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An Empirical Evaluation of Monetary and Fiscal Policy in Pakistan

by

Rozina Shaheen

Doctoral Thesis

This thesis is submitted to the
School of Business and Economic, Loughborough University
in partial fulfilment of the requirements for the degree of

Doctor of Philosophy

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Abstract

This thesis studies the relative roles of monetary and fiscal policies to achieve the basic macroeconomic objectives of stable prices with sustainable growth in Pakistan. Using data from December 1981 till June 2008, the changes in the monetary policy stance are shown to be capable of affecting the domestic price level and output growth. This thesis also tests the fiscal theory of price determination using quarterly data for the sample period 1977q1-2009q4, by investigating the relationship between the fiscal deficit, debt accumulation and inflation dynamics. The estimates reveal that there exists a fiscal dominant regime for most of the sample period since the fiscal authority is insensitive to monetary policy in the sense that neither taxes nor expenditure react (now or in the future) to the changes in the stock of outstanding government debt. It is also found that changes in the primary deficit exert an effect on aggregate demand which is also evidence of an active fiscal policy regime.

This study also explores the indirect channels of fiscal regime by including a monetary, real sector, exchange rate and the consolidated budget deficit variables in three different specifications of vector error correction models and finds the monetary and fiscal variables as the key determinants of inflation in Pakistan. It also suggests a positive and significant relationship between the budget deficit and seigniorage revenues, confirming the monetisation of the fiscal deficit and indirect evidence of the fiscal dominance in the economy. In addition, this thesis employs a SVAR specification of exogenous fiscal policy shocks to observe the relative effectiveness of fiscal multipliers and finds their significant role to affect inflation and output in the economy. Finally this study develops and estimates a small macro-econometric model and then it is used to assess the relative performance of the monetary and fiscal policies in Pakistan. Policy simulations suggest that if Pakistan follows a rule based regime then macroeconomic stability can be improved in terms of the stability of output and inflation.

JEL Classifications: E01, E12, E17, E27,E37,E42,E47,E51,E52,E58,E61,E62,E63,E64,E65,H61,H68
Thesis Supervisors: Prof. Paul M. Turner and Dr. Thanaset Chevapatrakul
Declaration

I hereby declare that this thesis is entirely my own work and has not been submitted in any form for any other degree at any other university. All references to ideas and work of other researchers have been specifically acknowledged.

Rozina Shaheen
Loughborough, United Kingdom

September, 2012
For my beloved son *Nad - e - Ali Khan*
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Chapter One

Introduction

1.1 The Background

It is a commonly accepted notion that the key objective of a macroeconomic policy is to achieve high and sustainable economic growth combined with low inflation. The factors which influence economic growth include the availability of capital, a skilled labour force and technological development. The Government uses fiscal policy and other related macroeconomic policies i.e. agriculture, industry, education, to affect these factors and to bring a change in the real sector of the economy. To achieve the second objective of controlling inflation, the central bank uses the tool of monetary policy since inflation is perceived to be a monetary phenomenon in the long run. However, in the short and medium run, inflation can be targeted through the changes in the relative elasticity of wages, prices, and the interest rates.

Low and stable inflation is considered to have positive effects on the economy because it provides the motivation to businesses to expand and hence low inflation is helpful to stimulate economic activity. In the academic literature, the traditional view on price level determination is based on the Quantity Theory of Money which explains that the equilibrium price level is determined when the demand for real money balances equals the real money stock. This implies that the price level can be controlled through controlling the money stock in the economy. However, Sargent and Wallace (1981)
argue that this control can be affected through the changes in seigniorage revenues (induced by the fiscal deficit).

Hence there is a potential game-theoretic interaction between the monetary and fiscal authorities and this thesis tries to address this question in one of its chapters. This interaction indicates that both types of policies have an impact on key macroeconomic variables which creates interdependencies in the pursuit of policy objectives. On one hand, monetary policy can influence the short term interest rates and inflation expectations. On the other hand, fiscal policy affects the price level, real interest rate, as well as aggregate demand and potential output.

There are three ways, through which fiscal policy can influence the short-term environment of monetary policy; Firstly, fiscal policy can affect economic growth and prices via discretionary fiscal policy stabilisation. Secondly, the operation of automatic fiscal stabilisers\(^1\) can contribute to reducing short-term volatility. Thirdly, governments have some instruments at their disposal that have a quick effect on price developments, such as changes in tax rates. Monetary policy on the other hand has an effect on the cost of financing government debt and the potential financial market effects of financing decisions. Hence, in a coordinated environment, it is expected that an effective monetary policy monitors the fiscal policy stance whereas fiscal policy maintains macroeconomic stability.

The debate surrounding the effectiveness of monetary policy and fiscal policy is rooted in the traditional views of monetarists (Friedman and Schwartz, 1963; Friedman and Meiselman, 1963 and Keynesians Ando and Modigliani, 1965). Monetarists believe that the money supply plays a major role in defining the economic performance, using evidence from their empirical studies they argue that money supply exerts larger impact on the economy than changes in fiscal variables, thus favouring monetary policy. On the other hand, Keynesians argue that fiscal policy is more essential, and that changes in the government expenditures are more effective in controlling the

\(^1\) An automatic stabiliser can be defined as any mechanism in the economy that reduces the effects of changes in autonomous demand. In terms of the Keynesian model it stabilises the economy by reducing the multiplier effects of any disturbance to aggregate demand. However, inflation and the propensity of government to spend additional tax revenue have tended to render the concept of automatic stabilisers practically irrelevant.
In fact, the economic impact of monetary policy is determined by the structure of the financial system and the linkages between the financial environment and spending decisions of households and firms. In addition, the strength of monetary policy impact is influenced by other factors which include; the extent of levering, margin, composition of currency denomination of assets and liabilities, and the degree of dependence on bank financing. Moreover, government intervention in financial markets can influence the monetary transmission process via policy actions such as imposing interest rate controls or other limits on financial market prices, imposing direct limits on bank lending, and/or providing government-financed credit to selected areas (Kretzmer, 1992). In Pakistan, during the period 1972 – 1990, the financial sector is characterized by credit ceiling, directed and subsidized credit, control on deposit and lending rates, etc. The bureaucratic control on the management of banks along with lack of healthy competition rendered the banking services inefficient and eroded the accountability mechanism in the sector. The direct methods of monetary control severely affected the banks' ability to respond flexibly to the credit demands of the economy. Mandatory allocations of banks credit for priority sectors, irrespective of their economic efficiency, and a regime of concessionary interest rates created distortions in the market and undermined the strength of the financial system. The capital market was also a shallow institution in this era. The market was thin with low capitalization and rampant insider trading, which lacked a competitive price mechanism. The foreign exchange market lacked a market-based price mechanism and was inelastic to changes in demand and supply conditions in the external sector. The process of financial restructuring started in Pakistan on the advice of International Monetary Fund and World Bank in late 1980s. The restructuring process in Pakistan included two types of actions: one for strengthening financial institutions and the other for developing efficient financial markets (Hanif. N, M. (2003)). Although, after the introduction of these reforms, the competition among financial institutions has been intensified and some positive developments have also been witnessed on the front of money and foreign exchange markets. However, the process of financial restructuring has not been very successful in improving the macroeconomic environment of the country (Hanif. N, M. (2003)). In Pakistan, the financial restructuring process was introduced in an environment of large budget deficit and high and variable inflation i.e., in an atmosphere of macro-economic instability. Therefore this thesis is an attempt to
evaluate the macroeconomic policy evaluation for both pre-reform and post-reform periods.

In addition, the growth of non-bank sources of financing investment has also contributed to weaken the monetary policy impact whereas due to globalization, flows of capital affect the domestic interest rate and therefore limiting the effectiveness of monetary policy. Also, with the larger foreign sector, exchange rate has become more important for the determination of output as it affects the level of both exports and imports and potentially making the economy more sensitive to monetary policy.

Fiscal policy refers to deliberate changes in government expenditures and taxes as tools to stimulate the economic activity and it transmits through the government budget. Government expenditures on goods and services are a component of aggregate demand and hence these directly affect the level of economic activity; however, transfer payments and taxes, affect disposable income and thus indirectly influence the other two major components of aggregate demand, consumption and investment spending. Therefore, fiscal policy works through the changes in government budget and induce changes in the aggregate demand while taking into account possible crowding out effect.

When the government increases its spending and/or reduces taxes, this will shift the government budget toward a deficit. If the government runs a deficit, it will have to borrow funds to cover the excess of its spending relative to revenue. Larger budget deficits and increased borrowing are indicative of expansionary fiscal policy. In contrast, if the government reduces its spending and/or increases taxes, this would shift the budget toward a surplus. The budget surplus would reduce the government’s outstanding debt. Shifts toward budget surpluses and less borrowing are indicative of restrictive fiscal policy. However, the rising level of budget deficits in recent years has forced policy makers to rely less on fiscal policy to influence the economy. A great deal of public attention has focused on the size of the deficits and their possibly negative effect.

2 An expansionary monetary policy will lead to higher exports and lower imports, thus leading to larger “output effect”.

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The deficit budget policy is an important indicator of fiscal policy which is most often used to enhance the rate of economic growth in the country. There are three ways to finance the fiscal deficit; - taxes, borrowing and monetization (inflation tax). The economic impact of deficits depends on the way they are financed. However persistent deficit financing can lead to specific macroeconomic imbalances in the economy. Due to large fiscal deficits, government resorts to domestic borrowing which leads to higher interest rate in the economy. Therefore, if fiscal deficit is financed through domestic borrowing it will result into the crowding out of private investment and consumption. In case of external borrowings, economy can face the problems of a current account deficit and appreciation of the real exchange rate and sometimes a balance of payments crisis 3 or an external debt crisis.

However, the most popular method to finance the deficit is borrowing, which is usually done by the issuance of government bonds. When the government is over indebted, then the central bank buys the government bonds which increases the money flow and reduces the interest rate pressure. However, it diminishes the real value of money and makes the future unpredictable for other economic stakeholders. Therefore, an undisciplined fiscal policy can jeopardize monetary stability of an economy. When a fiscal authority sets the budget independently of public sector liabilities; a fiscal expansion may eventually requires monetization, and results in higher inflation.

In developing countries, excessive government borrowing from the banking system as well as from the international sources to finance a large fiscal deficit, causes massive monetary expansion, which in turn leads to disequilibrium in the balance of payments. 4 In developing countries, the government often depends upon deficit financing due to its inability to mobilize domestic resources, a relatively narrow tax base, and an inflexible tax structure (Tanzi, 1982). The capital markets of these countries are also underdeveloped and institutionally determined interest rates (in most developing countries) often create a financial environment that has a built-in-bias towards the expansion of the money supply. So in the presence of supply constraints,

3 In case of low foreign reserves and debt crises in case when the level of debt is too high.

an excess of money supply contributes to increase in general price level and imports (Yousaf, 1988). Primarily, monetary policy in Pakistan is based on an overriding objective to control inflation and it is tightening in nature. However, fiscal imbalances also play an important role in price fluctuations and in turn affect monetary policy effectiveness.

The Pakistan economy is characterized with huge fiscal deficits and government finances its deficit either by issuing debt or printing of new money. Having underdeveloped financial markets, most often a large budget deficit is financed through printing of new money and therefore the execution of monetary policy is heavily dependent on the fiscal decisions made by the government. Sargent and Wallace (1981) discuss the link between fiscal and monetary policies and they argue that monetary policy will not always to be in a position to control inflation unless supported by fiscal policy. In this framework inflation is a fiscal driven monetary phenomenon and nominal monetary growth is endogenously determined by the need to finance exogenously given deficit to satisfy the budget constraint.

To assess the role of monetary policy in affecting aggregate demand and output, many central banks of the global economy, have used numerous indicators to measure the stance of monetary policy. These indicators include monetary aggregates, credit aggregates, short-term interest rates, index of minutes of Federal Open Market Committee (FOMC) introduced by Friedman and Schwartz (1963) and later by Romer and Romer (1989), the monetary policy index developed by Bernanke and Blinder (1992), and Bernanke and Mihov (1998), and Monetary Conditions Index (MCI) first constructed and used by the Bank of Canada. Central banks of Canada, Sweden, Norway, and New Zealand, among others have included and in some instances fully adopted the use of monetary conditions index in their monetary policy frameworks.

The MCI is a simplified measure to indicate the relative “tightness” or “looseness” of monetary policy. It gauges the degree of pressure that a country's monetary policy exerts in the economy (and hence inflation) through the changes in the exchange rate and interest rates. An MCI is specified as a weighted average of the short term interest rates and the trade-weighted exchange rate of the domestic currency. MCI, however, is also associated with some methodological criticisms both on their conceptual and empirical
foundations [see among others, Ericsson et al. (1996); Ericsson et al (1998); and Stevens (1998)]. First, is that it reflects changes in interest rate and exchange rate that are not directly related to central bank policy. Second, MCI does not consider other financial variables that may be important in the transmission mechanism of monetary policy. In addition, the use and interpretation of an MCI rests upon the assumptions of the underlying model. Several issues arise for that model, including dynamics, data nonstationarity and differencing, exogeneity and feedback, parameter constancy, the choice of model variables, and the uncertainty arising from estimating the model. These assumptions are often testable and, if violated, directly affect the economic interpretation of the MCI.

Bernanke and Mihov (1998) suggest a Vector Autoregression methodology that can include all the policy variables previously proposed for the United States as particular specifications of general model. This approach does not need to assume that a single variable is the best indicator of monetary policy. However, for the successful implementation of monetary policy, it is necessary that the central bank should be independent from the fiscal authorities and can freely use the instruments of monetary policy to achieve its major objective of stable prices in the economy. Whereas, when an economy is characterized as a fiscal dominant regime then there exists no such independence, and therefore, the implementation of any monetary policy regime is bound to fail. A fiscal policy that contains high and continuous fiscal deficits, results in an unsustainable accumulation of public sector debt. A weak financial position of the government constrains the central bank's ability to raise interest rates to reduce inflation\(^5\) in the economy as it will deteriorate further the government's debt situation. Therefore, an unsustainable fiscal policy would require a forced adjustment, either through debt default, domestic inflation, or both. At first, Sargent and Wallace (1981) formally pointed out the monetary policy implications of the government budget constraint. The recent macroeconomic literature on the 'fiscal theory of the price level' (as first discussed in Woodford, 1994) suggests that fiscal policy, rather than monetary policy, as the main determinant of inflation. In these models, the price level is the only variable that can balance the government's inter-temporal budget constraint.

\(^5\) as indicated by a Taylor rule in an inflation targeting scheme
Today, monetary and fiscal policies are both commonly accorded prominent roles in the pursuit of macroeconomic stabilization in developing countries. The macroeconomic literature suggests various econometric models to assess the relative effectiveness of monetary and fiscal policy. The history of macroeconomic modelling starts with the Dutch economist Jan Tinbergen (1903-1994) who built and estimated the first macroeconomic models in the mid-1930s and these models were used both for forecasting and policy simulation exercises, typically with short-run horizons of between eighteen months and two years. A macroeconomic model is a set of behavioural equations, as well as institutional and definitional relationships representing the behaviour of economic agents and the operations of an economy. The equations, or behavioural relations, can be empirically validated to capture the structure of a macro economy, and can then be used to simulate the effects of policy changes. During the 1950s and 1960s, there were massive developments in econometric modelling and it has since played a very influential role in economic policy formulation. However, during the decades of late 1970’s, the 1980’s and 1990’s, macroeconomic modelling observed several critiques which were mainly based on the systems, expectations and dynamics of the models. Monetarist critics introduced the St. Louis Model and the Rational Expectations School (Sargent, 1976) constructed the first forward-looking Macro-econometric Model. As a response to these criticisms, econometricians and policy-makers rallied together with the consensus that eclectic Macro-Econometric Modelling should be pursued vigorously (Klein, 1986; Bhattacharya & Kar, 2002). As the literature suggests that eclectic models are more efficient to deal with the diverse policy issues as compared to those which are pure in their structures. It is unrealistic to assume the similar structure of adjustment for all the economies and sectors and in fact the reality may not be consistent with one single phenomenon over time and across economies. Furthermore, it would be plausible to assume that economic and econometric models reflect the way in which people actually behave, rather than the way they ought to (Klein, 1986), this provides a very strong rationale in favour to construct the Macro-Econometric Model in the context of both developing and developed economies. However, an eclectic model should not abandon the theoretical considerations because those models which are not clearly spelt out in an analytical frame are useless because results based on such models can never be interpreted.

6 Anderson and Carlson(1970)
Bautista (1988) and Capros, Karadeloglou and Mentzas (1990) classify macroeconomic models into Macroeconometric models-MEM and computable general equilibrium (CGE) models. Challen and Hagger (1983) classify the Macroeconometric models into five categories; the KK (Keynes-Klein) model, the PB (Phillips-Bergstrom) model, the WJ (Walras-Johansen) model, the WL (Walras-Leontief) model, and finally the MS (Muth-Sargent) model. The KK model is based on the Keynesian demand-oriented macroeconomic fluctuations. This model deals with the problems of short-run instability of output and employment using generally fiscal policy and it is mostly used by model builders in developing countries to explain the Keynesian demand-oriented model of macroeconomic fluctuations. They deal with the problems of short-run instability of output and employment using mainly stabilisation policies.

After the publication of seminal work by Kydland and Prescott (1982), Dynamic Stochastic General Equilibrium (DSGE) models have become more important in the economic literature. These models are structured on micro founded theories and hence can identify various shocks in a theoretical consistent way. Therefore, these models are attracting policy makers and central bankers for comparing possible impact of different policy scenarios. In the last two decades significant progress has been made regarding specification and estimation of DSGE models according to the need and features of the economy at hand.

To modify the features of macro model and to evaluate the consequences of different policies, it is essential to introduce policy shifts through the introduction of some policy rules. Traditional policy analysis with macroeconometric models examine the possible impacts when some policy settings which are treated as exogenous in the model, are altered. In this context, the recent trend shows the deviation from an exogeneity assumption and the movement towards an endogenization of policy or 'closing' of the model, using a variety of techniques ranging from simple feedback rules to full optimization.

The macroeconomic literature indicates various studies which employ several analytic or numerical techniques to assess the statistical performance of different policy regimes in a macroeconomic model. In this direction, Taylor (1979) introduces optimal monetary policy rules based on the estimates of a two-equation model of the US economy with rational expectations. These policy rules are identified to stabilise fluctuations in output
and inflation, and therefore these rules show a long-run trade-off between the variability of inflation and the variability of output. On the other hand, using a small stylised model, Clark and Laxton (1997) reveal that any policy which is capable of stabilising the fluctuations in the business cycle, thereby minimises the variance of inflation, is also able to reduce the unemployment in the economy.

In addition, the specification of a fiscal closure rule which enforces the government's intertemporal budget constraint is also considered be an essential requirement in the large-scale macroeconometric models of an economy (Mitchell et al., 1999). These fiscal rules, serve a dual purpose. First, the inclusion of a fiscal rule in macroeconometric model ensures solvency for the fiscal sector and guarantees that the intertemporal budget constraint of the government is satisfied, which in turn rules out the possibility of an unstable or explosive path for the government debt ratio. Second, the fiscal rule incorporates some behavioural elements regarding the intertemporal behaviour of governments and reflects the adjustments of fiscal variables in case of any fiscal policy shock. Therefore, the time path of adjustments in fiscal and other variables in the model is influenced by the formulation of the fiscal rule.

Historically, Pakistan is categorized with macroeconomic imbalances such as extremely high foreign and domestic debt, high budget and current account deficits, extremely low international reserves, high inflation, high nominal interest rates and low economic growth. The current fiscal deficit is about 6% of GDP and average economic growth over 40 years remains around 4 percent. These macroeconomic imbalances have also contributed to high inflation and unemployment over the period.

In the early 1990s, financial reforms were introduced in Pakistan to reduce inflation and to foster economic growth. These reforms include: provision of more autonomy to the central bank of Pakistan, privatization of commercial banks, establishing a domestic bond market, launching Pakistan bonds in the international market and maintaining high foreign exchange reserves. The general consensus today is that the most effective way to ensure the credibility of monetary policy is to give the central bank a clear mandate with price stability as the overriding goal. As a consequence of this autonomy to State Bank of
Pakistan- SBP, it has been able to bring inflation down to single digits at a time when the economy has performed strongly. However, high domestic and international debt, high fuel prices and consistently high budget deficits remain central issues in Pakistan’s macroeconomic policies.

In Pakistan, macroeconomic imbalances have contributed to deceleration in economic growth and investment which in turns was translated into a rise in poverty levels. In this context a rule- based fiscal policy, enshrined in the Fiscal Responsibility and Debt Limitation (FRDL) Act 2005 was passed by the Parliament in June 2005. This act is intended to instill financial discipline in the country and to ensure responsible and accountable fiscal management by all governments - the present and the future, and to encourage informed public debate about fiscal policy. It requires the government to be transparent about its short and long term fiscal intensions and imposes high standards of fiscal disclosure.
1.2 The Objectives

Given that the Pakistan economy is suffering with the high inflation and low output growth, this thesis evaluates the relative impact of the macroeconomic policies using appropriate analytical and numerical techniques. Our objectives in this thesis are threefold:

First, we evaluate the role and effectiveness of monetary policy in Pakistan through measuring the monetary policy stance using the two approaches; the monetary conditions index, first introduced by the Bank of Canada in the early 1990s and the other approach suggested by Bernanke and Mihov (1998). We investigate the following questions; do the changes in the monetary aggregates (the monetary policy operators) have an impact on macroeconomic activity? Either it is the interest rate channel or exchange rate channel which is the key determinant of aggregate demand in the economy? Also what is the stance of monetary policy over the sample period? Either it is been more tight or loose or in which subsamples this stance changed? And if it is changed what are the economic consequences of these changes in the stance of monetary policy?

