alpha_{10} \sum_{t=0}^{p} \Delta D_{t-i} + \varepsilon_t \quad (7)$$

Where α_0 is the intercept parameter, p is the number of lags and εt is white noise in the model. α_1, α_2, α_3, α_4 and α_5 are the long run parameters on the independent side showing long run relationship. Moreover, the terms with summation and delta signs represent the error correction short run estimates.

4.3.2 Lag Selection Criterion

The ARDL approach has two steps to calculate F-statistic for co-integration. The first step is to select the lag length of ARDL model. Therefore, before estimating ARDL model, optimal number of lags is selected on the bases of different lag selection criteria. These criterion include Log Likelihood Ratios (LR), Log likelihood test (LL), Schwarz Bayesian Criterion (SBC) and Akaike Information Criterion (AIC).The Null hypothesis for all these selection criteria is this that the selected order of lag is optimal.

4.3.3 Wald Test

After optimal lag selection, the next step of the ARDL approach is to investigate the long run relationship of the selected ARDL model. For that purpose, Pesaran and Pesaran (1997) suggest Wald or F-test. This Wald or F-test is used to test the significance of lagged levels of the variables which are considered in a unrestricted equilibrium error

correction model. The null (no co integration exists among the variables) and alternative hypotheses for long run relationship are:

H_0: $a_i = 0$, H_1: $a_i \neq 0$ at least one α is not equal to zero.

The decision is taken on the basis of critical values of F- statistic given by Pesaran et al (2001).These F-values are based on I (0) and I(1) data generating process. If the calculated value F statistic is greater than the critical or tabulated value of I (1) that value is considered as an upper bound, then the null hypothesis is rejected which implies that there exists long run relationship. On the other hand, if calculated Fvalue is less than the critical lower value of F-table ,that value is considered as a lower bound, then the null hypothesis is accepted which implies that there is no long run relationship among the variables. However, if the calculated F-value lies in between I (0) and I (1) tabulated F-values then the result becomes inconclusive. Since the calculated F-value is compared with critical I (0) and I (1) values, therefore ARDL technique is not valid for I (2) data series.

4.3.3 Long run Estimates of the ARDL Model

If there exist long run relationship among the selected variables in the model, the next step involves the estimation of long run equilibrium coefficients of the selected ARDL model. The general form of the ARDL model is given in equation (7) alone.

4.3.4 Error Correction Model

After estimating the long run relationship among the variables using selected ARDL model, then we estimate the short run estimates of the model. The short run coefficients

are estimated by retrieving an error correction model from ARDL model through a simple linear transformation. Error correction model integrates short-run adjustments with long run equilibrium without losing long run information. The error correction term represents the speed of adjustment or speed of convergence of the dependent variable to the long run equilibrium after a short run shock in an explanatory variable. The low value of the coefficient of the error correction term means slower adjustment in inflation rate after any exogenous shock. It is expected that the sign of error correction term should be negative with high level of significance. The appearance of ECM with a negative sign and significance ensures that an established long run relationship can be attained.

So the error correction model along with short run coefficients is established in the form of the following equation.

$$\Delta P_t = \alpha_0 + \alpha_1 ECM_{t-1} + \alpha_2 \sum_{i=1}^{p} \Delta P_{t-i} + \alpha_3 \sum_{i=0}^{p} \Delta M_{t-i} + \alpha_4 \sum_{t=0}^{p} \Delta FD_{t-i} + \alpha_5 \sum_{t=0}^{p} \Delta O_{t-i} + \alpha_6 \sum_{t=0}^{p} \Delta D_{t-i} + \varepsilon_t \quad (8)$$

4.4 Diagnostic Tests

In the end the fitness of the model is tested by different diagnostic and stability tests.The diagnostic tests include serial correlation, functional form, normality of the residuals and hetero-scedasticity. Ramsey reset test is used to test whether the functional form of the estimated model is correct or not . Breusch Godfrey serial correlation LM test is used to

test the presence or absence of serial correlation. Jarque Bera test is used to test the normality of the residuals. ARCH test is used to the presence or absence of hetero-scedasticity.

4.4.1 Stability Test

Pesaran and Pesaran (1997) suggest cumulative sum of recursive residuals (CUSUM) and cumulative sum of recursive squares of residuals (CUSUMSQ) tests for testing the stability of the model presented by Brown et al (1975).The CUSUM and CUSUMSQ statistics are updated recursively and plotted against the break points. If these plots stay within the critical bounds of 5 percent level of significance, the null cannot be rejected. The null hypothesis is that of all the coefficients in the given regression are stable.

Chapter 05

Results and their Discussion

This chapter is organized in the five sections. In section one, we establish the order of integration of each variable to ensure that none of the variable is integrated of order 2. For this purpose, results of ADF and PP tests are given. In section two, results of lag selection criterion are presented. In section three, results of Wald test are presented. In section four, long run estimation results are discussed. In section four, results of short run coefficients and ECM coefficients are presented. In the last section, results of diagnostic analysis and stability tests are given.

5.1 Results of Unit Root Tests

First we have used ADF test on all the variables to check the unit roots of the series. The results are reported in Table 01.

Table 01: Results of ADF Test

Series	At Levels		At First Difference		Order of Integration
	Intercept	Intercept & Trend	Intercept	Intercept & Trend	
P	-1.27	-3.91	-2.03	-3.79*	I(1)
M	-0.21	-3.65	4.04*	3.67*	I (1)
FD	-1.95	-1.56	-5.63**	-5.98**	I(1)
O	-1.16	-2.09	3.49**	-4.08**	I(1)
D (FCD)	2.61	-5.37*	NA	NA	I (0)
D (ED)	-1.18	-1.82	3.10*	3.04**	I (0)

*,** indicate the significance of test statistics at 5 percent and 10 percent level of significance respectively against the null hypothesis of unit root. The critical values for ADF test were taken from Mackinnon (1991).

Based on the ADF test statistics, it is found that dollarization variable measured as foreign currency deposits in domestic banks is stationary at level i.e., it is integrated of order zero. However, all other variables inflation rate, money supply, fiscal deficit, oil prices and dollarization measured as foreign debt have unit roots at level. These variables become stationary after first difference i.e., these are integrated of order (1). As the order of integration is not same for all variables, so it provides a justification for applying the ARDL approach to co-integration developed by Pesaran et al. (2001).

Besides ADF test, we have also used another test of stationarity i.e., Phillips-Perron (PP). The PP test is generally used when there are structural breaks in the data. The results of PP test are reported in the following table 02.

Table 02: Results of PP Test

Series	At Levels		At First Difference		Order of Integration
	Intercept	Intercept & Trend	Intercept	Intercept	Intercept & Trend
P	-1.19	-1.85	-2.16	-2.27	I (1)
M	-1.16	-2.29	-3.29	5.96	I (1)
FD	-1.97	-1.40	NA	NA	I(0)
O	1.17	-1.57	3.27	3.36	I (1)
D (FCD)	2.73	5.06	NA	NA	I (0)
D (ED)	2.73	-1.82	3.90	-4.03	I (1)

The results of PP test indicate that all the variables have unit roots at level, however, stationary at first difference except fiscal deficit and dollarization index measured as foreign currency deposits in domestic banks which is stationary at level. If the order of integration of the variables in the model is not same then residual based Engel-Granger and Johansen-Juselius co-integration techniques cannot be applied. In such a situation,

Pesaran *et al.* (2001) suggest to apply ARDL techniques for testing the existence of long-run relationship among variables in levels. It is applicable when some variables are I (1) or others are of I (0).