Second, we examine the stabilization role of fiscal policy to affect the macroeconomic environment of Pakistan in three stages. In the first stage it attempts to empirically determine the type of regime in Pakistan that either it is categorised as a monetary dominant or a fiscal dominant regime through investigating these questions; whether the primary deficit adjusts itself to the changes in liabilities or real interest payments or if reduction in the current primary deficit reduces future liabilities? After determining the type of regime, it tries to answer the question that how much variation in inflation is explained by the fiscal deficits, money growth, exchange rate, and output (GDP). In addition, it examines whether the budget deficit leads to money creation in the economy. Lastly, it tries to answer the question as to what is the response of output

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*7 backward looking approach*  
*8 forward looking approach*
and inflation to exogenous fiscal policy shocks in terms of government expenditures and net tax revenues.

The third objective of this thesis is to develop and estimate a macroeconometric model for the economy of Pakistan that captures the basic elements of the economy, theoretical developments and data structure; the model is then subjected to different policy shocks with the view of evaluating the impacts of alternative policy scenarios and making policy-relevant recommendations. It also finds the answer that if central bank in Pakistan follows a rule based monetary policy then either it will help to bring stability in output and price level in the economy.

1.3 Contributions

While obtaining the given objectives (section 1.2), this thesis makes six main contributions to the literature, especially on the empirical front.

First, the thesis provides answers to questions regarding the stance of monetary policy and its role to affect inflation and employment in Pakistan. Although there is a study by Sajawal (2007) on the same topic our study differs in the sense that we are employing a different sample period with different set of variables. In addition we select different base periods for interest rate and exchange rate to construct monetary conditions index.

Second the thesis provides the answer about the type of regime in Pakistan, using backward and forward looking approaches, this is the first time for Pakistan, there is a study by Javid et al (2007) but they partially cover the topic only by employing forward looking approach with different set of variables and therefore their results are contrary to our findings. Javid et al (2007)’s findings are not clear about the type of regime in Pakistan, on one hand they find a negative relationship between liabilities accumulation and the innovations in surpluses, suggesting a monetary dominant regime, on the other hand they also find suggest an inverse relationship between the innovation in surplus
and real income and therefore suggesting a non Ricardian(fiscal dominant) regime. However our findings are consistent to claim a fiscal dominant regime in Pakistan.

Third, this thesis determines the channels of inflation through the specification of three different vector error correction models. Earlier (Agha & Khan, 2006) used a single vector error correction model and identify different source of inflation while confirming budget deficit as a major source of inflation. Our findings are consistent to Agha & Khan( 2006) but our model includes more variables and caters the issues of multicollinearity and autocorrelation. Fourth, this thesis identifies the role of fiscal shocks and calculates the related multiplier using structural VAR specification and it is the first time for Pakistani data.

Fifth, this thesis develops a comprehensive macroeconometric model for Pakistan, analyses the role of The Fiscal Responsibility and Debt Limitation (FRDL) Act 2005 to achieve macroeconomic objectives and our analysis are first empirical attempt to test the effectiveness of this law to attain its perceived objectives.

Sixth, this thesis also evaluates the combined role of fiscal policy rule with monetary policy rule and provides an insight to the policy maker for a co-ordinated macroeconomic policy.

1.4 The Outline of the Thesis

The following provides a guide to the remaining chapters.

Chapter two provides the overview of Pakistan’s macroeconomic environment. In Pakistan, fiscal management has resulted in a persistent budget deficit since the early 1970s and monetary policy has been more expansionary than contractionary. Although price stability is the ultimate objective of the monetary policy framework and economic growth is the main macroeconomic objective of fiscal policy, the performance of the economy on these indicators has been unsatisfactory. During the last half of 1980’s, financial sector reforms were introduced which resulted in a sound
banking sector in Pakistan with improved regulatory and supervisory capacity of the central bank. The availability of credit for consumer financing, establishment of small and medium enterprises and increase in micro financing resulted in better GDP growth rates in 2000's, but this process has slowed down in the second half of 2000s.

The Pakistan fiscal structure is categorised with high current expenditure and an inelastic, non-progressive tax structure with narrow tax base which always results in a high budget deficit. Despite the introduction of tax system reforms, the tax to GDP ratio has remained low at around 12.5% of the GDP over the last 3-4 decades. The fiscal authorities have consistently resorted to financing the fiscal deficit by domestic borrowing and external finance which has resulted in ever rising public debt and high expenses on debt servicing.

The Third chapter examines the role of monetary policy to affect output and inflation in Pakistan. Monetary policy in Pakistan is based on manifold objectives, such as price stability, non-inflationary growth with the additional objectives of maintaining a stable exchange rate and a desired current account balance. In this context the monetary authority needs a policy stance to align its policy objectives with the aggregate economic activity. The empirical literature on measuring monetary policy stance suggests two types of approaches: the approach which concentrates on a single financial variable and the second approach which takes a set of variables in a VAR specification.

Therefore, to measure the monetary policy stance in Pakistan, we construct a composite measure through the concepts of monetary conditions index-MCI and the Bernanke and Mihove (1998) approach which suggests a VAR methodology that does not assume that a single variable is the best indicator of monetary policy. Following Duguay (1994), we employ a reduced form equation model to derive weights for MCI construction in Pakistan. According to the Duguay (1994) approach, the IS curve relates the components of the MCI (the interest rate and exchange rate) to output growth controlling for external output, commodity prices, and fiscal policy. The Phillips curve provides the relationship between the output gap and inflation, controlling for expectation, therefore our model consists of a backward-looking IS curve and a
backward-looking Phillips curve. For this purpose we use monthly data from January 1982 to June 2008 and two base periods are selected to calculate MCI. The first base month is December, 1981 and the second base month is December 1990. The first date is chosen as the start of the sample period and the second is due to the initiation of financial sector reforms by the government of Pakistan during the financial year 1989-90. This choice seems to be reasonable to analyse monetary condition in Pakistan during the previous decades.

In addition, to measure the monetary policy stance, Bernanke and Mihov (1998) suggest a semi structural VAR methodology which includes all the policy variables to reflect the central bank’s operating procedure. In this methodology we identify two blocks of variables; the policy block and the non policy block. Then we evaluate the different stance indicators through statistical tests in the form of testing over identifying restrictions. The advantage of this approach over the MCI is that it considers various financial variables which may be important in monetary transmission mechanism.

**Chapter four** evaluates the role of fiscal policy in three steps. At first, it attempts to empirically determine the type of regime in Pakistan that either it is categorised as a monetary dominant or a fiscal dominant regime. As in Pakistan monetary policy is aimed at the dual objectives of inflation control and output growth. However, the presence of huge budget deficits constrains the ability of monetary policy to attain these objectives. In Pakistan, the fiscal deficit has the potential to directly affect the inflation level as government expenditure constitutes a large part of aggregate expenditures which might lead to demand pull inflation, and/or there is an indirect impact as the fiscal deficit is financed partly through the central bank. So it is relevant to examine that if the government adjusts its primary deficit to limit the debt accumulation and the central bank is not forced to inflate away the debt. Such a regime has been called monetary dominant (MD). However under a fiscal dominant (FD) primary deficits are set independently of real liabilities.
Then at second step, this chapter explores the linkages between the inflation, budget deficit and money growth. On one hand it tries to find the significance of budget deficit and money growth to affect inflation in Pakistan and on the other hand it signifies that either budget deficit leads to the money creation in the economy.

Finally, at third step, we empirically examine the economic effects of exogenous fiscal policy shocks, using a structural vector autoregression framework. It is relevant in the sense that Pakistan is facing a rise in public debt and fiscal imbalances which poses concerns about fiscal sustainability of the economy.

**Chapter five** provides a macroeconometric model for Pakistan. Since the empirical macro models provide a quantitative tool to assess the magnitude of the impact of different policies on the main variables as well as these models can help to assess the consistency between the targets of macroeconomic policy (such as low inflation, external balance and sustainable growth) and the setting of policy instruments to attain these targets. When deciding on the theoretical framework and the model structure, we need to take into consideration that the Pakistani economy is relatively open to international trade, and trade constitutes a large share of GDP. In addition, international transactions related to debt servicing and development assistance are large compared to the size of the economy. Therefore, we choose the IS-LM-BP framework for the Pakistan economy. Under this model, an economy will be in equilibrium when total withdrawals will equal total injections, and money demand will equal money supply. Aggregate demand is built up of consumption, investment and net exports components. Changes in aggregate demand alter the consumption and investment, and the resultant changes in demand for consumption and investment lead to a change in demand for money. Changes in demand for money affect the interest and inflation rates over time. Fiscal expansion increases aggregate demand and, through that route; it affects the demand for money, interest and inflation rates. Any change in interest and inflation rates affects aggregate demand through the investment and consumption function and the changes in aggregate demand influences the levels of employment.
The model is specified around the four well-known macroeconomic identities – national income, fiscal identity, monetary equilibrium and BOP identity – and a policy equation, i.e. inflation and employment, and accordingly there are five blocks in the model. These are the minimum requirements of a model to ensure consistency in macroeconomic analysis (Easterly 1989). The private sector budget constraint is linked indirectly by the levels of employment and general price. As the financial market is yet to be developed in a less developed economy, it is not considered to be a key block at this stage, and the changes in the financial sector are linked indirectly by the money demand function. Similarly, the labour market is not included because it is highly fragmented and imperfect and an appropriate data set is not readily available. However, the feedback from the private sector, labour market and financial market are captured by some of the variables of these sectors incorporated in the model.

We employ the structural equations model-SEM to empirically estimate this model and confirming the stability of the estimates, as Lucas (1976) emphasizes the fact that the decision models of economic agents are hard to describe in terms of stable parameterizations, simply because changes in policy may change these decision models and their respective parameterization. Then we specify the future path of the exogenous variables to do some medium term policy simulation experiments. These policy simulations enable us to evaluate the stability of the model and by changing the values of some policy variables, we can trace the major macroeconomic transmission channels of the economy. Then we simulate the model with some alternative fiscal and monetary policy rules. We adopt the fiscal rule on the basis of the Fiscal Responsibility and Debt Limitation (FRDL) Act 2005 which restricts the total public debt to 60% of the GDP. To conduct monetary policy in a systematic way, we follow Taylor (1999) and set a monetary policy rule in which the short term interest rate reacts to two variables: the deviation of inflation from a target rate of inflation, and the percentage deviation for real GDP from potential GDP. Finally, we introduce a policy feedback system to analyse the possible effects of the fiscal changes on money supply which in turns affect the inflation in the economy. We examine that how disequilibrium in the money market feeds through the macroeconomic system of the country through the estimation of P star model which hinges on the long-term quantity theory of money and puts together the long-term determinants of the price level and the short-term changes in current inflation.
Chapter six ends the thesis with some concluding remarks.
Chapter Two

A Review of Pakistan's Macroeconomic Performance

2.1 Introduction

Pakistan was marked as the most developed country of South Asia until the decade of the 1980s, with an average growth rate of 6 percent. The major reason for this impressive performance was the availability of external capital which also led to a large unaddressed structural imbalance, principally in the fiscal and the external sector accounts.

Table 2.1 Pakistan’s Macroeconomic Environment

<table>
<thead>
<tr>
<th>Variables/Years</th>
<th>1970s</th>
<th>1980s</th>
<th>1990s</th>
<th>2000s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Domestic Product</td>
<td>5</td>
<td>7.1</td>
<td>4.4</td>
<td>5.3</td>
</tr>
<tr>
<td>Agricultural</td>
<td>2.4</td>
<td>4.1</td>
<td>42</td>
<td>28</td>
</tr>
<tr>
<td>Industry</td>
<td>5.5</td>
<td>8.2</td>
<td>46</td>
<td>82</td>
</tr>
<tr>
<td>Services</td>
<td>6.3</td>
<td>6.7</td>
<td>4.5</td>
<td>5.3</td>
</tr>
<tr>
<td>Inflation(GDP deflator)</td>
<td>12.2</td>
<td>7.6</td>
<td>10</td>
<td>5.7</td>
</tr>
<tr>
<td>Saving</td>
<td>11.2</td>
<td>14.8</td>
<td>13.8</td>
<td>17.8</td>
</tr>
<tr>
<td>Investment</td>
<td>17.1</td>
<td>18.7</td>
<td>18.3</td>
<td>17.3</td>
</tr>
<tr>
<td>Budget Deficit</td>
<td>7.6</td>
<td>6.8</td>
<td>7.3</td>
<td>4.6</td>
</tr>
<tr>
<td>Current Account Balance</td>
<td>-5.2</td>
<td>-2.8</td>
<td>-4.1</td>
<td>0</td>
</tr>
</tbody>
</table>
The Real GDP growth rate was 5% in 1970s and 7.1% in 1980s which slowed to 4.4% in the 1990s and slightly improved to 5.2% in the 2000s (Table 2.1). During the decade of the 1970s, public savings were low largely because the fiscal deficit and the primary deficit remained at 7.6% and 5.9% of GDP on average respectively, mainly due to the large-scale investments in public sector, production subsidies and spending on social programmes. During this time, average inflation rate remained high i.e. 12.2% (Table 2.1) and the possible reasons for this high inflation were high oil prices, an increase in remittances, and enhanced public consumption along with decreased production output. Fiscal revenue remained low at 14.3% (Table 2.2) of GDP and the fiscal deficit was financed mostly from external sources, i.e. 50.9 percent, from bank borrowing and non-bank borrowing (Table2.3). The current account balance was in deficit of 5.2% of GDP on average. The deficit resulted from huge imports; even the boost in the exports as a result of massive devaluation of 131% in 1972 could not nullify the impact.

In the 1980s, GDP growth remained at 7.1% on average whereas the inflation rate was 7.6% on average as compared to 12.2% in 1970s. The current account balance remained in deficit at an annual average rate of 2.8% of GDP throughout the decade. It was better than that of the 1970s mainly due to the decrease in imports and enhanced remittances during this decade. The fiscal deficit was about 6.8% of GDP on average whereas the primary deficit was recorded about 3.5% on average.

However, in the 1990s, Pakistan witnessed the lowest GDP growth rate among the regional countries and this was attributed to the sharp decline in capital inflows. The poor economic performance during the 1990s and the failure to limit the fiscal and current account deficit led to unprecedented and unsustainable levels of public debt. In addition, the other macroeconomic indicators also worsened which include a low tax to GDP ratio, double digit inflation, low levels of investment deteriorating infra structure, poor social sector indicators and poor governance of institutions etc. In the early years of the 1990s, government initiated the structural reforms and introduced the supply side policies which include liberalisation, deregulation, and privatization, but the outcome of these policies was not successful as they were not backed by the demand side adjustment to stabilise the serious macroeconomic imbalances.
During the decade of 1990s, the GDP growth rate remained about 4.4% on average and the average inflation rate remained high i.e. 12.2 % (Table 2.1). The budget deficit and primary deficit remained 7.3% and 1.3% of GDP on average respectively in this decade; in addition, the current account deficit remained an annual average of around 4.1% of GDP (Table 2.2). During the 1990s, the Pakistan economy also faced some external shocks including economic sanctions, the September 11 event and tension on the Afghanistan border area. Many analysts termed this period as a “lost decade” for Pakistan economy.

**Table 2.2 External Sector Indicators**

<table>
<thead>
<tr>
<th>Variables/Years</th>
<th>1970s</th>
<th>1980s</th>
<th>1990s</th>
<th>2000s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of GDP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trade Gap</td>
<td>-8.14</td>
<td>-10.46</td>
<td>-6.53</td>
<td>-4.43</td>
</tr>
<tr>
<td>Interest payments</td>
<td>1</td>
<td>1.63</td>
<td>1.8</td>
<td>1.33</td>
</tr>
<tr>
<td>Remittances</td>
<td>3.13</td>
<td>7.4</td>
<td>2.96</td>
<td>3.82</td>
</tr>
<tr>
<td>Current Account Balance</td>
<td>-5.19</td>
<td>-2.79</td>
<td>-4.07</td>
<td>-0.002</td>
</tr>
<tr>
<td>Foreign Direct Investment</td>
<td>0.05</td>
<td>0.31</td>
<td>0.85</td>
<td>1.36</td>
</tr>
<tr>
<td>Portfolio Investment</td>
<td></td>
<td>0.14</td>
<td>0.52</td>
<td>-0.08</td>
</tr>
<tr>
<td>Reserve (Stock in $m)</td>
<td>970</td>
<td>1188</td>
<td>2410</td>
<td>13415</td>
</tr>
<tr>
<td>Reserve (Growth %)</td>
<td>26.9</td>
<td>4.3</td>
<td>10.7</td>
<td>35.7</td>
</tr>
</tbody>
</table>

Sources; IFS and Economic survey of Pakistan various issues

The decade of the 2000s brought the challenges of high inflation, unemployment growth, poverty and the large fiscal and external deficits, as well as the external shocks of war on terrorism. Thus the improvement in GDP growth proved to be short lived. The factual position of Pakistan's growth and development till the sixties and seventies has been reported by Papanec (1967), Lewis (1968) and Amjad (1984) etc. During this time, the GDP growth rate remained around an annual average of 4.9% and the inflation rate annual average was 5.7% per annum. The fiscal deficit remained around annual average of 4.5% of GDP and the sources to finance this deficit include; bank borrowing i.e. 5.8%, non-bank borrowing i.e. 62.4% and from external resources i.e. 31.8% (Table 2.3). The current account balance remained surplus around an annual average of 1.9% of the GDP. The period recorded investments around annual average of 17.3% of GDP and saving rates remained around 17.8% of GDP on average.
Table 2.3 Monetary Sector Indicators

<table>
<thead>
<tr>
<th>Variables/Years</th>
<th>1970s</th>
<th>1980s</th>
<th>1990s</th>
<th>2000s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of M2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government Borrowing</td>
<td>44.9</td>
<td>44.8</td>
<td>49.7</td>
<td>22.4</td>
</tr>
<tr>
<td>Private Sector credit</td>
<td>49.7</td>
<td>55.3</td>
<td>54.6</td>
<td>99.4</td>
</tr>
<tr>
<td>Domestic Credit</td>
<td>94.7</td>
<td>100.1</td>
<td>104.3</td>
<td>255.7</td>
</tr>
<tr>
<td>M2 as % of GDP</td>
<td>44.4</td>
<td>47.4</td>
<td>46.8</td>
<td>23.7</td>
</tr>
<tr>
<td>Reserve (Growth %)</td>
<td>26.9</td>
<td>4.3</td>
<td>10.7</td>
<td>35.7</td>
</tr>
</tbody>
</table>

Sources; IFS and Economic survey of Pakistan various issues

2.2 Monetary and Financial Structure of Pakistan Economy

Pakistan is characterized as a highly inflationary small open economy, monetary policy in Pakistan is based on the overriding objective to control inflation, and it is tightening in nature (over the sample period). Prior to the financial sector reforms in late 1980s, monetary and credit policies in Pakistan were conducted through direct quantitative controls within the framework of credit budgeting and credit ceilings. Beside global and sectoral credit ceilings, various instruments such as direct credit control included budget subsidies, credit floors, refinancing facilities together with the imposition of cash reserves and liquidity requirements were used (Hyder and Khan 2007).

The financial sector reforms were introduced in the late 1980s and direct controls were replaced by market-based liberalised ones. With the liberalisation, the money market gained prime importance in the transmission of monetary policy. During 1995, the credit deposit ratio (CDR) was abolished and Open Markets Operations (OMO) were institutionalised as the indirect controls become the only option for conduct of monetary policy. In essence, the post-reform money market is crucial in the transmission mechanism.
In Pakistan, the central bank uses the tools of cash reserve requirement and open market operations to manage the market liquidity and to contain monetary growth. The direction of monetary policy is indicated by changes in discount rate and overall monetary stance is reflected in assets prices, long-term interest rates and the exchange rate. After the adoption of free floating exchange rate regime in 1990s, the Pakistani Rupee exchange rate is also stabilized through the money market (Hyder and Khan 2007).

2.2.1 The Objectives and Institutional Framework of Monetary Policy in Pakistan

In Pakistan, the State Bank of Pakistan - SBP is responsible for the regulation of the monetary and credit system of the country. The institutional framework for monetary policy is based on State Bank of Pakistan’s Act of 1956. This act entrusts the Central Board of the Bank to formulate and monitor monetary and credit policy by taking into account the Federal Government's targets for growth and inflation. In order to achieve these twin goals of growth and inflation control, the State Bank of Pakistan performs all the traditional and non-traditional functions. The SBP is charged with approving the aggregate credit requirements of public finance bodies and the private sector, advising the federal government on the impact of monetary policy on the economy, managing foreign exchange, and reporting to the parliament on the state of the economy.

Currently, State Bank has a number of instruments at its disposal to regulate the volume of credit and to ensure its flow to the priority sectors. These instruments include both indirect (market oriented) and direct instruments of credit control. Indirect and market-oriented instruments incorporate changes in discount rate (3-day repo rate), T-bill auction rate, Open Market Operations in government securities and other eligible assets, Statutory Reserve Requirement, and Statutory Liquidity Ratio. Using these direct instruments, the Bank can prescribe credit ceilings, set credit/deposit ratio, fix margin requirements, and control the rate of return. It can also direct the banks to restrict credit for certain purposes as well as to direct the flow of credit to priority sectors.
Key Instruments to Conduct Monetary Policy in Pakistan:

(i) **SBP 3-day Repo Rate;** SBP provides a lending facility to the scheduled banks for up to 3 days through Reverse Repo transactions. The interest rate charged on this facility serves as the main tool to give interest rate signals to the money market. Increase in this rate gives a signal of monetary tightening.

(ii) **T-Bill Auctions;** SBP 3-day repo rate influences the yield of T-bills sold through auctions. The cut-off yield is determined by the Auction Committee, keeping in view monetary targets, current economic and financial conditions and expected market response. The six month T-bill is considered the most important benchmark by the money market.

(iii) **Open Market Operation;** SBP has conducted regular Open Market Operations (OMOs) since January 1995. Until October 1997, OMOs were unidirectional, i.e. the SBP used to mop up liquidity from the market in case of excess but it refrained to inject funds in case of liquidity crunch. However, in October, 1997, it started bi-directional intervention; now Repo transactions are used to mop up liquidity and Reverse Repo to inject it. Decisions upon the direction and extent of OMO are taken by the OMO Committee.

(iv) **Statutory Liquidity Ratio;** Commercial banks are required to keep some fraction of their assets in the form of cash, Treasury Bills (T-Bills) or other approved securities. This fraction is called the Statutory Liquidity Ratio. Its main objective is to ensure that banks have sufficient funds in the form of liquid assets. Currently this ratio (excluding Cash Reserve Requirement) is 15% of time and demand liabilities.
(v) **Statutory Cash Reserve Requirement (CRR);** Under this requirement, banks are required to keep a weekly average balance of 5% of their total time and demand liabilities with the SBP, subject to daily minimum balance of 4%.

The financial system in Pakistan has evolved over the years in response to growth of the economy and government plans for the development of the country. At the time of independence Pakistan inherited one commercial bank (Habib Bank) that was established in 1941 in Mumbai and after the creation of Pakistan, it was shifted from Mumbai to Karachi. On 1st July 1948 the Government of Pakistan established a central bank that is the State Bank of Pakistan (SBP). The SBP was jointly owned by the Government of Pakistan and the private sector. In the following years the government set up fully state owned bank namely National Bank of Pakistan. The development in the structure of financial sector of Pakistan can be categorised into two regimes; pre-reform period and post reform period

**A. Pre-Reform Financial Structure**

The Government of Pakistan nationalized all banks in 1974 to direct bank credit towards specific sectors and to ensure government funding. Domestic banks were consolidated into six major national commercial banks, besides which several specialized credit institutions and household savings schemes were established. This step of nationalization completely wiped out the private sector from the banking business. Nationalization affected the performance and efficiency of the banks. During the nationalization era, the financial sector remained heavily controlled. Interest rates were set administratively and were usually negative in real terms. The money market was under-developed, and bond and equity markets were virtually nonexistent. Commercial banks often had to lend priority sectors with little concern for the borrowing firm’s profitability (Qayuum, 2005).
Before the introduction of comprehensive financial sector reforms in Pakistan in 1991, its banking sector was comprised of commercial banks (including foreign banks) and non-bank financial institutions (including development finance institutions). At the apex, the State Bank of Pakistan (SBP) was responsible for guiding and regulating the banking system of the country. As on 30th June 1990 a total of 24 commercial banks (7 domestic and 17 foreign) were doing business in Pakistan. Domestic banks catered for the major commercial banking needs of the economy with a broad branch network and under absolute public sector ownership. Foreign banks activities were generally related to foreign trade and they held only 7.8 percent of total assets, and 7.0 percent of the total deposit base. Moreover, at that time public policy was aimed to promote industrial development through long-term financing which led to a rapid growth in Non Bank Financial Institutions (NBFIs) up to the 1980s. These NBFIs were also dominated by the public sector. A large part of NBFIs was constituted on three categories- DFIs, housing finance companies, and mutual funds. These three categories controlled over 90 percent of the business.

Prior to the introduction of reforms, the financial sector was supervised/regulated by three bodies: (1) SBP, dispensing its functions under the SBP Act, 1956; (2) the Pakistan Banking Council (PBC), monitoring the performance of nationalized commercial banks under the Banks (Nationalization) Act, 1974; and (3) the Corporate Law Authority (CLA), regulating the equity market under Securities and Exchange Ordinance, 1969.

**B. Post Reform Financial Structure**

After analysing the performance of nationalized institutions for a decade, the government has decided to revise the policy decision of nationalization to encourage private sector participation, enhance efficiency and promote competition among banks. In the late 1980s banking sector reforms were initiated under broader macroeconomic structural adjustment programs. Through these reforms, the government has been

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aiming to make the financial industry more competitive and transparent by reprivatizing formerly nationalized banks, liberalising interest rates and credit ceilings, strengthening the central bank’s supervisory capacity and imposing standardized accounting and auditing systems. Consequently the Banks (Nationalization) Act, 1974 was amended in 1991. These reforms were aimed to create a competitive environment for financial institutions and markets, strengthening their governance and supervision, and adopting a market-based indirect system of monetary, exchange and credit management for better allocation of financial resources. The areas covered by these reforms include: financial liberalisation, institutional strengthening, domestic debt, and monetary management, banking law, foreign exchange and capital market.

Through these reforms, a system of administered interest rates was streamlined and loosened starting in 1989-90. The share of credit directed to particular sectors was reduced in 1989, and bank-by-bank credit ceilings eliminated in 1992. New prudential regulations were introduced in 1989 and strengthened in 1992, while the State Bank of Pakistan (the central bank) enhanced its supervisory capacity. A system of auctioning government securities was established, and regular auctions for six-month bills and longer term bonds began in 1991 (Hardy and Daniel, 2000).

The current financial system comprised the Central Bank (SBP), Commercial Banks and a mix of Non-Bank Financial Institutions (NBFIs) including Development Financial Institutions (DFIs), Investment banks, housing finance companies, leasing companies, modarabas and mutual funds, brokerage houses and insurance companies. Three Stock Exchanges at Karachi, Lahore and Islamabad are also a part of Financial System in Pakistan. In addition to managing the monetary policy, SBP also regulates banks and DFIs. Securities and Exchange Commission of Pakistan (SECP) supervises investment banks, leasing companies, insurance companies, modarabas and mutual funds.

In order to enhance the performance of the commercial banks in Pakistan, a privatization strategy was initiated in 1990. Nationalization Act, 1974 was amended to
empower the Federal Government to sell all or any part of the share capital of commercial banks. In this context up to 51 percent of the share capital was taken up by the private sector. Under the financial reforms the private sector was allowed to open new banks. This was aimed to encourage private sector participation and to promote competition in the banking sector. This led to a significant increase in the number of banks and the branch policy for both the domestic private banks and foreign banks was eased to provide the opportunity for existing banks to grow (Qayyum, 2005).

Prior to the initiation of reforms, domestic banks and DFIs were trapped in operational bottlenecks; for example, large number of non performing loans and high intermediation costs. In order to strengthen self-governance, various amendments were made in Banking Companies Ordinance, 1962. These amendments were made to empower the SBP to frame guidelines for recovery of bad or doubtful loans by giving incentives to borrowers for making repayments within a specified time. At the same time, SBP was also authorized to publish a list of defaulters after notifying and hearing from them in advance.

Prudential regulations were also introduced to ensure credit discipline in the banking industry. These regulations focused on capital adequacy, adequate provisioning and effective loan recovery mechanisms, and legal procedures. Under these regulations, all domestic and foreign banks were required to maintain capital and unencumbered general reserves of not less than 8 percent of their risk-weighted assets. To improve the loan recovery process SBP asked banks to set quarterly recovery targets, submit progress reports, and develop strategies to recover loans performance. Furthermore, in order to institutionalize the credit-rating process and to safeguard the interests of prospective investors, depositors and creditors all banks and non bank financial institutions were required to have themselves rated by one of the approved agencies.

Open market operations are considered to be an important tool to conduct monetary policy and this instrument was introduced in January 1995. Over the years OMO has

become a major instrument of monetary policy in Pakistan. Since its introduction, SBP has been conducting OMO through the primary tool of Market Related Treasury Bills (MRTBs) which also enables it to control inter-bank market liquidity. After the initiation of reforms program, more emphasis was placed on cash reserve requirement (CRR), which was at around 5 percent on weekly average basis. Apart from that, banks were also required to maintain a given percentage of their demand and time liabilities in government securities as the statutory liquidity ratio (SLR) which was gradually reduced from 45 to 35 percent in October 1993 and further to 25 percent in March 1994. At present, the ratio stands at 15 percent.

In order to eradicate financial market distortions, lending rate were raised to make them competitive with the market rate and for this purpose, subsidy element in credit provision was abolished. All new credit schemes involving concessional finance were capped.

To encourage foreign investment, restrictions on capital inflows and outflows were liberalised and foreign investors were allowed to invest in all industries particularly in services, infrastructure and agriculture sector. These investors were allowed to purchase up to 100 percent of the equity in industrial companies and investment shares (issued to non-residents) could be exported and remittance of dividend and disinvestment proceeds was permissible without prior approval of SBP. Furthermore, foreign investment was allowed in registered corporate debt issues through public offerings and secondary market purchases as well as investment in the equity market.

In order to facilitate foreign exchange transactions many firms were licensed to work as money changers on payment of prescribed fee. These money changers were allowed to sell and purchase foreign currency notes and coins at their own exchange rates. To encourage trade, exporters were allowed to retain some of the commission amount in their special foreign currency accounts. On the import side, procedures were simplified to facilitate importers. In addition, the foreign exchange market was liberalised and authorized dealers were permitted to determine their own exchange rates for currencies
(other than US dollar) in terms of Rupee depending upon demand and supply position of the market whereas the exchange rate of US Dollar against Pak Rupee continued to be determined by SBP.

While considering the economic and financial market structure in Pakistan and to achieve the objective of controlling inflation (without any prejudice to growth), the central bank of Pakistan - SBP has for sometime pursued a monetary targeting regime with broad money supply (M2) \(^{11}\) as a nominal anchor. The process of monetary policy formulation usually begins at the start of the fiscal year (usually in the month of May) when SBP sets a target of M2 growth in line with government’s targets of inflation and growth and an estimation of money demand in the economy. The basic idea is to keep the money supply close to its estimated demand level, as both a significant excess and a shortfall may lead to considerable deviations in actual outcomes of inflation and real GDP growth from their respective targets. This framework is based on two strong assumptions: first, there is a strong and reliable relationship between the goal variable (inflation or real GDP) and M2 (which is also one of our topics to evaluate); and second, the SBP can control growth in M2. Since the composition of money supply at times requires policy actions and these actions can lead to a deviation in monetary growth from its target level. Considering the changes in monetary aggregates and other economic variables, the changes in monetary policy are signalled through adjustments in the policy discount rate (3-day repo rate). Further, the changes in the policy rate are complemented by appropriate liquidity management mainly through OMO (Open Market Operation)s and if required changes in the CRR(Cash Reserve Requirement) and SLR (Statutory Liquidity Ratio) are also made.

Abolishing sector and bank credit limits in mid 90s, central bank adopted “3-day SBP discount rate” as a major policy instrument to signal easing or tightening of monetary policy. In 1997, SBP and its Central Board were empowered to formulate, conduct and implement monetary policy and a Monetary and Fiscal Coordination Board was established to ensure fiscal policy is well coordinated with the monetary policy. With

\(^{11}\) M2 represents broad money supply comprising currency in circulation, other deposits with SBP and total time & demand deposits and residents’ foreign currency deposits
greater powers to formulate monetary policy, SBP moved to market oriented monetary policy where it relied more on interest rate to serve as a policy fulcrum and developed its capacity to manage financial markets and related activities effectively.

### 2.3 Historical Context of Fiscal Policy in Pakistan

As in many developing economies, the deficit remains high in Pakistan because of the political and administrative inability of the government to mobilize additional resources or to cut current expenditures. Weaknesses in the tax system have led to an inelastic tax structure and a heavy reliance on trade taxes for revenues (Haque and Monteal, 1991). Moreover, with defence expenditures constituting about 25% of expenditures, interest payments another 15%, and administration (including social services) another 15%, the structure of expenditure is not amenable to large cuts. The burden of expenditure cuts, therefore, falls on development expenditure at the cost of much needed infrastructure.

During 1977–88, the public debt grew at the average annual rate of 17.7 percent in nominal terms and nearly 10 percent in real terms during this period. In Pakistan, the ratio of debt to GDP increased from 48.16 percent in 1980-81 to 71 percent in 1988-89 (Figure 2.1).

**Figure 2.1 Debt to GDP Ratios in Pakistan**

![Graph showing Debt to GDP Ratios in Pakistan](image-url)
The debt problem became worst in the 1990s and reached an unsustainable level by 1999 because of the persistence of large fiscal and current account deficits during the last two decades. The result of persistent and rising fiscal deficits, stagnant export receipts, declining worker remittances, and large current account deficits Pakistan economy experienced some improvements during the earlier years of this century. Growth somewhat accelerated, and most macroeconomic indicators improved. Public debt indicators also showed significant improvement. Modest growth in public debt, coupled with the growth in nominal GDP, led to a significant fall in public debt to GDP ratio, from 81.4% in 2001/02 to 56.1% in FY 2006 and currently, the debt to GDP ratio is 59.3 %. Over the same period, domestic public debt to GDP ratio fell from 40.4% to 29.9%, while the external public debt to GDP ratio fell from 41.0% to 26.2%. The improvement in the public debt to GDP ratio in FY06 was due to the fact that both domestic and external debt grew slower than GDP.

However, this trend could not be sustained for long and Pakistan again started facing huge fiscal and current account deficits in the last few years. The fiscal and current account deficits are further widened through increased borrowing from domestic and external sources and a sharper alteration of the exchange rate. Public debt as a percentage of GDP, which stood at 56 percent in June 2007 has increased to 61 percent in current fiscal year – an increase of almost 6 percentage points of GDP in two years.

2.3.1 Fiscal Policy in Pakistan

The origin of fiscal deficits in Pakistan is in many ways similar to other developing countries. In brief, an upsurge of externally financed development spending during the early to mid seventies, primarily in the form of investment by public enterprises, proved to be relatively permanent, and the public sector was unable to generate the revenue either through taxation or from the direct return to the investment under taken to close the fiscal gap thereby created.
2.3.1.1 Fiscal Revenues

Pakistan has one of the world's lowest tax to GDP ratios. It has stood between 9.5% and 10.4% since long and is extremely low compared to neighbouring countries and similar economies. The OECD average is around 36 percent with true welfare states like Norway and Sweden having Tax to GDP ratios as high as 43.6 and 49.7 percent respectively. Pakistan’s tax structure is characterized by a number of structural weaknesses; First, due to a number of wide-ranging exemptions and concessions as well as rampant tax evasion, the tax base is narrow and punctured. Second, tax rates have been pitched at high levels, which created a vicious cycle of tax-base erosion and higher tax rates. Third, there is the issue of multiplicity of taxes, with an individual firm facing numerous types of taxes. Fourth, there is over dependence on indirect taxes, which until recently, accounted for nearly 60 percent share in revenues. This has increased the regressivity of the tax system and imposed a higher burden of taxation. Fifth, the tax system is complex and tedious which, along with high rates, has bred corruption and encouraged evasion(Ministry of Finance Report, 2008).

Table 2.4  Fiscal Indicators: Revenues

<table>
<thead>
<tr>
<th>Variables/Years</th>
<th>1970s</th>
<th>1980s</th>
<th>1990s</th>
<th>2000s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of GDP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tax</td>
<td>11.4</td>
<td>13.2</td>
<td>13.0</td>
<td>12.5</td>
</tr>
<tr>
<td>Non-Tax</td>
<td>2.3</td>
<td>3.6</td>
<td>4.2</td>
<td>4.0</td>
</tr>
<tr>
<td>Revenues</td>
<td>13.7</td>
<td>16.8</td>
<td>17.2</td>
<td>16.4</td>
</tr>
<tr>
<td>Grants</td>
<td>0.6</td>
<td>0.7</td>
<td>0.3</td>
<td>0.9</td>
</tr>
<tr>
<td>Total Revenues +Grants</td>
<td>14.3</td>
<td>17.6</td>
<td>17.6</td>
<td>17.4</td>
</tr>
</tbody>
</table>

Sources; IFS, Economic survey of Pakistan various issues

The miserable state of ability to collect sales, income, property and wealth tax has forced successive governments to increase indirect taxation in the forms of high GST, increased withholding tax and increasing the prices of basic utilities to increase revenue generation. Increases in tax collection are hardly keeping up with increased budgets and GDP. Over the last ten years, indirect taxation has increased on the average by 22.02 percent (FBR Yearbook ’07-’08) thanks to near static income tax collection. The tax to
GDP ratio of direct taxes stands at an average rate of 3.7 percent. There are number of reasons which have contributed to the fall in the tax-to-GDP ratio. These include; first, the loss of growth momentum of the economy, especially of large-scale manufacturing and imports, which constitute the primary tax bases in the economy. This has implied a low marginal tax-to-GDP ratio, which has resulted over time a fall in the average tax to-GDP ratio. Second, the revenue losses resulting from the on-going tax reforms in the country, during the decade of the 1990s, especially the process of trade liberalisation which has involved major reductions in statutory rates of import tariffs. Finally, the systemic decline in the quality of tax administration and in the face of growing evasion and corruption has contributed to low tax to GDP ratio. Pasha (1995), Pasha and Iqbal(1994) and Ahmed(1998) suggest that inefficient and unsuccessful revenue generation as the major cause of Pakistan’s high and persistent budget deficits. Figure 2.2 reveals a consistently low tax-GDP ratio between 10-14 per cent throughout the sample period. In addition, this tax system is heavily over-reliant on indirect taxes (e.g.on trade, excise, sales) that increases the regressivity of the tax system and impose a higher excess burden of taxation. The Pakistan tax system is also categorised as having a very narrow tax base due to the various exemptions and concessions (especially in the agricultural sector) coupled with widespread tax evasion and a large and unrecorded informal sector that remains outside the tax net have resulted in a narrow effective tax base, whilst tax administration remains weak and inefficient (Pasha, 1995; Ahmed, 1998; Cashin et al., 1999; GoP, 2002).

**Figure 2.2   Revenue Structure of Pakistan**
Realizing the existence of long-standing structural problems, and with a strong motive to mobilise additional resources to contain the fiscal deficit, the process of reform of the tax system started in the 1990s with the establishment in 1991 of the Resource Mobilization and Tax Reforms Commission (RMTRC), charged with developing and implementing taxation reforms on the part of the Government of Pakistan. Due to these reforms the relative share of indirect taxes (sales taxes, excise and international trade taxes) decreases from 67% of total revenue to 43% of the total revenue, whereas direct taxes collection is raised from 13% of the total revenue to 39% of the total revenue. Besides these alterations in the composition of tax revenue generation, the persistently low overall tax-GDP ratio is a major issue for Pakistan economy and which is more generally attributable to the prevalence of other inherent structural weaknesses. Indeed Pasha and Iqbal (1994) suggest that “the unfinished task of tax reforms…requires a level of political commitment and willingness to improve the quality of tax administration which has hitherto been lacking”. A report by Andrew Young Institute of Public Policy (2009) on Pakistan’s tax structure states “there is broad consensus that Pakistan’s tax system underperforms, as its tax base is very narrow. The government taxes only a limited number of sectors, businesses and people. The low level and large volatility of these tax revenues has greatly constrained the government’s ability to make plans for development and poverty reduction, and respond adequately to sudden economic crises. These weaknesses are so grave that they can undermine the confidence in Pakistan’s economy as a whole”.

2.3.1.2 Fiscal Expenditures

In Pakistan, the total expenditure in the National Accounts is divided into current and development expenditures. Throughout the sample period, defence and debt servicing have constituted the major share of current and total expenditures, whilst development expenditures are very low. Figures 2.3 and 2.4 depict these three components of expenditures as the % of current expenditures and as the % of total expenditures respectively.
During the sample period, the defence expenditures fell from 49% of total current expenditure to 21.5% whereas debt servicing expenditures increase from 26% to 47.4%. In the past, due to insecure eastern and western borders, and the Kashmir dispute, Pakistan was compelled to increase its defence expenditure but if regional tensions subside and the Kashmir dispute would be resolved, then it could provide fiscal cushion in the form —peace dividendl, and Pakistan may reduce the defence expenditure further. These figures reveal the fluctuations in the debt servicing component, as Pakistan has been facing financial crisis since its inception. Due to financial constraints, Pakistan economy has relied on domestic and external borrowing. Consequently, Pakistan has to spend considerable portion of its GDP on the interest payments of the
loans. During the 1980s Pakistan has spent on average 3.3% of its GDP on interest payments (Table 2.5). However, during 1980s the Afghan war motivated the developed countries and they provided aid accompanied with concessions on debt servicing. But after the Afghan war the problem become severe and in 1997-98, expenditure on debt servicing reaches 80% of current expenditure (7.5% of GDP). Once again after the event of 9/11, Pakistan got considerable relief on debt obligation, and expenditure on interest payment started reducing and in FY 2006-07 it shrunk to 6.6 % of GDP. Moreover, in the 1990s, after the Structural Adjustment Programme with IMF, the Government had to control the budget deficit to meet IMF conditionalities which resulted in rising interest payments on outstanding debt, consistently cut defence and development expenditures as a percentage of GDP. Development expenditure has suffered in particular, since defence reductions have been limited due to the intrinsic political power of the military, which has historically maintained an overt policing role even during periods of democratic rule (Zaidi, 1995).