5.2 Results of the Lag Selection Criterion

It is important to select optimal lag length because auto regressive models are very sensitive to the number of lags included in the model. Table 03 shows the results of lag selection criterions. LR and SBC criteria suggest 1 lag length for model 1 and model 2. While AIC suggests 3 lag length for model 1 and 1 lag length for model 2. As our sample span is very small, hence, we follow1 lag length as selected by LR and SBC.(Ang; 2010).

Table 03:Results of the Lag Selection Criterion

Lag	Model 1			Model 2		
	LR	AIC	SBC	LR	AIC	SBC
0	NA	-4.499918	-4.251381	NA	-4.492656	-4.244119
1	6.426639*	-4.889011	-4.590767*	5.700515*	-4.825894*	-4.527650*
2	0.003043	-4.784002	-4.436051	0.198096	-4.737139	-4.389188
3	3.283998	-4.977284*	-4.579625	1.642712	-4.781213	-4.383555

As ADF and PP test show that some data series have I(0) and some data series are I(1) but none 1(2).Therefore, ARDL technique is the appropriate technique for testing the co-integration. After selecting the optimal lag lengths, the next step is to apply Wald test for establishing long run relationship.

5.3 Results of Wald Test

We have tested the existence of long-run relationship for the estimated ARDL equation by applying Wald or F-test. Table 04 shows that calculated values of F statistic are 3.99 and 4.27 for model 1and for model 2 respectively. For model 2 the calculated F-value is 4.27. Both the calculated F-values are greater than upper bounds (2.62 – 3.79) observed from table with unrestricted intercept and no trend at 5 percent level of significance. This indicates the existence of long-run relationship among the variables included in the model.

Table 04: Results of Wald or F-Test at 5% Level

	Calculated F value	Critical Lower Bound	Critical Upper Bound	Result
Model 1	3.99	2.62	3.79	F-test is conclusively significant
Model 2	4.27	2.62	3.79	F-test is conclusively significant

5.4 Results of Long-Run Estimates of the ARDL Model

After Wald test, we have estimated the long run ARDL model by Ordinary Least Square (OLS). Table 05 shows the results of long run coefficients of model 01 and model 02.

Table 05: Results of Long-Run Estimates of the ARDL Model

	Model 1			Model 2		
Variable	Coefficients	t-values	Probability	Coefficients	t-values	Probability
Constant	-1.44	-8.23	0.000	-2.61	-4.50	0.000
M	0.45	7.66	0.000	0.63	6.35	0.000
FD	0.119	2.66	0.015	0.13	2.70	0.040
O	0.08	2.47	0.023	0.12	0.43	0.065
D	0.016	0.99	0.331	0.07	2.19	0.041

Test	Model 1		Model 2	
Adj. *R2*	0.78		0.88	
DW Stat	2.32		2.27	
Diagnostic Test Statistics	F-statistics	Probability	F-statistics	Probability
Jarque-BeraTest for Normality	0.463	0.232	0.356	0.121
Breusch-Godfrey LM Test for Serial correlation	3.11	0.146	4.125	0.325
ARCH Test for Hetroschedasticity	0.737	0.482	1.398	0.986
Ramsey'sRESET Test for Functional form	0.316	0.341	0.353	0.653

For model 01, the results indicate that the coefficient of the money supply is 0.45 that is positive and statistically significant. The magnitude implies that 1percent increase in money supply increases the inflation rate by 0.45 percent. These findings support that money supply is a major contributor of inflation in Pakistan. These results are consistent with the findings of Qayyum (2006) and Kemal (2006).

The sign of fiscal deficit is positive implying that fiscal deficit affect inflation in Pakistan. The magnitude of the coefficient of the fiscal deficit is 0.12. It means that 1 percent increase in the fiscal deficit increases inflation in Pakistan by 0.12 percent. This implies that an increase in fiscal deficit creates demand pressure in the economy that in turn fuel iflation. These results are in line with the findings of Shabbir and Ahmed 1994.