The reduction in development expenditure has adversely affected the economic growth in Pakistan through three channels. Firstly, reductions in social spending on health & education have stunt the development of human capital which is a prerequisite for sustainable economic growth. Secondly, cuts in public investment, especially in infrastructure such as roads, power, water supply and irrigation have created bottlenecks in the economy and raised the cost of doing business in Pakistan. Thirdly, these cuts in development expenditure were also resulted in discouraging the private investment, which is complementary to public investment in infrastructure. However, the relative reduction of these components after 1995 still failed to curtail the deficit, as interest payments soared on rapidly accumulating debt and general administration expenditures continued to creep upwards, instigating further cuts in development spending.
Table 2.5 Fiscal Indicators: Expenditures

<table>
<thead>
<tr>
<th>Variables/Years</th>
<th>1970s</th>
<th>1980s</th>
<th>1990s</th>
<th>2000s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share in Current Expenditure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest payments</td>
<td>12.5</td>
<td>18.3</td>
<td>30.2</td>
<td>36.6</td>
</tr>
<tr>
<td>Defense</td>
<td>43.9</td>
<td>36</td>
<td>29.5</td>
<td>22.1</td>
</tr>
<tr>
<td>Others</td>
<td>43.6</td>
<td>45.8</td>
<td>40.3</td>
<td>41.3</td>
</tr>
<tr>
<td>Percent of GDP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest payments</td>
<td>1.7</td>
<td>33</td>
<td>6</td>
<td>66</td>
</tr>
<tr>
<td>Defense</td>
<td>6</td>
<td>63</td>
<td>58</td>
<td>39</td>
</tr>
<tr>
<td>Current Expenditure</td>
<td>13.7</td>
<td>17.8</td>
<td>19.8</td>
<td>17.8</td>
</tr>
<tr>
<td>Development Expenditure</td>
<td>3.3</td>
<td>29</td>
<td>3.4</td>
<td>37</td>
</tr>
<tr>
<td>Net Lending to PSEs</td>
<td>49</td>
<td>37</td>
<td>1.7</td>
<td>0.4</td>
</tr>
<tr>
<td>Grand Expenditure</td>
<td>21.9</td>
<td>24.3</td>
<td>24.8</td>
<td>22</td>
</tr>
</tbody>
</table>

Sources: IFS and Economic survey of Pakistan various issues

Table 2.6 Fiscal Indicators: Gaps & Financings

<table>
<thead>
<tr>
<th>Variables/Years</th>
<th>1970s</th>
<th>1980s</th>
<th>1990s</th>
<th>2000s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of GDP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Deficit</td>
<td>59</td>
<td>35</td>
<td>13</td>
<td>-2</td>
</tr>
<tr>
<td>Overall Deficit</td>
<td>7.6</td>
<td>7.1</td>
<td>6.8</td>
<td>4.6</td>
</tr>
<tr>
<td>Percent of Overall Deficit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External Financing</td>
<td>509</td>
<td>22.6</td>
<td>30.7</td>
<td>26.5</td>
</tr>
<tr>
<td>Domestic Financing</td>
<td>49.1</td>
<td>77.4</td>
<td>69.3</td>
<td>73.5</td>
</tr>
<tr>
<td>Bank borrowing</td>
<td>21.2</td>
<td>27.8</td>
<td>28.5</td>
<td>12</td>
</tr>
<tr>
<td>Non-Bank borrowing</td>
<td>28</td>
<td>49.6</td>
<td>40.8</td>
<td>57.5</td>
</tr>
</tbody>
</table>

Sources: IFS and Economic survey of Pakistan various issues

Fiscal deficit has remained a major challenge for Pakistan's economy, during 1970s fiscal deficit was on average 7.6% of its GDP, during that time period due to 1971 war, East Pakistan was separated and there is crunch in revenue and expenditure were on rise. Later on during the 1980s Fiscal deficit was reduced and during that time period it was on average 7.1 % of GDP. During 1990s government has tried its level best to bring the fiscal deficit to 4% of GDP as agreed with IMF in Structural Adjustment Program, but it was able to reduce the fiscal deficit to only 6.8% of GDP. However, Fiscal deficit continued to decrease to 4.6% of GDP in 2000s. Siddiqui (2006) has pointed out that since 1980s, both the ratios of revenue-GDP and the expenditure-GDP has a declining trend in Pakistan, and decline in expenditure-GDP ratio was faster than the decline in
revenue-GDP ratio. Moreover development expenditure was reduced more than other components of the expenditure and the situation has affected economic growth adversely. It is most appropriate that reduction in fiscal deficit would be achieved by revenue mobilization, reduction in the debt burden, and privatization efforts and not by curtailing the development expenditure

2.4 Conclusions

This chapter provides an overview of Pakistan’s macroeconomic environment. In Pakistan, the conduct of fiscal and monetary policies remained a challenging task for the concerned authorities. The fiscal profile has been characterized by budget deficits and the accommodation of fiscal deficits by the monetary authorities has been more of the norm than the exception. The trends in GDP growth were stable during the 1970s and 1980s but the 1990s onward period remained a difficult time for Pakistan economy with low GDP growth rate as well as double digit inflation. Turning to the external sector, after a peak deficit of 11% of GDP in 1979, Pakistan achieved a substantial current account adjustment registering a small surplus in 1982-1983. This improvement in the current account deficit was major attributed to the substantial increase in workers’ remittances (primarily from Pakistani workers employed in Middle Eastern Oil exporting countries). Again from 2001 till 2003, the current account of the balance of payments recorded a substantial surplus. This improvement in the current account of the balance of payments was broad-based, as all the three components of the current account (trade deficit, services account deficit, Net current transfers) showed an improvement.

During the last half of 1980s, financial sector reforms were introduced which resulted in a sound banking sector in Pakistan with improved regulatory and supervisory capacity of the central bank. Deregulation of the interest structure, like auctioning of government securities through bids, discount rates and increased market share of foreign banks has made the banking sector competitive and capable of supporting growing economy. The availability of credit for consumer financing, establishment of
small and medium enterprises and increase in micro financing resulted in better GDP growth rates in 2000s, but this process has been slowed down in the second half of 2000s.

Furthermore, Pakistan’s fiscal structure is categorised with high current expenditure and an inelastic, non-progressive tax structure with narrow tax base which always resulted in high budget deficit. Despite the introduction of tax system reforms, the tax to GDP ratio remained low at around 12.5% of the GDP over the last 3-4 decades. The fiscal authorities always resorted to finance fiscal deficit by domestic borrowing and external finance which resulted into ever rising public debt and high expenses on debt servicing.
Chapter 3

Measuring Monetary Policy Stance in Pakistan

3.1 Introduction

Monetary policy plays an important role in the determination of the output growth rate and price inflation. It is a process through which a monetary authority controls the supply of money (monetary aggregates) and cost of money (the interest rate) to attain a set of objectives oriented towards the growth and stability of the economy.

According to the State Bank of Pakistan Act (1956), monetary policy in Pakistan is aligned with the dual objectives of promoting economic growth and price stability. It achieves these goals by targeting monetary aggregates in accordance with the real GDP growth and inflation targets set by the Government. Following Ben Bernanke (2006) the argument that “price stability is an end of monetary policy; it is also a means by which policy can achieve its other objectives”, the State Bank of Pakistan places more weight and demonstrates increased concentration on controlling inflation relative to the output growth, and financial and exchange rate stability (Qayyum, 2008).

In early 1990s, financial reforms were introduced in Pakistan to reduce inflation and to foster economic growth. These reforms include: provision of more autonomy to the
central bank of Pakistan, privatisation of commercial banks, establishing a domestic bond market and launching Pakistan bonds in the international market, and maintaining high foreign exchange reserves. The general consensus is that the most effective way to ensure the credibility of monetary policy is to give the central bank a clear mandate with price stability as the overriding goal. As a consequence of this autonomy the SBP has been able to bring inflation down to single digits at a time when the economy has performed strongly. However, high domestic and international debt, high fuel prices and consistently high budget deficits remain central issues in Pakistan’s monetary policy.

Economists view that monetary policy has the advantage of the Central Bank’s ability to act faster than the fiscal administration and to better judge the appropriate timing and magnitude of a stimulus. Since in Pakistan monetary policy is designed to reduce inflation and to achieve economic growth, in this context the monetary authority needs a policy stance to align its policy objectives with the aggregate economic activity. So, this chapter evaluates the role and effectiveness of monetary policy in Pakistan through measuring the monetary policy stance.

The monetary policy stance is defined as a quantitative measure of policy strength whether it is too tight, neutral or too loose relative to the objectives of monetary policy. As monetary policy decisions affect economic activity and the rate of inflation level through various channels, it is critical to select a viable and accurate measure of policy stance for the evaluation of alternative theories of transmission, [Bernanke and Mihov (1998)]. Hence, different monetary aggregates are used to analyze monetary policy role to affect different macroeconomic indicators through VAR specifications.

The rest of the chapter is organized as follows; section 3.2 reviews the literature on different measures of monetary policy stance, section 3.3 discusses the data and methodology to measure monetary policy stance which includes both the measurement of monetary conditions index as well as the SVAR specification suggested by Bernanke.

12 Bernanke and Mihov (1998)
and Mihov (1998) approach to measure monetary policy stance and finally section 3.4 concludes the findings of this chapter.

3.2. Literature Review:

3.2.1 Measuring Monetary Policy Stance

There has been a great resurgence of interest among macroeconomic researchers about the role of monetary policy. For a long period, it was perceived that monetary policy had no impact on real economic activity but in late 1980s empirical research in macroeconomics showed that monetary policy significantly affects the short term course of the real economy (Sims, 1980). There seems to be a general consensus that changes in aggregate economic activity depend on how monetary policy is conducted. Monetary policy analysts are confronted with the issue of choosing appropriate measures of the monetary policy stance. Unfortunately, there is no consensus on how to measure the size and direction of changes in monetary policy. However, the empirical literature on measuring monetary policy stance can be segmented into two types of studies: the research which concentrates on a single financial variable and the research which takes a set of variables in a VAR specification.

3.2.1.1 Single Financial Variable as the Policy Indicator

A. Monetary Aggregates as a Measure of Monetary Policy Stance

Historically, changes in monetary aggregates have often served as a measure of monetary policy. Friedman and Schwartz (1963) and Sims (1972) argue that innovations in the monetary aggregates can be used as an approximate measure of the monetary policy shocks. They suggest a positive correlation between the monetary aggregates and output and prices. However, using monetary aggregates as indicators of policy is controversial because changes in monetary aggregates can result from factors other than changes in policy, which include the factors such as changes in money demand or bank
behaviour due to economic conditions over the business cycle. Furthermore, using monetary aggregates as a measure of monetary policy also leads to the “liquidity puzzle”, where positive innovations in these aggregates are associated with interest rate increases (contrary to what theory suggests). Theoretically, an increase in the rate of growth of money supply, holding the output and prices constant, causes the nominal interest rate to fall (the liquidity effect). However, in the long run the interest rate and money growth will move in the same direction due to the adjustments of expected inflation to the changes in money. Hence the negative interest elasticity of money demand produces the liquidity effect but ultimately expected inflation effect dominates the liquidity effect [Leeper and Gordon (1992)]. Lawrence, Christiano and Ljungqvist (1988) produced parallel findings and suggest that if money is at least partly exogenous, then changes in the nominal money can be used to produce real effects. Lucas (1999), Fuerst (1990), Christiano (1991) and Christiano and Eichenbaum (1991) suggest that only unanticipated increases in money supply can reduce interest rates and anticipated changes in money supply can only cause the expected inflation effect. Moreover, the growth rates of monetary aggregates depend on a variety of non policy factors. Observed changes in money growth can reflect both changes in money demand and money supply. Changes in financial structure, introduction of financial innovations and deregulation are such factors which affect velocity of the money and in turn create barrier to use money growth as a measure of policy direction.

B. The Interest Rate as a Measure of Monetary Policy Stance

Recognising the deficiency of money growth as a measure of policy stance, many researchers have suggested various alternative indicators. First Sims (1980) and then Litterman and Weiss (1985) suggested a dominant role of interest rate in forecasting output when added to a vector- auto regression containing money, output, and prices. These authors interpreted this finding as evidence against the effectiveness of monetary policy, whether systematic or non- systematic. This interpretation was disputed on empirical grounds by King (1982) and Bernanke (1986) and on theoretical grounds by Bennett T. McCallum (1983). Bennett T. McCallum (1983) explains that innovations in money stock do not necessarily reflect irregular components of monetary policy. However, when the Fed uses an interest rate as its operating instrument—as it has
during most of the post-war period—it is likely that its irregular actions will be better represented by a VAR system’s interest rate innovations than by its money-stock innovations. And in fact interest-rate innovations do contribute importantly to output movements in Sims’s results. Thus, it cannot be concluded that the actions of the monetary authority are unimportant for the explanation of output and nominal GNP movements.

Some studies suggest the term structure spread as an alternative measure of policy. e.g. Laurent (1988); Goodfriend (1991) and Oliner and Rudebusch (1996). Laurent (1988) and others have suggested the spread between the funds rate and a long-term bond rate as a useful monetary indicator, on the grounds that the long rate incorporates the inflationary expectations component of all interest rates, but is relatively insensitive to short-run variations in monetary tightness or ease. For instance if the short term rate is expected to return back to its initial value then long term rate will change less than the short term rate. On the other hand, if market participants expect that this change is just the first stage of longer sequence of change, then long rate will move by more than the short rate. Sims (1992) uses innovations in the interest rate and Bernanke (1992) uses innovations in the funds rate as a measure of policy. Bernanke (1992) suggests that if policy affects the real economy then the funds rate should be a good reduced-form predictor of major macroeconomic variables. Their results conclude that the Federal funds rate is markedly superior to both monetary aggregates and to most other interest rates as a forecaster of the economy.

Innovations in the overnight rate are suggested by Armour, et al. (1996), they argue that these innovations can reflect monetary policy actions as it is significantly influenced by the operational framework of the central Bank. Moreover innovations in the overnight rate provide identical information about the monetary policy shocks as do innovations of the Bank’s current operational target. Fung and Kasumovich (1998) suggest that M1 innovations produce input responses that are consistent with what one would expect from a monetary policy shock. However, this creates an additional challenge known as the “price puzzle”. The price puzzle arises because increases in the federal funds rate tend to be followed by increases in inflation (Bernanke and Blinder 1992; Christiano,
Eichenbaum, and Evans 1994, and Sims 1992). It is a puzzle because an unexpected tightening of monetary policy (that is, an unexpected increase in the federal funds rate) is expected to be followed by a decrease in the price level, rather than an increase. Many economists have attempted to explain the price puzzle. Sims (1992) argues that the Federal Reserve systematically responds to expectations of higher future inflation by raising the federal funds rate, but by not enough to prevent inflation from actually rising. The result is that increases in the federal funds rate are followed by increases in inflation. A temporary, negative supply shock, for example, would have the effect of raising real interest rates, decreasing output, and increasing prices (at least in the short run).

Moreover, measuring the monetary policy stance directly using the federal funds rate is also implausible. Movements in the rate reflect both the Federal Reserve’s response to economic developments, as well as Federal Reserve actions that are independent, or exogenous, of these developments. To assess the impact of exogenous monetary policy actions on the economy, several studies have used empirical models called vector autoregressions (VARs). Using the VAR methodology, Bernanke and Blinder (1992), Sims (1992), and Christiano, Eichenbaum, and Evans (1994) have found that movements in the federal funds rate are largely consistent with the view that the funds rate is a good proxy for the stance of monetary policy. However, even in these VARs the price puzzle remains: exogenous monetary policy tightenings are followed by increases in the price level. Sims (1992) and Grilli and Roubini (1998) suggest that a positive innovation in the interest rates might leads to an exchange rate puzzle which implies that a positive innovation in interest rates is followed by the depreciation of local currency rather than appreciation, as the increase in the interest rate increases the debt service burden of the fiscal authority, this in turn increases the inflationary expectations and, hence, weakens the currency. Therefore the use of the changes in these variables as policy measure becomes ambiguous.
C. Non Borrowed Reserves as a Measure of Monetary Policy Stance

In the face of the issues of various puzzles with the monetary aggregates and interest rates, there has been a diversion in monetary policy research to the market operation which is immediately impacted by the actions of monetary authority - the market for bank reserves. Christiano and Eichenbaum (1992), suggest the quantity of non-borrowed reserves as an indicator of monetary policy with the argument that innovations in the quantity of non-borrowed reserves only capture the monetary policy shocks while innovations to broader money aggregates confound many other shocks, in addition to policy shocks. Therefore, inference about the effect of monetary policy is very robust when the innovations in the quantity of non-borrowed reserves are used as a measure of monetary policy stance.

Strongin (1992) identifies a confounding mix of supply and demand innovations in the reserve data and suggests two measures of reserves: the level of total reserves and the mix of borrowed and nonborrowed reserve. This approach distinguishes between the changes in reserves due to the policy innovations and the changes which result from the accommodation of demand innovations. Strongin(1992) finds a strong liquidity effect for positive innovations in monetary policy and argues that his proposed measure of monetary policy disturbances has substantially more explanatory power for interest rates and real output than a pure nonborrowed reserves measure or any other single monetary-aggregate based measure.

3. 2.1.2 The Narrative Approach to Measure Monetary Policy

An alternative way to explore the effects of monetary policy is to use official records such as proceedings of the meetings of the Monetary Policy Committee to determine the stance of monetary policy over a given time period. Potts and Luckett (1978) created a binary measure of monetary policy (0 – tight, 1 – easy) depending on whether the intention of the Fed was to slow down or boost economic activity. Romer and Romer
(1989) adopted this approach to address the identification problems highlighted by the time series models. They created a dummy variable for periods when the Fed followed a contractionary monetary policy to offset inflationary pressures. They argued that the responses of output and unemployment to such identified monetary policy contractions demonstrate that monetary policy has strong and persistent real effects on the economy.

This approach is advantageous in that it uses additional information and is nonparametric, but it is constrained with the challenges of subjectivity and endogeniety. [Leeper(1993, 1997) and Sims and Zha (1993)]. Furthermore it takes into account only unidirectional movements in monetary policy like the contractionary direction and makes no distinctions between mildly and severely contractionary episodes [Bernanke and Mihov (1998)].

Boschen and Mills (1995) develop a monthly index of monetary policy stance for the U.S. based on their reading of the Federal Open Market Committee (FOMC) policy directives and records contained in the Annual Report volumes of the Federal Reserve (FED). They generated a discrete measure of monetary policy stance taking five different values {-2, -1, 0, 1, 2}, where -2 indicates a very tight policy stance, while 2 indicates a very loose policy stance. It is a more informative measure of monetary policy, since it differentiates the stance according not only to direction but also size (intensity of the change).

Though more information is used in this measure and it also provides a more continuous measure than Romer’s method - two other problems i.e. subjectivity and endogeneity become more severe. Bagliano, et al. (1999) further extends this narrative approach to an open economy, but identification of interest rate movements as monetary policy changes becomes more difficult due to the simultaneity problem of the exchange rate and the interest rate [Norbin (2000)]. Other attempts to extend the Romer’s approach include; [for example Skimmer and Zettelmeyer (1996) and Rudebusch (1996)]. Skimmer and Zettelmeyer use a change in three months interest rate instead of a dummy variable. However, this approach also suffers from an endogeneity problem [Norrbin
(2000)]. Rudebusch (1996) creates series for the unexpected change in the interest rate from 30-day Fed fund contracts. The problem with this estimate is that it measures all unexpected movements in interest rates not only those associated with Federal Reserve announcements [Norrbin (2000)].

### 3. 2.1.3 Composite Measures of Monetary Policy Stance

The process of financial deregulation and liberalisation of foreign exchange transactions motivated the central banks to evaluate a broader range of monetary indicators to measure the monetary policy stance rather than a single or narrow range of indicators. These studies include the use of a Monetary Conditions Index and a VAR specification with a set of policy and non policy variables as suggested by Bernanke and Mihov(1998).

#### A. Monetary Conditions Index

The Bank of Canada pioneered the use of a monetary condition index (MCI) in the early 1990s because of the close inter-linkages between its money and foreign exchange markets. The MCI is a weighted sum of changes in short term interest rates and exchange rates relative to the values in a baseline year. The change in MCI is interpreted as “the degree of tightening or easing the monetary conditions”. It captures, in a single number, the degree of pressure that monetary policy is placing on the economy, and therefore inflation. Algebraically:

$$MCI_t = \omega_{er} (er_t - er_0) + \omega_i (i_t - i_0)$$

Where $\omega_{er}$ and $\omega_i$ are weights for exchange rate($er$) and interest rate($i$), $t=0$ implies the base period and $\omega_{er}+\omega_i = 1$. Central banks of various countries have also used MCI as a
device for interpreting the changes in monetary policy (Freedman (1994); Hansson and Lindberg (1994)). AMCI has been used as supplementary information to evaluate the divergence between the actual and desired monetary conditions and as an indicator of policy stance in addition to other variables. Today, various international agencies such as the Organization for Economic Co-operation and Development (OECD), the International Monetary Fund (IMF) and the European Central Bank (ECB) and the investment firms such as Deutsche Bank, Goldman Sachs, and J.P. Morgan have constructed MCIs to gauge monetary conditions for various countries.

To evaluate the monetary policy stance in the European Monetary Union- EMU region, Frochen (1996) constructed MCIs for five European countries for the period from 1987 to 1995, considering the effective exchange rate and nominal short-term and long-term interest rates. The indicators suggest a stabilizing impact of monetary policy on the price level since 1990 in France and Germany and that monetary policy might have had stabilizing influence on the price level in these two countries. They also observe the opposite consequences of floating currencies on the economies of the United Kingdom, Italy and Spain starting in 1992. While evaluating the impact of monetary policy on real growth, the same asymmetrical findings appear between the countries with strong currencies and those with weak currencies.

An alternative index of monetary conditions for UK is developed by Batini and Turnbull (2000) which is known as the dynamic MCI (DMCI). It is built by aggregating individual lags of interest and exchange rates to capture the lags between the change in monetary conditions and their first effect on output. The DMCI is strongly correlated with both output (in levels) and inflation (in differences). DMCI suggests that policy became tighter when the UK entered the ERM, but most of the tightening manifested itself between 1990 and 1991, rather than before 1990. The DMCI also indicates that the overall policy stance became tighter after the 1996 surge in sterling. However, it suggests that the first effects on monetary conditions materialized in mid-1997, i.e. almost one year after the beginning of that rise.
Emphasizing the role of interest rate and exchange rate for small open economy like Thailand, Hataiseree (1998) argues that these two channels are important in policy making as through the exchange rate channel monetary policy affects inflation and economic activity and the MCI is an important tool to compare the degree of importance between interest rate and the exchange rate in influencing the future inflation rate. Jin-Lung Lin (1999) confirms that variants of MCIs are capable to indicate the monetary stance in Taiwan.

While analysing the role of monetary policy, Kesriyeli and Kocaker (1999) suggest that in Turkey the exchange rate is thought to be the driving force in the price adjustment process, so weights for interest rate and exchange rate are derived through the estimation of a price equation rather than from an aggregate demand equation. They argue that despite the tight monetary policy, inflation and output growth were still at very high level. The paper stressed that increases in price levels and the output growth should not be interpreted only the result of the monetary policy implemented by the central bank. Other general expansionary policies also contribute to these macro indicators.

Using a simple rational expectations framework, Gerlach and Smets (2000) explain the rationale behind conducting monetary policy with the help of a MCI. They derived a theoretical model to show that the optimal feedback rule of a central bank can be written in terms of an MCI, i.e., the central bank can optimize its objective function by setting a weighted average of interest rates and exchange rates according to macroeconomic conditions. They suggest that if a central bank is using an MCI as an operational target for monetary policy, then it should be able to identify the reasons for exchange rate changes. In case of any change due to the underlying supply and demand developments the target MCI should be adjusted and held constant if other factors are responsible.

Peng and Leung (2005) viewed bank credit as an important channel through which China’s monetary policy is implemented. They extended the conventional MCI and estimated MCIs for China through a weighted sum of real interest rates and the real effective exchange rate. The MCI suggests a distinct easing of monetary conditions in 2002-03, reflecting a weaker US dollar, a relaxed lending policy by banks and an easing of deflation, which reduced the real interest rate thereby facilitating faster economic
growth. However, macroeconomic measures to curb the credit supply and raise interest rates in 2004 resulted in tighter monetary conditions. This was marked by a considerable rise in the MCI, which indicated a reversal of about half of the earlier easing.

For Pakistani data, Qayyum (2002), Hyder and Khan (2006) and Khan and Qayyum (2007) constructed MCIs using different methodologies. The first study targets only CPI inflation but the later concentrates both on output and CPI inflation. Qayyum (2002) used monthly data from June 1990 to June 2001 and suggest that in Pakistan interest rate and exchange rate are the key determinants of the rate of inflation. This study finds value of monetary conditions index for Pakistan approximately 2.79:1 which is close to the estimated ratio of small developing countries as Turkey, Thailand etc. MCI ratio indicates whether a rise in interest rates is compensated along with depreciation in the exchange rate. A value of 2.79 implies that the effect of a depreciation of the exchange rate of 2.79 percentage points can be offset by one percentage point increase in the interest rate. In general, the MCI ratios tend to be smaller for small open economies (i.e. it attributes more weight to exchange rate) than for a larger or closed economies. They find an overall tight monetary policy during the decade with an exception of the phase of 1997 to 1999, which reveals the determination of the monetary authorities to keep inflation low. The low inflation at the end of the decade rationalises the use of MCI as a suitable indicator of monetary policy stance to achieve policy objectives.

In addition, using Johansen’s cointegration techniques, Hyder and Khan (2006) construct a MCI for Pakistan. They derive the weights of exchange rate and the interest rate from cointegrating equations of both prices and output and suggest eight tight and six soft periods of monetary stance during March 1991 to April 2006 in the case of Pakistan. Khan and Qayyum (2007) employ two approaches to measures the monetary policy stance in Pakistan for the sample period 1984 to 2004. Using the monthly data, their first measure is based on the concept of MCI whereas the second measure employs the Bernanke and Mihov(1998) ‘s SVAR approach. Their results reveal the MCI (IS equation-Individual coefficients) plays an important role in determining the output and inflation in Pakistan and the demand shocks have dominated for about eight
years. The results also show that the exchange rate channel is more important than the interest rate channel. Even though the measure constructed through Bernnake and Mihov(1998) is consistent with economic theory and shows small correlation with output and inflation in Pakistan.

Although the MCI can serve as an important indicator of monetary stance, however the use of MCIs as an operational tool is criticized both on their conceptual and empirical foundations by [Eika, Ericsson and Nymoen (1996); Ericsson et al (1998); and Stevens (1998)]. MCI weights cannot be observed directly, so they depend on the assumptions made to estimate them (including parameter constancy, cointegration, dynamics, exogeneity, estimation uncertainty and the choice of variables), and hence are model-specific. Moreover, the MCI is a convex combination of an asset price and a rate of return, which may affect goal variables of monetary policy at different speeds. Different types of shocks have different implications for monetary policy. Through MCI construction we cannot segregate the shocks in exchange rate and interest rate. Further, MCI’s construction is criticized on the ground that, while the interest rate is exogenous, the exchange rate is endogenous and, therefore, these two variables should not be considered as substitutes in the way they are interpreted under MCI (King, 1997).³

**B. VAR Specifications and Composite Index to Measure Monetary Policy Stance**

The monetary conditions index cannot be interpreted as a measure of monetary policy stance because the stance of monetary policy should capture only central bank actions. However, the MCI also reflects changes in the interest rate and the exchange rate which are not only related to central bank policy (Fung and Yuan (2001). As a consequence, a stance measure is required that captures not only central bank actions with respect to inflation control but also includes other important financial variables.

³ For a discussion of the role of the MCI in the conduct of policy, see Freedman (1995).
Most of the existing empirical studies on monetary policy stance measurement employ Vector Autoregression (VAR) techniques. Bernanke and Mihov (1998) suggested a VAR methodology which does not assume that a single variable is the best indicator of monetary policy. They suggest following unrestricted linear dynamic model\textsuperscript{14};

\begin{equation}
Y_t = \sum_{i=0}^{K} B_i Y_{t-i} + \sum_{i=0}^{K} C_i P_{t-i} + A^Y V^Y_t \tag{3.2}
\end{equation}

\begin{equation}
P_t = \sum_{i=0}^{K} D_i Y_{t-i} + \sum_{i=0}^{K} G_i P_{t-i} + A^P V^P_t \tag{3.3}
\end{equation}

where $B_i$, $C_i$, $A^Y$, $G_i$ and $A^P$ are square matrices of coefficients. $Y$ is a vector of non-policy block variables and $P$ is a similar block of policy variables.

At first, a simple model of the market for bank reserves is constructed and the central bank’s operating procedure is used to achieve identification of the VAR model. Then the different stance indicators are evaluated, as implied by different operating procedures, by performing statistical tests in the form of testing over identifying restrictions. Finally, Bernanke and Mihov (1998) constructed an overall measure of the stance of monetary policy—the measure being a linear combination of all the policy variables included in the VAR—by studying a just-identified version of the model. This linear combination is composed of the anticipated or endogenous part of policy (the “policy rule”) and of the monetary policy shocks. One problem in interpreting the monetary policy instrument as a measure of policy stance is that it is not clear what should be the neutral stance.

Following Bernanke and Mihov(1998), Fung and Yuan (2001) applied this methodology to Canada. They assumed that the policy stance, though unobserved, is reflected in the behaviour of a set of observed financial variables, which are known as policy variables or indicators. These policy variables are directly influenced by

\textsuperscript{14} Capital letters indicate vectors or matrices of variables or coefficients; lower-case letters indicate scalars.
monetary policy within a given period. They consider four financial variables, M1, the term spread, the overnight interest rate, and the exchange rate.

Höppner (2001) analyses the overall monetary policy stance in the EU-11 area from 1980 to 1999. A Structural Vector Autoregression – SVAR model is estimated by decomposing the short term interest rate into an endogenous and exogenous component. The deviation of the short rate from a neutral rate (when there is no output gap and the actual inflation rate equals the target) is interpreted as a measure of the course of overall monetary policy. A historical decomposition yields information on the importance of the response of the interest rate to the structural shocks identified in the SVAR. Although historical measures for the EU-11 are constructed on somewhat artificial values, as there was no clear single monetary policy for Europe between 1983 and 1999. However, there was at least some common structure in the conduct of national monetary policies in the EMS and finally, accumulation of the structural interest rate residuals produces a measure of the stance of monetary policy in Europe.

While measuring monetary policy stance for Brazil, Lima, et al (2005) construct two monetary conditions indices: the Conditional Monetary Conditions Index (CMCI) and Bernanke-Mihov Monetary Conditions Index (BMCI). The BMCI measures the stance by a linear combination of contemporaneous values of policy variables with weights given by a SVAR. The CMCI defines the stance of monetary policy as the log of the output gap conditional forecast given observed paths of the main potential instruments of monetary policy (the interest rate and real exchange rate). The two MCIs show, despite conceptual differences, some similarity in their chronology of the stance of monetary policy. The CMCI is a smoother version of the BMCI, possibly because the impact of changes in the observed values of the interest rate is partially compensated by changes in the value of the real exchange rate.

For a highly inflationary small open economy like Turkey, Berument (2007) proposes an alternative measure; the spread between the interbank interest rate and the depreciation rate to assess the monetary policy stance. Most of the studies on
constructing empirical measures of exogenous monetary policy shocks are based on developed countries data. The central banks of developing countries face different type of challenges like currency substitution and close monitoring of fluctuations in foreign exchange reserves. The empirical evidence suggests that positive innovations in the spread contain the properties of the tight monetary policy. These innovations, when they are positive, decrease income and prices, and appreciate the local currency. For prices and the exchange rate, the effects are permanent; but for income the effect is transitory.

Pakistan is also characterized as a highly inflationary small open economy and monetary policy in Pakistan is based on the overriding objective to control inflation and it is tightening in nature. Prior to the financial sector reforms in late 1980s, monetary and credit policies in Pakistan were conducted through direct quantitative controls within the framework of credit budgeting and credit ceilings. Beside global and sectoral credit ceilings, various instruments such as direct credit control included budget subsidies, credit floors, refinancing facilities together with the imposition of cash reserves and liquidity requirements were used. After the introduction of financial reforms in late 1980s, direct controls were replaced by market-based liberalised ones and Open Markets Operations (OMO) were also institutionalised. In Pakistan, the central bank uses the cash reserve requirement - CRR and open market operations - OMO to manage the market liquidity and to contain monetary growth. The direction of monetary policy is indicated by the changes in the discount rate and the overall monetary stance is reflected in the assets prices, long-term interest rates and exchange rate. After the adoption of free floating exchange rate regime, the Pak. Rupee exchange rate is also stabilized through the money market.

3.3 Data and Methodology

To measure the stance of monetary policy this research focuses on two measures; the monetary conditions index and the one developed by Bernanke and Mihov (1998)].
3.3.1 Monetary Conditions Index

The monetary conditions index (MCI) describes the combined effects of the level of interest rates and exchange rate and it is a weighted sum of the changes in short term interest rates and exchange rates relative to the values in a baseline year. The estimated weights of the two measures reflect the respective importance of the interest rates and exchange rate for real measures such as the output gap and inflation. Batini and Turnbull (2002) enumerate three possible applications of such an index: operating target in monetary policy, policy rule or leading indicator measuring monetary policy stance or, more generally, short to mid-term impact of monetary conditions on real economy. The MCI captures the degree of pressure that monetary policy is placing on the economy, and therefore inflation. Monetary policy influences inflation mainly through two channels: interest rates and exchange rates. The rise in interest rates or exchange rates causes the economy to slow down and lowers inflationary pressures. Similarly, a fall in interest rates or a decline in exchange rates generally stimulates the economy and may lead to higher inflationary pressures. Changes in spending feed through into output and, in turn, into employment. That can affect wage costs by changing the relative balance of demand and supply for workers. But it also influences wage bargainers’ expectations of inflation. The impact on output and wages feeds through to producers’ costs and prices, and eventually consumer prices. Thus, the aim of construction an MCI is to take both of these channels into consideration for the sample period 1981 m01 – 2008 m06.

**A. Construction of the MCI**

The concept of MCI has been developed in the seminal papers by Freedman (1994, 1995). As mentioned earlier, MCI is a weighted average of the change in the domestic interest rates and exchange rates, relative to their values on a pre-specified base date. (Freedman, 1994). The basic formula for the MCI is:
\[ MCI_t = \omega_r (r_t - r_0) + \omega_e (reer_t - reer_0) \]  

where \( \omega_r \) indicates relative weight of real short term interest rate \( (r_t) \) and \( \omega_e \) denoting relative weight of the real exchange rate \( (reer_t) \). 0 is the basis period. The ratio \( \omega_r / \omega_e \) reflects the relative impact of interest rate and exchange rate on a medium-run policy goal (e.g., output or inflation) and sum of \( \omega_r \) and \( \omega_e \) equals to unity and the ratio \( \omega_r / \omega_e \) reflecting the relative impact of interest rate and exchange rate on a medium-run policy goal (e.g., output or inflation).

To derive the weights for interest rate and exchange rate the literature has suggested three approaches for estimating MCI weights. These include:

a) **Single equation approach** by estimating either price or output equation which has been used by IMF, OECD, Deutshe Bank, and Merrill Lynch. Moreover Freedman (1994) also suggested that MCI can be constructed in terms of the effect of the interest rate and exchange rate changes on either “aggregate demand” or “prices”. The estimated weights derive from the aggregate demand equation indicate the effect of changes in exchange rate and interest rates on the real aggregate demand. It is expected that exchange rate has a large weight in case of price equation because it has a direct effect on prices in addition to its indirect effect through aggregate demand. Duguay(1994) specified an aggregate demand equation to construct a MCI for Canada, considering the output gap, along with the expected inflation as the major determinant of changes in the inflationary pressures.

b) **Trade share based MCIs** - J.P. Morgan (JPM) constructs a real MCI for the UK in which the weight placed on the exchange rate variable is a function of the long-run exports to GDP ratio. The interest rate weight is then calculated as one minus the exchange rate weight. So the weights are interpreted as a crude relative measure of the effect of the exchange rate on UK’s GDP (through its net trade component) vis-à-vis the interest rate effect on GDP.
Multiple equation approach- this approach deals with the estimation of weights by using a system of equations through cointegration method. The first two approaches are criticized on the basis of omitted variables bias, dynamics (it refers to short term and long-term multipliers of the relationship), exogeneity, and feedback problems. Davies and Simpson (1996) construct MCIs for Goldman Sachs in the UK. Their estimates are based on an unrestricted vector autoregression in four endogenous variables (GDP, the short-term interest rate, the 10-year gilt yield and sterling ERI) and one exogenous variable (oil prices). MCI weights are obtained by looking at the impulse response functions of GDP to a shock to each of the other three endogenous variables in the system. Batini and Turnbull (2000) introduced the concept of dynamic MCIs and they calculated dynamic MCI for the monetary policy committee of Bank of England.

B. Methodology to Estimate the Model

Following Duguay (1994) the current research employs a reduced form equation model to derive weights for MCI construction in Pakistan. Duguay’s (1994) relates the IS curve to the components of the MCI (the interest rate and exchange rate) to output growth controlling for foreign output, commodity prices and fiscal policy. The basic idea is that interest rate and exchange rate movements affect domestic demand via potentially different transmission mechanisms. While monetary policy changes the level of aggregate demand through the real interest rate channel (encompassing fiscal policy changes), exchange rates affect international relative prices and the composition of demand. Moreover, changes in the exchange rate can have a direct effect on inflation through import prices. The advantage of an MCI is that it presents a broader picture of pressures on the economy than the nominal interest rate does.

The Phillips curve provides the relationship between the output gap and inflation, controlling for inflationary expectation. The current model consists of a backward-looking IS curve that relates the output gap to interest rates, exchange rates, and a backward-looking Phillips curve that relates inflation to the output gap.
\[ Y_t^* = a_1 + \sum_{t=1}^{n} \sum_{j=1}^{m} \lambda_{i,j} x_{t-j} + \sum_{k=1}^{p} \gamma_k Y_{t-k} + \varepsilon_{yt} \]  

(3.5)

\[ \pi_t = \alpha_2 + \sum_{t=1}^{m1} \beta_{1i} \pi_{t-1} + \sum_{j=1}^{m2} \beta_{2j} Y_t^* - j + \varepsilon_t. \]  

(3.6)

where \( Y_t^* \) is the output gap (manufacturing production index is used as proxy for measuring output in case of monthly data). The output gap is defined as the difference between the actual output of an economy and the output it could achieve when it is most efficient, \( \pi_t \) is inflation rate, \( x_{t-j} \) is component \( i \) of MCI, here \( x = \{ \text{real interest rate, real effective exchange rate (REER)} \} \).

**Output Gap:** The output gap as a measure of economic activity or “excess demand” is the difference between actual and potential output. Since potential output is an unobserved variable how the literature has defined the concept of potential output has evolved over the time, from its focus on the maximum attainable output to the level of goods and services that an economy can produce without any inflationary pressure. There are two approaches to define potential output; the Keynesian tradition and the neoclassical tradition. According to the first approach, the gap between the movements in aggregate demand in relation to a slow moving level of aggregate supply generates a business cycle and factors of production are not fully employed in case of downswings in the business cycle, most critically, unemployment remains above its frictional level, and wage and inflation pressures are subdued. In this case potential output is formalised based on the concept of non accelerating inflation rate of unemployment (NAIRU), where the gap between actual and potential output indicates the extent to which economy can expand without inflation accelerating. The neoclassical tradition states that potential output is driven by exogenous productivity shocks to aggregate supply that determine both the long run growth trend and, to a large extent, short term fluctuations in output over the business cycle. Under such framework, business cycle fluctuations are not caused by the changes in fiscal, monetary or other policy choices; they are instead unavoidable reactions by rational agents that are responding to unexpected productivity shocks by writing off old investments and regrouping resources.
in order to re-coordinate production and thereby adapt to the new conditions (Thies, 1991). Unlike the Keynesian framework where the economy might reach potential only after an extended period, potential output in the neoclassical framework is synonymous with the trend growth rate of actual output (Scacciavillani and Swagel, 1999). The key measurement problem is thus to distinguish between permanent movements in potential output and transitory movements around potential.

The construction of the output gap is difficult because, among many other problems, potential output is an unobserved variable. Therefore, potential output must be estimated and there are many different ways to estimate potential output. However, these methodologies to calculate potential output do not divide these two intellectual frameworks. Initially, to measure the potential output trends-through-peaks method was developed by Lawrence Klein at the Wharton School (Artus, 1979) which was based on the notion of “maximum attainable” output levels and on the supply of goods and services as a deterministic process. Subsequently various other measures have been developed which can be broadly categorized as the economic (production function) and the statistical (time series) approaches (Bank of England, 1999).

The most widely used univariate technique for time series data is the Hodrick-Prescott (HP) filter. Like the other univariate techniques, the HP filter uses only information included in the actual output series to derive the potential output measure. Other univariate techniques include the Beveridge-Nelson (1981) method, the band-pass (BK) filter proposed by Baxter and King (1995), the "Running Median Smoothing" (RMS) algorithm of Tukey (1997) and the so-called "wavelet filters" (Scacciavillani & Swagel, 1999).

Beveridge-Nelson (1981) decomposition is a detrending method using unobserved components. Output is assumed to contain unobserved permanent component consisting of a random walk with drift and temporary component consisting of a stationary autoregressive process. BN decomposition implies that much of the variation in output is variation in trend, while the cycle component is small and noisy. The band-pass (BK)
filter proposed by Baxter and King (1995) isolates the cyclical component of a time series by specifying a range for its duration, thus the business cycles, and the high-frequency components that reflect irregularities or seasonal effects, do not affect the trajectory of potential output. Here, the business cycle duration is set to last between 8 to 32 quarters, though other specifications were tested as well, yet they did not produce results that differed significantly.

To investigate the consequences of reducing the ‘smoothness’ imposed by the HP filter, an alternative estimate of potential output is computed using a variant of the ‘Running Median Smoothing’ (RMS) algorithm of Tukey (1977). A simple form of RMS filter uses a running window on data, the smoothed value in each period being set equal to the median of the values in the window. The method can be extended to multiple passes and to use different sizes of data windows and observation weights. The wavelet filters separate permanent movements in output from transitory fluctuations. The wavelets filters do not hinge on arbitrary assumptions about the regularity of fluctuations. This is because wavelets theory does not assume that an economic variable evolves according to the smooth dynamics conveniently represented by series of sines and cosines, but rather maps the observed data into more general functional spaces the orthogonal bases of which are called ‘wavelets’. This allows the measure of potential output to include time varying dynamics (Scacciavillani & Swagel, 1999).

However, the main advantages of the HP filter, when estimating potential output, include; it is relatively straightforward to implement, it only requires data on actual real GDP (Bovha Padilla, Padilla Mayer, 2002) and it does not require any judgements about when trend growth changes during the sample. The Hodrick-Prescot (HP) filter can be defined as decomposing a time series \( y_t \) into an additive cyclical component \( y_t^c \) and a growth component \( y_t^g \) (St-Amant & van Norden, 1997).

\[
y_t = y_t^g + y_t^c
\]  

(3.7)
Applying the HP filter involves minimising the variance of the cyclical component $y_t^c$ subject to a penalty for the variation in the second difference of the growth component. This is expressed as:

$$\min_{y_t^g} \arg \sum_{t=1}^{T} \left[ \left( y_t^g - y_{t+1}^g \right) + \lambda \left[ \left( y_t^g - y_{t-1}^g \right) - \left( y_{t+1}^g - y_{t-1}^g \right) \right] \right]^2$$

where $\lambda$ is a smoothness parameter and larger values of $\lambda$ reflect the smoothness of the growth component. Hodrick and Prescott propose setting for $\lambda$ equal to 100, 1600 and 14400 for annual, quarterly and monthly data respectively. The advantage of a mechanical method, such as the HP filter is that the researcher can apply a well known technique to estimate the trend component (potential output) and only a decision on the degree of smoothness must be made. Hence to estimate potential real GDP, seasonally adjusted (logged) real output series is detrended using the HP filter and then real output gap (Gap) is calculated by subtracting the seasonally adjusted and detrended real output series from the actual real output.