Similarly, the coefficient of oil price is 0.08 which indicates that increase in the oil price increases the inflation rate in Pakistan. The value of coefficient implies that 1 percent increase in the oil price causes the prices to increase by 0.08 percent. The results appear to be significant in both the models. These results imply that huge import bills deteriorating balance of payment position of Pakistan. Consequently, it results in an increase in the general price level.

However, the coefficient of the dollarization in model 01 has positive sign. But the magnitude of the coefficient is small as well as insignificant implying that this type of dollarization in Pakistan does not have significant effect on inflation in Pakistan. This may be due to doubtful data on estimates of dollarization in the Pakistan economy. The unexpected trend in data after nuclear explosion and freezing of accounts by the government and due to sanctions imposed on Pakistan, Pak rupee depreciated significantly. Consequently, dollarization increased in Pakistan after nuclear explosion. Since data on foreign currency deposited abroad and foreign cash held by residents are not available, the dollarization data is based on foreign currency deposits in domestic banks only, this data underestimate the dollarization and are downward biased. (Mirakhor and Zaidi; 2006).

Due to high transaction costs in the banking system, lack of confidence in the banks, delays in the provision of banking services and due to high administrative costs, the currency-to-deposit ratio in Pakistan is very high as compared to other developing countries. For this reason, one would expect that there are large foreign currency cash holdings in Pakistan and the official data of dollarization provides a lower limit for actual estimates of dollarization.

In model 02, results of long run coefficients for dollarization index change when we use foreign debt as our dollarization variable. In this case, as we know that dollarization index is measured as external debt as a share of GDP. In the long run, this type dollarization significantly affecting inflation in Pakistan as coefficient of the dollarization is positive and significant. The magnitude of the dollarization coefficient is 0.07 implying that 1percent increase in dollarization increases inflation in Pakistan by 0.07 percent.

However, the proxy for dollarization is imperfect to say the least. A better approach is to construct an index of dollarization focusing on external debt and foreign currency holdings of commercial banks. This will more accurately reflect the dollarization of the economy.

5.5 Results of Error Correction Model

Table 06 reports the short run coefficient estimates obtained from the error correction method for model 01 and model 02.

Table 06: Results of Error Correction Model

Dependent Variable = ΔP						
	Model 1			**Model 2**		
Regressors	Coefficients	t-values	p- value	Coefficients	t-values	p-value
ΔP(-1)	0.21	5.43	0.00	0.32	-4.62	0.05
ΔM	0.25	5.67	0.06	0.36	2.09	0.01
ΔFD	0.07	0.39	0.47	0.11	0.95	0.58
ΔD	0.06	2.27	0.04	0.04	-1.07	0.16
ΔO	0.08	-2.08	0.03	0.14	-3.06	0.05
ECM(-1)	-0.62	-4.089	0.01	-0.59	-1.82	0.09
Constant	0.04	0.22	0.82	1.23	3.26	0.39

Test	**Model 1**		**Model 2**	
Adjusted *R* Square	0.769		0.89	
Durbin Watson Statistics	1.71		1.90	
Diagnostic Test Statistics	F-statistics	Probability	F-statistics	Probability
Jarque-Bera Test for Normality	0.373	0.547	0.345	0.589
Breusch-GodfreyLM for Serial correlation	2.331	0.246	3.323	0.238
ARCH Test for Heteroskedacticity	2.32	0.125	0.800	0.337
Ramsey'sRESET Test for Functional form	1.423	0.141	0.583	0.326

In the short run analysis of the ARDL model, the most important result is the error correction term (ECM). This term shows the speed of adjustment or speed of convergence. The significance of coefficient of lagged error correction term with negative sign confirms convergence towards long-run equilibrium. The value of coefficient of ECM is –0.62 at 5 percent level of significance for the short run model 01. This implies that any deviation due to a given shock in inflation is corrected by 62 percent in a period of one year. In table 04 the value of coefficient of ECM is –0.59 at 5 percent level of significance for the model 02. This implies that long-term deviation in inflation is corrected by 59 percent over each year.