For measuring inflation we use the consumer price index (CPI). Inflation (LINF) is measured as the first difference of the logarithm $\text{LCPI}_t - \text{LCPI}_{t-1}$ is used to measure inflation. According to Freedman (1994), monetary conditions index explicitly considers both changes in the interest and exchange rates, expressed in real terms because, in principle, these determine the decisions of economic agents. Furthermore, the transmission of monetary policy cannot be seen as independent from inflation and expected inflation. Ericsson et al (1997) point out that, from an operational point of view, switching between the nominal and real specification of these two variables should be relatively safe inasmuch as inflation and relative prices are nearly constant during the horizon over which MCI-based policy is typically implemented.
The real exchange rate is best proxied by real effective exchange rate (IFS data base). We select REER (CPI based) to reflect changes in the exchange rate and these changes are interpreted as percentage appreciation or depreciation over a month. The call money rate (short term interest rate) is used as the measure of changes in the interest rate and it is deflated through the current inflation to get a measure of real interest rate (RI). All these variables are for the sample period 1981 M1 : 2008M6.

**Testing the Stationarity of the Data**

It is suggested that when dealing with time series data, a number of econometric issues can influence the estimation of parameters using Ordinary Least Squares (OLS). Regressing a time series variable on another time series variable using the Ordinary Least Squares (OLS) estimation can obtain a very high $R^2$, although there is no meaningful relationship between the variables. This situation reflects the problem of spurious regression between totally unrelated variables generated by a non-stationary process. Therefore, prior to the estimation of IS equation, we need to examine the stationarity; for each individual time series, most macro economic data are non-stationary, i.e. they tend to exhibit a deterministic and/or stochastic trend. Therefore, it is recommended that a stationarity (unit root) test be carried out to test for the order of integration. A series is said to be stationary if the mean and variance are time-invariant. Therefore, a stochastic process that is said to be stationary simply implies that the mean $[E(Y_t)]$ and the variance $[Var(Y_t)]$ of $Y$ remain constant over time for all $t$, and the covariance $[covar(Y_t, Y_s)]$ and hence the correlation between any two values of $Y$ taken from different time periods depends on the difference apart in time between the two values for all $t≠s$. Since standard regression analysis requires that data series be stationary, it is obviously important that we first test for this requirement to determine whether the series used in the regression process is a difference stationary or a trend stationary.
Unit Root Test

This test helps to determine the order of integration of the individual series. Several procedures for the test of order of integration have been developed. The most popular ones are Augmented Dickey-Fuller (ADF) test due to Dickey and Fuller (1979, 1981), and the Phillip-Perron (PP) due to Phillips (1987) and Phillips and Perron (1988). The augmented Dickey-Fuller test relies on rejecting a null hypothesis of unit root (the series are non-stationary) in favor of the alternative hypotheses of stationarity. The tests are conducted with and without a deterministic trend (t) for each of the series. The general form of ADF test is estimated by the following regression.

\[ \Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{i=1}^{n} \alpha \Delta y_i + \delta_t + e_t \]  

Where \( y_t \) is a time series, \( t \) is a linear time trend, \( \Delta \) is the first difference operator, \( \alpha_0 \) is a constant, \( n \) is the optimum number of lags in the dependent variable and \( e \) is the random error term. We employ the augmented Dickey-Fuller test (ADF) to check the stationary properties of the data series before the estimation of weights of the MCI.

These tests show that for inflation, real interest rate and the output gap, the null hypothesis can be rejected at the 5 per cent level but it cannot be rejected for the real effective exchange rate. In contrast, the unit root hypothesis is rejected at the 5 per cent level taking the first difference of the real effective exchange rate. Hence, we conclude that this variables is integrated of order one (Table 3.1).

<table>
<thead>
<tr>
<th>Variable</th>
<th>t-Ratio</th>
<th>Variable</th>
<th>t-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>LInf</td>
<td>-7.86605</td>
<td>ΔInf</td>
<td>-11.841</td>
</tr>
<tr>
<td>RI</td>
<td>-4.44977</td>
<td>ΔRI</td>
<td>-12.6814</td>
</tr>
<tr>
<td>LREER</td>
<td>-2.2879</td>
<td>ΔLREER</td>
<td>-4.746</td>
</tr>
<tr>
<td>Gap</td>
<td>-13.7509</td>
<td>ΔYG</td>
<td>-11.7851</td>
</tr>
</tbody>
</table>

Table 3.1 ADF Test of Unit Roots
IS and Phillips Curve Estimates

Following Duguay (1994), a backward looking IS and a backward looking Phillips curve are estimated to determine the weights for MCI. In the IS curve, the real output gap is the dependent variable; on the right-hand side of the equation, lagged real interest rate based on nominal call money rate (deflated by consumer price index) and real effective exchange rate serve the purpose of estimating the MCI-ratio. We do this by dividing the interest rate parameter by the exchange rate parameter. The signs for the interest rate coefficient are expected to be negative, since an increase in the interest rate lowers the aggregate demand whereas the exchange rate coefficient is expected to be positive because an increase in REER signifies an appreciation of the Pakistani Rupee and, hence, *ceteris paribus*, dampen aggregate demand. The equation also contains the lagged real output gap as an independent variable to address the issue of any serial correlation if it exists. Estimation output is presented in Table 3.2.

Table 3.2 Estimation of the Backward Looking IS Equation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAP(-1)</td>
<td>0.702</td>
<td>17.279</td>
</tr>
<tr>
<td>RI(-2)</td>
<td>0.002</td>
<td>3.967</td>
</tr>
<tr>
<td>RI(-4)</td>
<td>-0.001</td>
<td>-2.065</td>
</tr>
<tr>
<td>RI(-16)</td>
<td>-0.001</td>
<td>-1.895</td>
</tr>
<tr>
<td>D(LREER(-1))</td>
<td>-0.492</td>
<td>-2.616</td>
</tr>
<tr>
<td>D(LREER(-8))</td>
<td>0.081</td>
<td>0.439</td>
</tr>
<tr>
<td>D(LREER(-10))</td>
<td>0.322</td>
<td>1.761</td>
</tr>
<tr>
<td>D(LREER(-12))</td>
<td>0.293</td>
<td>1.565</td>
</tr>
<tr>
<td>D(LREER(-14))</td>
<td>0.003</td>
<td>0.016</td>
</tr>
<tr>
<td>D(LREER(-16))</td>
<td>-0.282</td>
<td>-1.543</td>
</tr>
<tr>
<td>D(LREER(-18))</td>
<td>0.074</td>
<td>0.407</td>
</tr>
</tbody>
</table>

R-squared = 0.5506 Adjusted R-squared = 0.5351  AIC = -4.6012  S.E. of regression= 0.0238  D.W stat = 1.6695

The estimation of backward looking IS curve shows that the estimated parameters have expected signs. We take only those coefficients which are comparatively larger in magnitude, although some of them are not statistically significant. The summation of real interest rate coefficients is negative in the real output gap equation in conformity
with the theory and it reflects that a decrease in real interest rate will increase the actual output, since the major components of aggregate demand (investment and consumption) are affected by a change in the interest rate. A decrease in the interest rate reduces the capital costs of the firms and increases the present value of their future profit—thus an increase in the investment. At the same time, consumption also tends to increase, leading to an increase in the aggregate demand, and hence output to increase. These changes in aggregate consumption and investment have direct link to the gross domestic product (GDP).

Another channel of monetary transmission is the exchange rate channel. Since the real effective exchange rate series is non-stationary therefore we use the first difference of the series and $\Delta$ REER shows the movement in the exchange rate. The summation of the real exchange rate coefficients is negative which reflects that a negative change in real exchange rate implies a depreciation of the domestic currency and it will increase the real output gap since a positive output gap implies an overheating economy and upward pressure on inflation. This effect is transmitted through the prices of exporting goods. Real exchange rate depreciation improves the competitive position of producers in the tradable sector (exporters) vis-à-vis their foreign counterparts.

All the coefficients are theoretically consistent and each of this total value of coefficients can be used to estimate the relative influence of changes in interest rates and changes in exchange rate on the output gap. The coefficients for both the variables are small, possible due to the fact that we are taking the real interest rate and the log values of the real effective exchange rate as our explanatory variables. Although the interest rate coefficients are statistically significant but their magnitude is smaller than the exchange rate. The sum of coefficients for the interest rates measure stays at -0.00015, whereas the sum of coefficients for the exchange rate measure is -0.00029 and the value of real MCI is 0.512280702 (alternatively 1:1.95). In other words, a one percentage point increase in the interest rate is equivalent to a 1.95 percentage point increase in the exchange rate in terms of their impact on aggregate demand over time.
The important estimation result appears in line with the set of expectations, in which MCI ratios tend to be smaller for small open economies (Reserve Bank of New Zealand, 1996). In addition, the results of the analysis indicate that changes in the interest rates as well as changes in the exchange rate influence the output gap significantly. Weight for interest rate is $0.338747(\omega_i/\omega_i+\omega_{er})$ and for exchange rate is $0.661253(\omega_{er}/\omega_i+\omega_{er})$. Based on equation (3.5) and using the estimation of the coefficients of the MCI, the index over the sample period is constructed as follows;

$$\text{MCI}_t = [0.338747(r_t - r_0) + 0.661253(reer_t - reer_0)] \times 100 + 100 \quad (3.10)$$

In this computation, the MCI is a linear combination of deviation of interest rates and exchange rate from the defined base period. It is essential to select the most appropriate base period as an equilibrium period. Only by doing so we can seek a possible approach to compare any situation with equilibrium and conclude the degree of tightness and looseness in monetary conditions. For this purpose we use monthly data from January 1982 to June 2008 and two base periods are selected to calculate MCI. First base month is December, 1981 and the second base month is December 1990. There is no theoretical basis to select these months. The decision is an arbitrary decision due to the start of the sample period and the second is due to the initiation of financial sector reforms by the government of Pakistan during the financial year 1989-90. This choice seems to be reasonable to analyse monetary condition in Pakistan during the previous decades.
Figure 3.1 Monetary Conditions Index (December 1981 as base)

Figure 3.2 Monetary Conditions Index (December 1990 as base)

Figure 3.1 plots the Pakistan’s Monetary Conditions Index (adjusted for trends and cycles) taking December 1981 as base period whereas Figure 3.2 plots the MCI with December 1990 as base period. A decline in the interest rate increases aggregate demand and lowers the MCI, as does a depreciation of Pakistani Rupee, so a fall in the index is interpreted as a loosening of monetary conditions. As a policy indicator, the MCI aims to keep track of both interest rate and exchange rate movements and their effects on aggregate demand Figure (3.1) shows that both the series are noisy in late 1990s, indicating the time period when economy was in transition to financial reforms period.
Although the two indices exhibit similar trends and they only differ in constant value but, to check the robustness of our estimates we have constructed two MCIs with different base years. In case of MCI (1) with December 1981 as a base, MCI fluctuates above the base year as shown in the Figure 3.3. Figure 3.3 depicts the percentage change in the MCI(MOV1, MOV2) each year and it reveals that monetary conditions index tends to be more volatile in the post reform period which can be attributed to the liberalisation of financial markets and less controlled foreign exchange market in Pakistan. It is evident from the figures that spell of tight monetary policy remained operative till 1996-97 and monetary authorities are easing monetary policy since 1997-98. Both MCIs reflect that monetary policy remained relatively tight up to January 2002 and then MCI index tends to decline continuously from the base period signalling a general loosening of monetary conditions. It is important to note that the MCI index was continuously declining from June 2001 primarily due to a sharp reduction in interest rate amid incomplete sterilization of money supply arising from the State Bank of Pakistan- SBP intervention in the foreign exchange market which was slightly offset by the appreciation of rupee/dollar parity. However, MCI inched up slightly from January 2004(till 2008 M06), which reflects the tightening of monetary conditions.

Table 3.3 identifies different tight and soft periods of monetary policy stance during the sample period from December 1981 to June 2008. As, a higher value of MCI reflects a tight monetary policy hence we can observe several tight monetary policy phases in Table 3.3 which are associated with high interest rate and high MCI values. In addition,
Figure 3.4 reflects that movements in the exchange rate are unidirectional which implies that Rupee depreciates over time and this pattern remains stable over the sample period. Therefore, the interest rate is the swing factor in the movement of MCI and hence in the monetary stance. Specifically, a decline in interest rates resulted in a soft monetary policy and a rise in the interest rates tightened the policy which is further revealed by the Table 3.3.

Table 3.3 Stance of Monetary Policy during December 1981 to June 2008

<table>
<thead>
<tr>
<th>Duration</th>
<th>MCI</th>
<th>Average MCI</th>
<th>Real Exchange Rate</th>
<th>Average REER</th>
<th>RI</th>
<th>Average RI</th>
<th>Monetary Stance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-85 - Jan-90</td>
<td>-163</td>
<td>87.95</td>
<td>-40.723</td>
<td>114.34</td>
<td>194.91</td>
<td>141.288</td>
<td>2.66</td>
</tr>
<tr>
<td>Feb-90 - Aug-92</td>
<td>-256.54</td>
<td>99.76</td>
<td>-47.84</td>
<td>110.01</td>
<td>119.78</td>
<td>115.336</td>
<td>0.055</td>
</tr>
<tr>
<td>Sep 1992 – Sep-96</td>
<td>-226.035</td>
<td>254.358</td>
<td>63.34</td>
<td>105.84</td>
<td>118.16</td>
<td>111.304</td>
<td>0.941</td>
</tr>
<tr>
<td>Jan-02 - Dec-04</td>
<td>-265.02</td>
<td>1.44</td>
<td>-161.32</td>
<td>88.18</td>
<td>97.24</td>
<td>92.569</td>
<td>-0.028</td>
</tr>
<tr>
<td>Jan 2005 – June 2008</td>
<td>-207.26</td>
<td>121.39</td>
<td>-1.924</td>
<td>89.34</td>
<td>98.11</td>
<td>95.771</td>
<td>1.678</td>
</tr>
</tbody>
</table>

Figure 3.4 Trends in Real Interest Rate, Real Effective Exchange Rate and MCI

From December 1981 to December 1984, real interest rate remains within the range from 4.902 to 10.534, real effective exchange rate (REER) moves between 181.188 and
219.14 and monetary conditions index fluctuates between -77.069 and 116.84. During this time, monetary authorities in Pakistan decided to abandon the fixed exchange rate mechanism and adopted a floating exchange rate system. These three years are also characterized as the time period when the government relied heavily on bank borrowings to finance its budget deficit which also translated into an increase in the inflation rate (about 12.5%). In the next phase, January 1985 to August 1992, the government changed its strategy and resorted to non bank borrowings which led to low real interest rate, and hence a low value for the monetary conditions index during this time period. Figure 3.4 indicates that during this phase, the exchange rate depreciates but with a stable pattern so movements in the MCI are attributed to the changes in the real interest rate.

In the early 1990s, the State Bank of Pakistan decided to reduce the repo rate from 17.0 percent to 15.0 percent and consequently lower the interest rate on Treasury-bills. In 1995, SBP introduced a market based interest rate and decided to eliminate interest rate subsidies. This episode of tight monetary policy was followed due to rising rate of inflation. At that time the domestic currency was also depreciating due to a current account deficit and hence SBP pushed up the repo rate thrice during this period from 15.5 percent to 20 percent.

At the time of Asian Financial Crises in 1997, the SBP introduced various measures in order to safeguard the country’s economic viability, these measures include; the devaluation of Rupee, reduction in the repo rate as well as in export refinance rate. In addition, SBP also reduced the reserves requirement and the repo rate was reduced from 18.5 percent to 18 percent. In May1999, Pakistan economy faced economic sanctions by major donors countries and the IMF halted all its assistance due the atomic detonation. At that time, increased government borrowing from the SBP for budgetary support eased the interest rate in the money market. In addition, SBP reduced the repo rate thrice from 16.5 percent to 13.0 percent during this period. In January 2000, SBP further reduced the repo rate to 11 percent. In October 2000, SBP raised the discount rate and cash reserve requirement in order to reduce the speculative activities in exchange rate.
Table 3.3 shows January 2002 till December 2004 as soft period with lower values of MCI, real effective exchange rate and real interest rate. This soft period is attributed to the external shock of September 11 and the subsequent surge in workers’ remittances into the formal banking channel led to continuous appreciation of the Rupee in the interbank market. Additional impetus to dollar liquidity in the interbank market also came from narrowing trade deficit. The consequent influx of huge Rupee liquidity in the money market due to partial sterilization of reserve money and better economic management also led to a sharp fall in interest rates across the board (Zulfiqar, 2007). These external shocks were translated into a soft monetary policy up to December 2004.

Since January 2005, in response to inflationary pressures (11.3%), the SBP has been and remains in monetary tightening phase which is also reflected by the upward movements in MCI. These inflationary pressures were the consequence of the easy monetary policy followed in preceding few years. Although SBP has raised the policy discount rate from 7% to 9% to control inflation but there were some renewed demand pressures due to fiscal and external account deficits. These twin deficits were caused by both international oil price increase as well as unforeseen spending demands triggered by the earthquake. Then SBP further raised its policy discount rate to offset these additional demand pressures. These measures tried to moderate aggregate demand but various other factors disrupted the impact of monetary tightening ((Figure 3.5 )). These factors include; huge government borrowing from central bank and domestic commercial banks, SBP being mandated to provide higher than projected refinancing for the textile sector and higher than expected foreign inflows which resulted in monetary expansion.

**Figure 3.5 Relationships between the Movements in MCI, Inflation and Output**
Figure 3.5 indicates that lower values of MCI lead to an upward movement in real output but inflation is not determined only by monetary variables but there are some other factors which contribute to the inflationary pressures in Pakistan.

3.3.2 Bernanke and Mihov (1998) Approach- Semi Structural VAR

Despite the fact that there are some obvious benefits of the MCI; as it is straightforward, easy to understand, and, in the past, was seen as a better indicator and has been used by central banks, international organisations, as well as financial corporations in different ways over the years, however it has been criticized both on its conceptual and empirical foundations [see among others, Eika, Ericsson and Nymoen (1996); King (1997); Ericsson et al (1998); and Stevens (1998)]. It is difficult to operationalise given that it combines a monetary policy tool (interest rate) and a macroeconomic outcome (the exchange rate) and a lot of judgement is required for its calculation. MCI weights are model dependent and they cannot be observed directly. These estimates are derived empirically from a model of the economy either through aggregate demand or inflation equation. Moreover, the weights may not remain stationary and tend to change over-time and MCI can vary on the choice of variable. In addition, the market expectation of a shift in policy is not captured by MCI and it does not consider other financial variables that may be important in the transmission mechanism. To measure the monetary policy stance, Bernanke and Mihov (1998) suggest a semi structural VAR methodology which includes all the policy variables to reflect the central bank’s operating procedure. Then they evaluate the different stance indicators through statistical tests in the form of testing over identifying restrictions. Finally, they constructed an overall measure of the stance of monetary policy which is a linear combination of all the potential candidates of policy indicators.

They argued that their method has several advantages over previous approaches. First, their specification captures all the best-known quantitative indicators of monetary policy used in VAR modeling. Second, their analysis leads directly to estimates new optimal policy indicator. Third, they argued that by estimating the model over different sample periods, they were able to capture changes in the economy structure, while imposing a
minimal set of identifying assumptions. Finally, this method is applicable to other countries and period. Earlier, both Bernanke and Blinder (1992) and Christiano and Eichenbaum (1992) proposed structural VARs where one policy variable (respectively, the Fed Funds rate and nonborrowed reserves) is listed last. This ordering is meant to reflect policy endogeneity. Bernanke and Mihov (1998) have extended and generalized the approach of Bernanke and Blinder (1992) and Christiano and Eichenbaum (1992) by considering a vector of policy variables, instead of just one policy variable and their methodology assumes a “true” economic structure in the following unrestricted linear dynamic model:

Bernanke and Blinder (1992) proposed the following strategy for measuring the dynamic effects of monetary policy shocks

\[ Y_t = B_0 Y_t + B_1 Y_{t-1} + C_0 P_t + C_1 P_{t-1} + u_t \]  
(3.10)

\[ P_t = D_0 Y_t + D_1 Y_{t-1} + G_0 P_t + G_1 P_{t-1} + v_t \]  
(3.11)

where \( Y \) is a vector of nonpolicy variables, \( P \) is a vector of policy variables, and \( u \) and \( v \) are orthogonal disturbances. The system (3.10)-(3.1) is not identified. Two types of identifying assumptions are most obvious: The preceding discussion suggests excluding \( Y_t \) from (3.11), which means assuming that there is no feedback from the economy to policy actions within the period. If \( D_0 = 0 \), we can convert this system into a standard vector autoregression (VAR) by substituting (3.11) into (3.10) and solving to obtain

\[ R_t = D_1 Y_{t-1} + G_0 P_t + G_1 P_{t-1} + v_t \]  
(3.12)

\[ Y_t = (1 - B_0)^{-1} \left[ (B_1 + C_0 D_1) Y_{t-1} + (C_0 G + C_1) P_{t-1} + u_t + C_0 v_t \right] \]  
(3.13)

In this case, the effects of policy innovations on the nonpolicy variables can be unambiguously identified with the impulse response function of \( Y \) to past changes in \( v \) in the unrestricted VAR consisting of (3.12) and (3.13), with \( P \) placed first in the
ordering. An alternative identifying assumption is to suppose that contemporaneous \( P \) does not enter equation (3.10), that is, that \( C_0 = 0 \), so that policy actions affect real variables only with a lag. In this case, the appropriate VAR has \( P \) last in the ordering, viz

\[
Y_t = (1 - B_0)^{-1}\left[ B_1Y_{t-1} + C_1P_{t-1} + u_t \right]
\]

(3.12)

\[
P_t = (D_1 + D_0(1 - B_0)^{-1}B_1)Y_{t-1} + (G + D_0(1 - B_0)^{-1}C_1)P_{t-1} + v_t + D_0(1 - B_0)^{-1}u_t
\]

(3.13)

here \( v_t \) is still a policy innovation, but \( P_t \) is now also affected by contemporaneous macro shocks \( u_t \). since Bernnake and Blinder (1992) method assumes that a good scalar measure of policy is availableHowever, Bernnake and Mihov(1998) suggest that it may be the case that we have only a vector of policy indicators, \( P \), which contain information about the stance of policy but are affected by other forces as well. For example, if the Fed’s operating procedure is neither pure interest-rate targeting nor pure reserves targeting, then both interest rates and reserves will contain information about monetary policy; but in that case, both variables may also be affected by shocks to the demand for reserves and other factors. In this more general case the structural macroeconomic model (3.10)–(3.11) may be written as

\[
Y_t = \sum_{i=0}^K B_iY_{t-i} + \sum_{i=0}^K C_iP_{t-i} + A^YV^Y_t
\]

(3.14)

\[
P_t = \sum_{i=0}^K D_iY_{t-i} + \sum_{i=0}^K G_iP_{t-i} + A^PV^P_t
\]

(3.15)

where \( B_i, C_i, A^Y, G_i \) and \( A^P \) are square matrix of coefficients. \( Y \) is a vector of non-policy block of variables and \( P \) is a vector of policy variables. Variables included in non-policy block are real GDP(yr), CPI (LCPI), and world commodity price (\( LCPIF \)). Since Pakistan’s most of trade flows are to the USA hence USA’s CPI is used as a proxy for World commodity price. Variables included in policy block are real interest rate (RI), real exchange rate(LREER), interest term-spread (spr), and monetary aggregate (\( m2 \)). These policy variables are potentially useful as indicators of the stance of the monetary policy. It is possible that these policy variables are also influenced by other shocks,
however the central bank might have a significant influence on these variables within the current period. For instance, when the central bank introduces a change in monetary policy through the changes in short-term interest rate, it also considers the contemporaneous reaction of the exchange rate and the subsequent effects on the economy. Non-policy variables include other macroeconomic variables, such as real output and prices, whose responses to monetary policy shocks we would like to examine. In this system, each variable is allowed to depend on current or lagged values of any variable in the system. The vectors \( V^p \) and \( V^p \) are mutually uncorrelated “structural” or “primitive” disturbances.

Since Bernanke and Mihov (1998) use the estimates of the central bank’s operating procedure to identify policy stance from a set of policy indicators, this approach also allows us to examine cases in which the central bank uses hybrid operating procedures—for example, targeting an interest rate while smoothing exchange rate fluctuations. In this case, both the interest rate and the exchange rate contain information about the stance of monetary policy, but both variables may also be affected by demand or other shocks. Even if there is only a single policy indicator, their approach allows us to choose among the candidate indicators statistically.

In equation (3.15), when policy block has more than one element, suppose that one element of the set of shocks \( v^p \) indicates the shock to monetary policy. For the identification of \( v^p \) and dynamic responses to shock, we assume that innovations to variables in policy block do not affect variables in non policy block within that period i.e., \( C_0=0 \). Now suppose that we write the system equations (3.14) and (3.15) in standard reduced-form VAR format by moving the contemporaneous terms \( Y_t \) and \( P_t \) to the left-hand side. We define \( U^y_t \) to be the VAR residuals corresponding to the Y block and \( U^p_t \) to be the component of the residuals corresponding to the P block, which is orthogonal to \( U^y_t \). Then equations (3.14) and (3.15) can be rewritten as a reduced-form VAR:

\[
Y_t = \sum_{i=1}^{K} H^y_{ti} Y_{t-i} + \sum_{i=1}^{K} H^p_{pi} P_{t-i} + U^y_t
\]

(3.16)
\[ r_t = \sum_{i=1}^{K} J^y_{i} y_{t-i} + \sum_{i=1}^{K} J^p_{i} P_{t-i} + \left[ (I - C_0)^{-1} D_0 U^y_t + U^p_t \right] \]  

(3.17)

Suppose that we estimate equations (3.16) and (3.17) by standard VAR methods and then extract the component of the residual of equation (3.17) that is orthogonal to equation (3.16), denoted by \( U^p_t \), comparing equations (3.12) and (3.13) with equations (3.14) and (3.15), it can easily be shown that is related to by the following:

\[ U^y_t = (I - B_0)^{-1} A^y V^y_t \]  
\[ U^p_t = (I - C_0)^{-1} A^p V^p_t \]  

(3.18)

Equation (3.18) can also be rewritten as

\[ U^p_t = G_0 U^p_t + A^p V^p_t \]  

(3.19)

Equation (3.19) is a standard structural VAR system that relates observable VAR-based residuals \( U \) to unobserved structural shocks \( V \). This system can be estimated and identified by conventional methods. Given the parameter estimates, we can recover the structural shocks \( V^p_t \), including the exogenous monetary policy shock \( v^t \), by inverting equation (3.19):

\[ V^p_t = (A^p)^{-1} (I - C_0) U^p_t \]  

(3.20)

The associated impulse-response functions can be used to evaluate the dynamic responses of all variables to the policy shock. To identify the monetary policy stance, this approach allows us to concentrate on the identification restrictions in the policy
block by modelling equation (3.19). To identify the policy block, we rely on a model of the market for money to impose parameter restrictions on the policy variables. To identify the non-policy block of equation (3.17), we impose a recursive causal ordering of the non-policy variables and restrict to be diagonal. In other words, if output is ordered first in the non-policy block, it will not react contemporaneously to other variables in either the policy or non-policy blocks. Under the Choleski scheme, the ordering of the variables is particularly important for the structural economic interpretation of the VAR (see Lutkepohl 1993 and Hamilton 1994). Given the estimated coefficients of the VAR, we can also obtain the following vector of variables:

\[
(A^P)^{-1}(I-G_0)P
\]  

(3.21)

which are linear combinations of the policy indicators, the orthogonalized VAR innovations of the variables described by equation (3.21) correspond to the structural disturbances in equation (3.20). When $P$ is a vector of policy variables, the estimated linear combination of policy variables included in $P$ can be used to measure policy stance, including both the endogenous and exogenous portions of the policy and the shock to this measure represents the exogenous monetary policy shock. Then we examine the impulse-response functions of a shock to policy stance to see whether it is consistent with the expected monetary policy shock. We also compare our stance measure with changes in inflation and with output growth.

### 3.3.3.1 The Model

The model, written in innovation form, is described by the following set of equations:

**Money Demand:**

\[
u_M = -\beta \mu_{SPR} + \nu^d
\]  

(3.22)

**Money supply:**

\[
u_{SPR} = \alpha^d \nu^d + \alpha^x \nu^x + \alpha^b + \nu^b
\]  

(3.23)
Equation (3.22) reflects the short-run money demand function as it inversely relates the innovation in the demand for money to the innovation in term spread and an autonomous shock to money demand; Equation (3.23) determines the amount of money that commercial banks are willing to supply by influencing the term spread (SPR). The money supply decision is also influenced by the shocks in money-demand shocks ($v^d$), shocks in monetary policy ($v^s$), and the exchange rate shocks ($v^x$). The term ($v^b$), is a money-supply shock or alternatively a credit shock. Here we assume that currency is mainly demand-determined, and thus credit supplied by commercial banks determines the supply of money to the economy (Laidler (1999)). The determination of call money rate (RI) is explained through Equation (3.24) which assumes that that the central bank observes and responds to shocks to the total demand for money, shocks to the supply of money, and shocks to the exchange rate within a given period, with the strength of the response given by the coefficients $\phi^d$, $\phi^b$, and $\phi^x$. Setting for example $\phi^d=0$ implies that the Bank completely offsets the money-demand shock to keep the call money rate from changing. The term $v^s$ represents exogenous monetary policy shocks that we want to identify.

The exchange rate equation (3.25) relates the innovation in the exchange rate to the innovations in all the other policy variables. In this equation, innovations in the exchange rate are decomposed into two components: the responses to innovations in other variables in the policy block, plus an exogenous exchange rate shock. We can write the relationship between $U$ and $V$ as

$$(I - G)\mathbf{u} = \mathbf{A} \mathbf{v}$$

$$
\begin{bmatrix}
1 & \beta & 0 & 0 \\
0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 \\
\gamma_1 \gamma_2 \gamma_3 & u_M & u_{SPR} & u_{RI} & u_{REER}
\end{bmatrix}
= 
\begin{bmatrix}
1 & 0 & 0 & 0 \\
0 & \alpha^d & \alpha^s & \alpha^x \\
0 & 0 & 0 & 1 \\
\phi^d & \phi^b & 0 & 0
\end{bmatrix}
\begin{bmatrix}
v^d \\
v^b \\
v^x
\end{bmatrix}
\Rightarrow
(3.26)$$
Then Equation (3.26) can be inverted to determine how the monetary policy shock, \( V^s \),
depends on the VAR residuals.

\[
v^s = \omega_M u_M + \omega_{SPR} u_{SPR} + \omega_{RI} u_{RI} + \omega_{REER} u_{REER}
\]  

(3.27)

where

\[
\omega_M = \left[ \frac{\phi^b \alpha^d - \phi^d}{1 - \phi^b \alpha^s} \right] \gamma_1
\]

\[
\omega_{SPR} = \left[ \frac{\phi^b \alpha^d - \phi^d}{1 - \phi^b \alpha^s} \right] \gamma_2
\]

\[
\omega_{RI} = \left[ \frac{1 + \phi^b \alpha^d - \phi^d}{1 - \phi^b \alpha^s} \right] \gamma_3
\]

\[
\omega_{REER} = \left[ \frac{\phi^b \alpha^d - \phi^d}{1 - \phi^b \alpha^s} \right]
\]

Equation (3.27) shows that the monetary policy shock is a linear combination of all the
VAR residuals in the policy block, with the weight on each variable equal to some
combinations of the model parameters. A measure of the stance can be constructed
using the same weights on the corresponding variables as in Equation (3.21).

Model is under identified as 14 unknowns are to be estimated from 10 residual
variances and covariance. We need four more restrictions for identification of model.
Bemanke and Mihov (1998) impose enough restrictions to just identify the model,
which allows the derivation of a measure of policy stance as a linear combination of all
the policy variables. We adopt the same strategy by choosing restrictions in such a way
that weight on each variable remain non-zero and avoiding the imposition of too many
restrictions. For identification purpose we impose restrictions as follow;

\[
\gamma_1 = 0, \gamma_2 = \gamma_3 = 0 and \phi^d = 0
\]
First three restrictions imply that the innovations in exchange rate do not respond to any other variable contemporaneously and this is purely stochastic. Furthermore, these parameters were found to be very close to zero when they were unrestricted. The last restriction implies that to avoid changes in the interest rate, the bank fully offsets the shock to money demand. Therefore we can write weights as\textsuperscript{15}:

\[ \nu^x = \omega_M u_M + \omega_{SPR} u_{SPR} + \omega_{RI} u_{RI} + \omega_{REER} u_{reer} \]

where

\[ \omega_M = \frac{\phi^b \alpha^d}{1 - \phi^b \alpha^s} \]

\[ \omega_{SPR} = \frac{\beta \phi^b \alpha^d - \phi^b}{1 - \phi^b \alpha^s} \]

or \[ \beta \omega_M - \phi^b \omega_{RI} \]

\[ \omega_{RI} = \frac{1}{1 - \phi^b \alpha^s} \]

\[ \omega_{REER} = \frac{\phi^s \alpha^x - \phi^x}{1 - \phi^b \alpha^s} \]

\textbf{3.3.3.2 Estimation Results}

The estimation results are reported in of Table 3.4.

\textbf{Table 3.4 Parameter Estimates of the Structural Model ($\phi^d = \gamma_1 = \gamma_2 = \gamma_3 = 0$)}

<table>
<thead>
<tr>
<th>(Sample Period 1992 M1 to 2008M6)</th>
<th>(\beta)</th>
<th>(\alpha^d)</th>
<th>(\alpha^s)</th>
<th>(\alpha^x)</th>
<th>(\phi^b)</th>
<th>(\phi^x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficients</td>
<td>-0.180587</td>
<td>4.661</td>
<td>0.3234</td>
<td>1.4214</td>
<td>-6.182</td>
<td>-5.3379</td>
</tr>
<tr>
<td>Z value</td>
<td>29.1850</td>
<td>34.6387</td>
<td>28.996</td>
<td>19.779</td>
<td>36.2364</td>
<td>15.1758</td>
</tr>
<tr>
<td>Weights in the measure of stance</td>
<td>(\omega_M)</td>
<td>(\omega_{SPR})</td>
<td>(\omega_{RI})</td>
<td>(\omega_{REER})</td>
<td>(-0.9421)</td>
<td>0.3713</td>
</tr>
</tbody>
</table>

The short-term interest rate elasticity of money demand, $\beta$, is estimated to be -0.180587 and it is highly significant. The parameters $(\alpha^d>0, \alpha^s>0, \alpha^x<0)$ in the term-spread equation are all significant.

A positive value of the parameter $\alpha^d$ implies that when a positive money demand shock occurs, the short-term interest rate rises to clear the money market. The parameter estimate $\alpha^s = 0.3234$ indicates that the term spread would increase by 32 basis points when the overnight rate rises by 100 basis points. The term spread rises less than one-for-one with the overnight rate because of the two offsetting effects of a monetary policy shock: a liquidity effect and an expected-inflation effect. The parameter $\alpha^x$ reflects that unexpected currency depreciation would lead to an increase in the short-term interest rate.

The parameter $\phi^b$ captures the reaction of the central bank to innovations in the term spread. The estimated value of the parameter $\phi^b$ is 6.182245 (also the value is high in the post-reform period) and implies that a positive innovation in term spread will lead to an increase in the overnight rate. The Bank would also raise the overnight rate in response to an unexpected currency depreciation, resulting in a positive sign of $\phi^x$. All the estimated parameters are statistically significant which implies that the central bank in Pakistan closely monitors the changes in credit and exchange rate markets and does respond to these shocks within a given period.

Weights for money supply and exchange rate variables have negative signs, reflecting that expansion in money supply or currency depreciation represents an easy monetary policy whereas positive signs for term spread and market rate which indicate a tightening of monetary policy. According to the estimate of the weight on $M$ is -0.9421, which implies that a one-percentage-point increase in M1 implies a reduction in the stance measure of 94 basis points and it is also statistically significant. The weight on the exchange rate is estimated to $\omega_{\text{REER}} = -0.461$, which means that a depreciation of Pakistani currency reduces the stance measure. The weight on the term spread is 0.3713 and the weight on the overnight rate is 0.0327. Both of these signs are statistically significant. Due to the introduction of financial reforms during 1990s in Pakistan,
parametric stability of the estimates might be a concern, so for that reason we split the full sample period into two sub samples: 1981 M12 to 1991 M12 and 1992 M1 to 2008 M6.

Table 3.5 Parameter Estimates of the Structural Model ($\phi^d = \gamma_1 = \gamma_2 = \gamma_3 = 0$)

(Sample Period: 1981 M12 to 1991 M12)

<table>
<thead>
<tr>
<th>$\beta$</th>
<th>$\alpha^d$</th>
<th>$\alpha^s$</th>
<th>$\alpha^x$</th>
<th>$\phi^d$</th>
<th>$\phi^x$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficients</td>
<td>-0.272</td>
<td>2.528</td>
<td>0.0935</td>
<td>0.9368</td>
<td>-2.8027</td>
</tr>
<tr>
<td>Z value</td>
<td>10.781</td>
<td>3.426</td>
<td>6.834</td>
<td>3.872</td>
<td>5.972</td>
</tr>
<tr>
<td>Weights in the measure of stance</td>
<td>$\omega_M$</td>
<td>$\omega_{SPR}$</td>
<td>$\omega_{IR}$</td>
<td>$\omega_{REER}$</td>
<td></td>
</tr>
<tr>
<td>-1.3722</td>
<td>0.9160</td>
<td>0.19367</td>
<td>-0.7375</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.6 Parameter Estimates of the Structural Model ($\phi^d = \gamma_1 = \gamma_2 = \gamma_3 = 0$)

(Sample Period 1992 M1 to 2008 M6)

<table>
<thead>
<tr>
<th>$\beta$</th>
<th>$\alpha^d$</th>
<th>$\alpha^s$</th>
<th>$\alpha^x$</th>
<th>$\phi^d$</th>
<th>$\phi^x$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficients</td>
<td>-0.1499</td>
<td>5.7459</td>
<td>0.2872</td>
<td>1.405</td>
<td>-7.1215</td>
</tr>
<tr>
<td>Weights in the measure of stance</td>
<td>$\omega_M$</td>
<td>$\omega_{SPR}$</td>
<td>$\omega_{IR}$</td>
<td>$\omega_{REER}$</td>
<td></td>
</tr>
<tr>
<td>-1.3528</td>
<td>0.4382</td>
<td>0.03306</td>
<td>-0.1184</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The estimation results for sub samples are reported in Table (3.5) and (3.6) and the related residuals are plotted in the Figure 3.6. These results are consistent with the overall sample. However, the weight for term spread in the monetary policy stance is fluctuating over the samples and it contains more weight in the pre reform period.
3.3.3.3 Impulse Responses to Monetary Policy Shocks

Standard impulse response functions (IRF) can be used to provide a quantitative measure of the dynamic effects of policy changes on the economy. An impulse response function traces the effect of a one standard deviation shock to one of the innovations on current and future values of the endogenous variables. This process tracks the path of a perturbation in one innovation in the VAR that sets up a chain reaction over time in all variables, until the variables return to the equilibrium (Green, 2000). Now to estimate the extent of the effect of perturbation on the endogenous variables, a standard method is to set a one standard deviation innovation in one of the variables calculated from the variance-covariance matrix. A shock to the $i^{th}$ variable directly affects the $i^{th}$ variable, and is also transmitted to all of the endogenous variables through the dynamic structure of the VAR. A change in one variable will immediately change the current values of other variables. It will also change all future values of all the variables considered in the model, since the lagged variables appear in all the equations. If the innovations are uncorrelated, interpretation of the impulse response is straightforward. The impulse response function measures the effect of a one standard deviation shock on current and
future values of the variables concerned. The innovations are, however, usually correlated, so that they have a common component that cannot be associated with a specific variable. A somewhat arbitrary but common method of dealing with this issue is to attribute all of the effect of any common component to the variable that comes first in the VAR system. Figure 3.7 shows the estimated dynamic responses of real output, real money, the price level, the term spread, the overnight rate, and the exchange rate to a monetary policy shock.

**Figure 3.7  Impulse Responses to an Interest Rate Shock**

A positive shock in the real interest rate reduces the term spread and also reflects the presence of liquidity effect and inflation effects. The responses of the term spread are very similar to those of the real interest rate however they are smaller in magnitude. This similarity can be attributed to the fact that monetary policy shocks have relatively small effects on the long-term rate. A positive shock in the interest rate reduces the output overtime. Compared with output, the price level responds more quickly and the responses are more persistent. In short run, higher interest rate pushes up the marginal cost of capital if there are adjustment costs to capital formation\(^\text{16}\) and to some extent;

business may then pass on this higher marginal cost of capital to prices. However in the long run there is an increase in the interest rate reduce the inflation. In addition, Figure 3.7 also indicates that positive policy shock leads to the appreciation in the value of Pakistan’s Rupee and a decrease in demand for money and these findings are consistent with theory.

While impulse response functions trace the effects of a shock to one endogenous variable on to the other variables in the VAR, variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR. Table 3.7 presents the variance decomposition of output and inflation. It shows the domestic interest rate as the major determinant of the fluctuations in the domestic output and inflation. Although domestic inflation is also affected by the foreign price level, however the table gives a policy insight that interest rate can be used as a policy instrument to enhance domestic output growth and to control domestic inflation.

Table 3.7 Variance Decomposition of Output and Inflation

<table>
<thead>
<tr>
<th>Period</th>
<th>S.E.</th>
<th>LCPIF</th>
<th>YR</th>
<th>LCPI</th>
<th>LRM</th>
<th>SPR</th>
<th>RI</th>
<th>LREER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.099</td>
<td>0.535</td>
<td>99.465</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0.159</td>
<td>2.332</td>
<td>88.466</td>
<td>1.097</td>
<td>3.146</td>
<td>1.975</td>
<td>0.039</td>
<td>2.946</td>
</tr>
<tr>
<td>10</td>
<td>0.164</td>
<td>2.224</td>
<td>84.514</td>
<td>2.67</td>
<td>3.376</td>
<td>2.825</td>
<td>0.911</td>
<td>3.48</td>
</tr>
<tr>
<td>15</td>
<td>0.167</td>
<td>2.156</td>
<td>81.423</td>
<td>3.742</td>
<td>3.27</td>
<td>2.757</td>
<td>3.087</td>
<td>3.565</td>
</tr>
<tr>
<td>20</td>
<td>0.171</td>
<td>2.193</td>
<td>77.917</td>
<td>4.369</td>
<td>3.132</td>
<td>2.641</td>
<td>6.087</td>
<td>3.661</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Period</th>
<th>S.E.</th>
<th>LCPIF</th>
<th>YR</th>
<th>LCPI</th>
<th>LRM</th>
<th>SPR</th>
<th>RI</th>
<th>LREER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.003</td>
<td>5.058</td>
<td>3.741</td>
<td>91.201</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0.007</td>
<td>18.418</td>
<td>5.897</td>
<td>70.542</td>
<td>0.444</td>
<td>0.084</td>
<td>3.235</td>
<td>1.381</td>
</tr>
<tr>
<td>10</td>
<td>0.01</td>
<td>27.754</td>
<td>3.369</td>
<td>53.378</td>
<td>2.52</td>
<td>0.114</td>
<td>11.148</td>
<td>1.718</td>
</tr>
<tr>
<td>15</td>
<td>0.013</td>
<td>32.049</td>
<td>2.615</td>
<td>40.851</td>
<td>5.197</td>
<td>0.123</td>
<td>17.616</td>
<td>1.549</td>
</tr>
<tr>
<td>20</td>
<td>0.016</td>
<td>34.313</td>
<td>3.33</td>
<td>32.005</td>
<td>7.473</td>
<td>0.311</td>
<td>21.17</td>
<td>1.398</td>
</tr>
</tbody>
</table>
Figure 3.8 shows the impulse response function for the sample 1981m12 to 1991m12. During this sample period, positive innovation in real interest rate transmits a negative change in the real interest rate after four months. Contrary to over all sample, during the first sample period, an increase in interest rate will lead to an increase in the price level after six months and demand for money increases till the eighth month and then starts decreasing. Changes in term spread and changes in the interest rates have same patterns and the liquidity effect appears after two months and continues for the longer duration. A positive shock in the interest rate leads to the domestic currency appreciation; hence all the relationships are theoretically consistent.