In short run money supply has positive impact on inflation. Fiscal deficit is positively linked with inflation in model 01and model 02. Oil prices are also positively associated with inflation in both the models. Moreover, the coefficient of the dollarization is positively correlated with inflation in model 02. Dollarization in model 1also shows its positive impact on inflation rate

5.6 Diagnostic Tests

The results of diagnostic tests for model 01 and model 02 are also given at the end of table 06. The value of the Jarque-Bera test is 0.373 which implies that the null hypothesis of normality in residuals of regression cannot be rejected. The value of the Durbin Watson statistic is 1.71 which indicates the presence of autocorrelation; however, in presence of lagged dependent variables as a explanatory variables in the model, Durbin Watson statistics is not valid. For this purpose, we have applied Breusch Godfrey LM test to check serial correlation. The results of the LM test show the presence of no serial

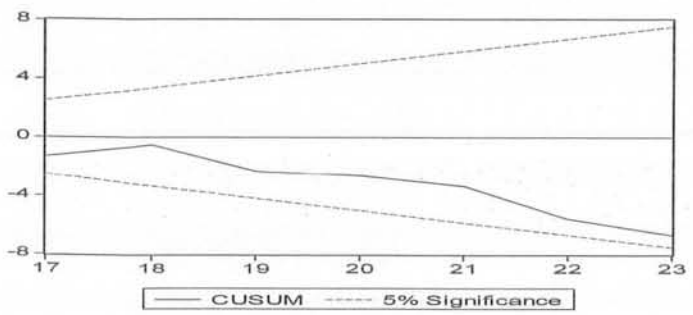
correlation as p-value is 0.246 which is greater than 0.5 so null hypothesis of no serial correlation is accepted.

The value of the ARCH test result is 2.331 which shows that null hypothesis of presence of no ARCH effect is not rejected as p value is 0.246. Ramsey Reset Test has been applied to check the correct specification of the model and Chi2 (1) is 1.423which shows that null hypothesis of correct specification cannot be rejected as the probability is 0.141. Diagnostic test results of model 2 are also reported in Table 06.

5.6.1 Stability Test

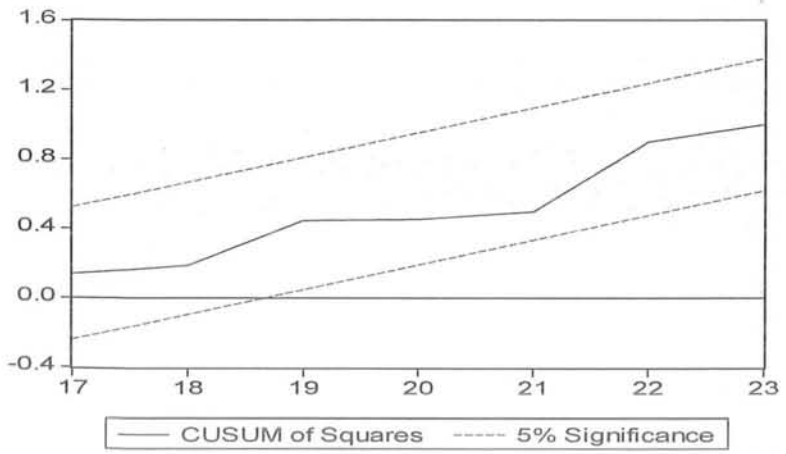
Pesaran and Pesaran(1997) suggest that stability of the ARDL model can be tested through cumulative sum of residuals (CUSUM) and cumulative Sum of squares of residuals (CUSUMSQ) given by Brown et al (1975). In this section, we have performed these two tests on our ARDL models. Figure 08 illustrates the result of the CUSUM test for model 01, which shows that our estimates are stable as the plot of the CUSUM is within the critical bounds, implying that all coefficients of the model are stable. The straight lines represent critical bounds at 5% significance level.

Figure 08: Plot of Cumulative Sum of Recursive Residuals



Similarly, the CUSUM-of-squares test is performed on the squares of the residuals. This test also measures stability of the parameters within the given range and indicates whether estimates of the model are stable or not. Figure 08 shows that the cumulative sum of squares is within the given range. This implies that our estimates also pass the second stability test. As both the models have clearly verified the stability tests, but we have presented stability plots of model 01 only.

Figure 08: Plot of Cumulative Sum of Squares of Recursive Residuals



The results can be summarized as follows. Money supply, fiscal deficit and oil prices significantly contributing in increase in inflation in model 01 am model 02. Dollarization appears to be significant in model 02 but not in model 01. The error correction terms also appear to be significant and negative in model 01 and model 02 which show convergence to the equilibrium. Both the models pass through the usual diagnostic and stability tests.

Chapter 06

Conclusion

High inflation is not good for economic activity as it confuses price signals, it raises cost of living and it redistributes wealth from salaried people to businessmen and from citizens to government. Inflation has been a serious issue for Pakistan economy for the last three decades. This research, therefore, aimed to investigate the main determinants of inflation which may be helpful to formulate appropriate policies to control inflation.

Inflation is caused for three main reasons; demand-pull, cost-push and imported. Previous studies have focused mostly on demand-pull and cost-push factors. However, for a developing country like Pakistan where demand for imports is quite inelastic, imported inflation is also very crucial. It occurs due to continuous depreciation of local currency or due to continuous worsening of balance of payments situation of a country. The balance of payments deteriorates either due to current account or trade deficits or due to capital account deficits mostly because of holding of foreign currency by private public and because of increasing external debt.

To keep our model manageable we have considered only four main determinants; money supply and fiscal deficits as demand pull factors, oil prices as a cost push factor and dollarization first measured by foreign currency deposits in domestic banks and then measured by foreign debt as a representative factor of imported inflation. We have used data from 1991-2013. Its narrow span is because official dollarization in Pakistan started in 1991. Although Pakistan delinked Pak rupee with US dollar in 1982 but it did not

allow residents to keep their foreign currency in domestic banks until 1991.Even then the official data of dollarization became doubtful after nuclear explosion. Therefore, dollarization has also been measured by external debt. We have estimated two equations, in one dollarization has been measured by deposits of citizens in domestic banks and in the other, dollarization has been measured by foreign debt.

Money supply appears to be the most significant variable determining the variation in prices in both the models. Both the models validate that fiscal deficits and oil prices also contribute to inflation in Pakistan as both the variables have significant positive coefficients. In model 01 dollarization coefficient is positive but insignificant which is due to limitations of data on this measure of dollarization. However, the study finds significant long run relationship between inflation and dollarization in model 02. in model 2. The error correction terms are found to be negative and statistically significant. Similarly, the models pass through the usual diagnostic tests of normality, serial correlation, heteroscedasticity, functional form and stability. So from this the following conclusion can be drawn.

Policy Recommendations

In our results money supply, fiscal deficit and oil prices significantly affect inflation rate in Pakistan. Therefore, it is recommended that unwarranted expansionary monetary policy should be avoided probably by granting more autonomy to State Bank of Pakistan because currently SBP adopts expansionary policy under government pressure. Moreover, fiscal disciplines should also be strengthened through legislation. There is need to better coordinate monetary and fiscal policies to improve macro-economic

stability. In Pakistan, inflation has persisted despite tight monetary policy stance by the state bank of Pakistan. This was due to lack of coordination between monetary and fiscal policies. Also government should invest heavily to develop alternative energy resources in order to reduce dependence on oil imports. Last but not the least, to take care of dollarization government may introduce gold coins which should be used to preserve one's savings and wealth from depletion due to inflation and currency depreciation. They should not be used for settlement of economic transactions.

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