The impulse responses for the second sub sample 1992m12 to 2008m06 are presented in Figure 3.9. This sub sample includes the time period when comprehensive financial reforms were introduced in Pakistan. The responses of output and the price level in the second sub sample and across the sample are similar and these are insignificant. In the first sub sample 1981M12 to 1991m12 the output and price responses to an expansionary monetary policy are significant. In the second sub sample, responses of real exchange rate to a positive innovation in the interest rate lead to the appreciation of currency after six months, again consistent with theory.

Figure 3.8 Impulse Responses to an Interest Rate Shock (1981M12 to 1991m12)
3.4.4 Measure of Policy Stance

An overall measure of monetary policy stance can be constructed using the weights estimated through the Equation (3.23) and this measure includes both the endogenous and exogenous components of policy.

Figure 3.10 Monetary Policy Stance (twelve months moving average)
Following Bernanke and Mihov (1998), the stance measure is normalized at each date by subtracting from it a twelve-month moving average\(^{17}\) of its own past values. The derived stance is plotted in Figure 3.10, when stance value is at zero, it implies that monetary policy is neutral and policy has not deviated from the average stance in the past twelve months.

**Figure 3.11 Monetary Policy Stance and Inflation (lead=12)**

![Graph showing the relationship between monetary policy stance and inflation with a 12-month lead.](image)

Figure 3.11 compares the changes in monetary policy stance, with a 12 month lead in inflation. As empirical evidence suggests that in a developing economy, there is a 6-24 months time lag in the transmission of monetary policy to impact its aggregate demand\(^{18}\) hence we select both macroeconomic variables with a lead of 12 months. Changes in the stance measure captures the inflationary pressures in the economy as a tight monetary policy is followed by a decrease in inflation if no other supply or demand shocks occur, and hence higher value for the stance measure of monetary policy. Figures 3.11 indicate that the relationship between the stance and inflation generally holds for most of the sample period. During the phases of expansionary monetary policy, inflation rises above its past trend (1992-97 and 2002-2008). Apart from the expansionary monetary policy, various other supply side shocks contributed to the rising inflationary trends in the time period 2002-2008. These supply side inflationary shocks are the consequent of various factors which include; increase in

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\(^{17}\) We consider a twelve-month moving average because it takes, on average, about 12 to 18 months for monetary policy to affect the economy.

support price of wheat for three years in a row, shortage of wheat owing to less than the targeted production, high import prices especially the energy prices, high price of food in the international markets and higher utility tariffs.

**Figure 3.12 Monetary Policy Stance and Output (lead=12)**

The relationship between GDP growth and stance measure is indicated by the Figure 3.12. A tight (easy) policy stance should be followed by a decrease (increase) in output growth and the figure shows that this relationship generally holds during the these soft monetary policy periods i.e. early 1980s and January 2002 till December 2004, therefore, monetary policy plays an important role in affecting short run aggregate demand and output in these periods. However, these figures depict only the influence of monetary policy on inflation and output but there are various other demand and supply side shocks which can affect these macroeconomic variables such as government-spending shocks which can influence aggregate demand and hence inflation. Furthermore, supply shocks, such as commodity-price shocks and technological innovations, can also affect inflation.
3.4 Conclusions

This research focuses on different methodologies to measure the stance of monetary policy in Pakistan. Monetary policy stance is a quantitative measure which reflects whether policy is too tight, neutral or too loose relative to the objectives of stable prices and output growth. It is considered to be important because of two reasons; first, it helps the monetary authority to determine the course of monetary policy needed to attain the targets, secondly it is an empirical study which provides an insight about the transmission of monetary policy actions through the economy.

The empirical literature suggests various approaches to measure the policy stance. Traditionally, changes in interest rate or some monetary aggregates were considered as monetary policy stance. But these changes in monetary instruments are also characterised with some puzzling consequences (price puzzle, liquidity puzzle and exchange rate puzzle). Then empirical literature pursued two basic strategies to resolve these puzzles. The first relates to “the narrative approach” and the second is in the tradition of “vector auto regression (VAR) literature”. Earlier, VAR literature considers shocks to a single variable as an exogenous policy indicator. But there is a disagreement on the selection of a monetary variable which can accurately captures the stance of policy. This disagreement motivates the researchers to use composite measures which include monetary condition index and an overall measure developed by Bernanke and Mihov(1998).

The current research employs both of these composite measures i.e. Monetary Conditions Index and the one developed by Bernanke and Mihov(1998), to measure the monetary policy stance in Pakistan for the sample period 1981M12 – 2008M6. Following Duguay(1994), MCI weights are derived from a reduced form IS equation. These weights are determined through the estimated coefficients of the interest rate and the exchange rate variables in the IS Equation. The estimation of backward looking IS curve shows that the estimated parameters have expected signs. All parameters are statistically significant The sum of coefficients for the interest rates measure stays at -0.00015, whereas the sum of coefficients for the exchange rate measure is -0.00029 and the value of real MCI is 0.512280702 (alternatively 1:1.95). In other words, the influence of the real exchange rate outweighs the one of the interest rate. The important
estimation result appears in line with the set of expectations, in which MCI ratios tend to be smaller for small open economies (Reserve Bank of New Zealand, 1996). In addition, the results of the analysis indicate that changes in the interest rates as well as changes in the exchange rate influence the output gap significantly. Weight for interest rate is 0.338747 and for exchange rate is 0.661253.

Two MCIs are constructed using a fixed base of 100 for December 1981 and December 1991, first MCI considers the start of the sample period, and the later one takes into account the financial reforms impact. Both indices have shown co-movement. The subsequent analysis of MCI with base December 1981, suggest different periods with tight and soft monetary policy. The movements in the exchange rate are mostly unidirectional exchange rate has mostly moved one-way (i.e. the Rupee depreciates overtime) up to September 2001, and swings in the MCI are the consequent of the changes in interest rate. It is evident that a decrease in the interest rate was translated into a soft monetary policy and a rise in interest rates tightened the policy. After September 2001, the fall in interest rates led to the softening of monetary conditions till December 2003 which was slightly offset by the appreciation of Rupee/Dollar parity. Since January 2005, in response to inflationary pressures (11.3%) , SBP has been and remains in monetary tightening phase which is also reflected by the upward movements in MCI. These inflationary pressures were the consequent of the easy monetary policy followed in preceding few years. Due to the limitations and caveats with the MCI as an operational tool, then this research uses the Bernanke and Mihov(1998) methodology to analyse the stance measure of monetary policy. The Bernanke and Mihov approach is assumed to be advantageous over MCI as it considers those financial variables which may be important in the monetary transmission mechanism. This approach considers three channels of monetary transmission: the interest rate channel, the exchange rate channel, and the money channel. The orthogonal policy shocks derived from the SVAR model are used to assess the effectiveness of monetary policy and the roles of various transmission channels in affecting the inflation and other macroeconomic variables in Pakistan. This seven variable-SVAR model also captures the pre reform and post reform sub sample periods to compare the dynamic responses of these macroeconomic variables to the changes in the financial structure of the economy. The estimated weights for the four policy variables have their expected
signs. Weights for money supply and exchange rate variables have negative signs reflecting that expansion in money supply or currency depreciation represents an easy monetary policy whereas positive signs for term spread and market rate which indicate a tightening of monetary policy. The estimates also reveal the fact that overnight rate captures the most significant amount of information about policy stance. The impulse responses to a positive shock in the interest rate show that it leads to lower output whereas this shock results into higher inflation (due to high capital cost) in the short run. The variance decomposition of the output and inflation also indicate the market interest rate as the major contributor to the fluctuations in these two major macroeconomic variables. In addition, the estimated measure of monetary policy stance also captures the inflationary pressures in the economy and a tight monetary policy is followed by a decrease in inflation if no other supply or demand shocks occur, and hence higher value for the stance measure of monetary policy. The stance measure also reflects that tight (easy) policy stance should be followed by a decrease (increase) in output growth. However, while inferring the role of monetary policy stance measures, we should also consider the fact that there are several other factors which can affect the aggregate demand and aggregate supply in the economy.
Chapter Four

Fiscal Dominance and the Effectiveness of Fiscal Policy in Pakistan

4.1 Introduction

When the whole global economy is in the phase of recession, this time is most appropriate to discuss the macroeconomics of fiscal policy. The last few years have seen government spending, taxation, and deficit financing move to the forefront of policy debates worldwide. Policy makers in various economies (especially USA and UK) are seeking to use fiscal policy instruments to recover from the current recession. However, at the same time, the discussion of fiscal policies has renewed attention to the effects of large sustained fiscal deficits on national savings, investment, interest rates and the current account.

4.1.1 Fiscal Policy and the Macro Economy

Fiscal policy affects aggregate demand through its effects on incomes, the
distribution of wealth, and the economy's capacity to produce goods and services. The following flow chart identifies different channels of transmission mechanism of fiscal policy through which changes in spending and taxes can affect the aggregate demand.

**Figure 4.1 Transmission Mechanism of Fiscal Policy**

- **Cut in personal income tax** → **Boost in Disposable Income** → **Adds to consumer demand**
- **Cut in indirect Tax** → **Lower prices** → **Adds to consumer demand**

**Expansionary Fiscal Policy**

- **Cut in corporation taxes** → **Higher post tax profits** → **Adds to business capital spending**
- **Cut in tax on Interest from savings** → **Higher disposable Income** → **Adds to consumer demand**

In the short run, changes in spending or taxing can alter both the magnitude and the pattern of demand for goods and services. Over the time, these changes in aggregate demand affect the allocation of resources and the productive capacity of an economy through their influence on the returns to factors of production, the development of human capital, the allocation of capital spending, and investment in technological innovations. Similarly, changes in tax rates can also affect both the magnitude and the allocation of productive capacity through their effects on the net returns to labour, saving, and investment.
The macroeconomic literature has traditionally been divided, on one hand it relies on the adoption of the methodological tools of Real Business Cycle models and the role of rational expectations; on the other hand it acknowledges the role of monetary policy in managing fluctuations in demand and controlling inflation. In this context there is hardly any room for fiscal policy. This lack of interest in fiscal policy was driven by the belief that the role of demand management should be assigned to the Central Bank and that the governments should do as little as possible [Mankiw, (2006), Blanchard, (2008), Woodford (2009)].

In the standard Keynesian aggregate demand model, an expansionary fiscal policy is associated with high level of employment and output given that economy operates below full employment level. In this respect, fiscal policy is considered as a stabilization tool by the Keynesian general theory Keynes (1936). This Keynesian view that fiscal expansion is beneficial has been a subject of long standing debate about both its theoretical validity and practical importance. Although, during the 1980s and 1990s, monetary policy remained a focal point for most of the empirical research, there is now a diversion and literature on fiscal policy is also growing. The major reason for this diversion is the current recession which leads to an aggressive use of discretionary fiscal policy as a stabilisation tool in the USA and other major economies (especially UK). However, the introduction of new empirical techniques (like vector auto regressions-VAR and SVAR) to evaluate fiscal policy role is another contributor to the growth of the literature on fiscal policy.

The contemporary literature on the role of fiscal policy can be divided into two general schools of thought. The neo-classical literature claims that the expansionary fiscal policy decreases private sector output through crowding out and hence inflation. An increase in public debt leads to an increase in the interest rates which in turn decrease output and inflation. In addition, an increase in the public debt leads to an increases in public expectations of future taxes, which in turn increases labour supply and consequently lower real wages and consumption, and along with current activity and inflation. On the other hand, the New Keynesian School argues that the increase in
public spending increases demand and hence increases economic activity, i.e. output. This is the so called “crowding in” or “multiplier” effect

The outline of the current chapter is as follows; first it explains the theoretical basis for role of fiscal policy to constrain monetary policy and it provides the linkages between the fiscal and monetary policy through the concept of consolidated budget constraints. Then it evaluates the role of fiscal policy in three stages. In the first stage it attempts to empirically determine the type of regime in Pakistan i.e. whether it is categorised as a monetary dominant or a fiscal dominant regime. In Pakistan monetary policy is aimed at the dual objectives of inflation control and output growth. However, the presence of huge budget deficits constrains the ability of monetary policy to attain these objectives. In Pakistan, the fiscal deficit has a direct impact on inflation as government expenditure constitutes a large part of aggregate expenditure that might lead to demand pull inflation, and an indirect impact as the fiscal deficit is financed partly through the central bank. So it is relevant to examine that if the government adjusts its primary deficit to limit the debt accumulation and the central bank is not forced to inflate away the debt. Such a regime has been called monetary dominant (MD). However under a fiscal dominant (FD) primary deficits are set independently of real liabilities.

In the second stage, this chapter examines the connection between inflation, budget deficit and money growth. On one hand it tries to find the significance of the budget deficit and money growth to affect inflation in Pakistan, and on the other hand it signifies that either the budget deficit leads to money creation in the economy and validates the Monetarist views on the source of inflation in Pakistan.

In third stage, this chapter empirically evaluates the effects of discretionary fiscal policy shocks on economic variables using a structural vector autoregression framework. It is relevant in the sense that Pakistan is facing a rise in public debt and fiscal imbalances which poses concerns about fiscal sustainability of the economy. The earlier literature revolved around the discussion about the relative importance of fiscal and monetary
policy on aggregate economic activity (Hussain, 1982; Massood and Ahmad, 1980; and Saqib and Yasmin, 1987) which investigates the relative importance of fiscal and monetary policy on aggregate economic activity. Hence there is a need to examine the effects of exogenous fiscal policy shocks on a set of key macroeconomic variables within a SVAR framework which relies on institutional information about the tax and transfer systems and the timing of tax collections to identify the automatic response of taxes and spending to activity, and, by implication, to infer fiscal shocks. This approach is associated with twofold strengths. First, discretionary fiscal policy is generally exogenous to output. Unlike monetary policy, fiscal variables are affected by many factors of which output stabilization is seldom the main driver. Second, at high enough frequency and because of the long lags of fiscal policy implementation, there will be very little or no discretionary response of fiscal policy to unexpected contemporaneous economic activity within the quarter.

4.1.2 The Role of Fiscal Constraints and Monetary Policy

Most often the success of monetary policy is reflected though the achievement of its inflation targets and the presence of huge budget deficits constrain monetary policy to attain this objective. There is a large and expanding literature on the role that fiscal policy, in particular government budget deficit, has in determining monetary policy. Although causal influence of deficits on monetary policy is by no means universally accepted (see, for example, Dwyer, 1982) such an effect is supported in studies that include Blinder (1983), Burdekin (1986a), Laney and Willet (1983) and McMillan (1936). In general, however, it is assumed (implicitly or explicitly) that there is no reverse direction of causality running from monetary policy to fiscal policy.

In Pakistan, the fiscal deficit has a direct impact on inflation as government expenditure constitutes a large part of aggregate expenditure that might lead to demand pull inflation, and an indirect impact as the fiscal deficit is financed partly through central bank. Hence, inflation emerges as a fiscal driven monetary phenomenon. Several empirical studies have found a connection between the budget deficit, money growth and inflation, both for developing and industrialized economies. For industrialised
economies, most of these studies conclude that there is little evidence that government
debt influences money growth and inflation. In developing countries, it is often argued
that high inflation materialises when governments face large and persistent deficits that
are financed through money creation. However, if inflation is a consequence of non-
fiscal factors, real tax revenues might decline and the budget deficit could end up being
endogenous to the inflationary process. There are three approaches to evaluate the
endogeneity (exogeneity) of the budget deficit and money supply with respect to
inflation; The Monetarist Hypothesis, Fiscal Theory of Price Level and the Neo
Keynesian hypothesis

4.1.2a The Monetarist Hypothesis

The Monetarist hypothesis is rooted in the quantity theory of money in which the price
level is determined through the nominal money supply which is exogenously
determined by the monetary authority. If the nominal money supply differs from the
desired real balances, it will translate into changes in the price level. Hence, the price
level has to be fully flexible and determined exclusively by the exogenous nominal
money supply. In the case of fiscal policy, the nominal money supply changes due to
the use of seigniorage as a main source of financing for public expenditure, or as the
result of an open market operation in which the central bank purchases interest-bearing
government debt. Monetarist economists argue that the budget deficit and its subsequent
financing through money creation (seigniorage) are regarded as exogenous to the
monetary authority. Hence, money growth would be dominated by the government’s
financing requirements, and the price level increases as a result of that monetary
expansion. Consequently, with a monetarist approach, there is expected to be a positive
correlation between monetary growth and inflation. A regime of that nature is known as
fiscal dominant. Barro (1974) and Sargent and Wallace (1981) present the monetarist
hypothesis. Barro (1974) suggests that it is demand for liquidity that determines prices.
This in turns leads to a regime where fiscal policy is passive and government bonds are
not considered as net wealth. In this case monetary policy works through the interest
rate or another instrument to determine prices. Sargent and Wallace (1981) explain the
monetary policy implications of the government budget constraint. They suggest that
the causality runs from the fiscal deficit to money growth and, subsequently, from money growth to inflation. They argue that in a so-called “fiscal dominant” regime, where the fiscal authority determines the financing needed for any given budget deficit through bond sales and seigniorage then monetary authority loses its ability to control inflation whenever the real interest rate exceeds the growth rate of the economy.

However, in the wake of financial innovation and deregulation the monetarist hypothesis faces difficulties in giving an appropriate definition of the nominal money supply as there is substitution between monetary and non-monetary financial assets. This has influenced the effectiveness of standard nominal money supply to affect prices. Instead, the nominal interest rate becomes the instrument used to affect the price level, and the nominal quantitative supply of money ends up being determined endogenously in the money market.

4.1.2b The Fiscal Theory of the Price Level (FTPL)

The fiscal theory of the price level relates the price level to the fluctuations in the government budget surpluses and the nominal value of government debt. It states that all governments face an inter-temporal constraint. This constraint is satisfied when the current real value of the net liabilities of government equates the present discounted value of future primary surpluses (tax revenues minus non-interest expenditures). If this constraint is satisfied without a change in either policy or the price level, then the current fiscal policy is said to be sustainable. a monetary dominant (MD) or Ricardian regime exists when the government adjusts the primary deficit to limit its debt accumulation and the central bank does not monetise the debt. By contrast, under a fiscal dominant (FD) or non-Ricardian regime, primary deficits are set independently of real liabilities (Sargent and Wallace, 1981). There are three channels through which fiscal policy may affect prices: seigniorage, aggregate demand and aggregate supply.
In case of seigniorage, the fiscal authorities determine the level of budget deficit and then assign the budget shortfall to the Central Bank, which then creates money to cover this deficit; it leads to an increase in the monetary base and thus creates inflationary pressure. Therefore, according to the monetarist view, inflation is purely a monetary phenomenon and the problem can be easily solved if the independence of the Central Bank is assured and printing money to cover the budget deficit is not allowed.

As to the second channel, fiscal policy can affect prices via its effect on aggregate demand. According to the proponents of the Fiscal Theory of Price Level (FTPL) "an increase in the deficit causes a net increase in the permanent income of the private sector and, given that the total available resources of the economy has not changed, the new equilibrium requires an increase in the price level (Cos, Momigliano (2003))". In such a case there is an impact even if the monetary policy rule is absolutely independent of fiscal shocks. Hence independence of the Central Bank should be accompanied by a fiscal policy rule. The relevance of this channel is highly disputed since it relies on many explicit assumptions and the most controversial assumption is about the budget deficit that it is the political process which determines the budget deficit without considering the level of debt.

The third channel explains that fiscal policy can affect the price level through its impact on aggregate supply. There is a direct impact of fiscal variables on prices stemming from higher (or lower) indirect tax (e.g. Value Added Tax) rates as well as employer's rate of social security contributions. In a standard neoclassical model, higher taxes would have opposite income and substitution effects on labour supply, with income effects increasing the labour supply and substitution effects decreasing it (if leisure is a normal good). At the individual level, tax effects on labour supply depend on the consumption-leisure elasticity of substitution. The tax effects on aggregate supply might be large in unionised labour markets, because they will demand high pre-tax wages in case of an increase in labour taxation. This would in turn lead to higher unit labour costs and a loss of competitiveness. To what extent the economy will suffer from a loss of competitiveness depends on the labour market institutions. When labour unions are weak then effects on labour costs tend to be smaller. The relevance of trade union
moderation is also apparent on the expenditure side. Declining public expenditure and, particularly, public employment would have a depressive effect on the dynamics of public wages, which, through spillovers in the labour market, would be transmitted to private sector wages. In turn, this would increase profits and investments, with some supply-side effects also present (Alesina and Perotti, 1995a, 1995b and 1996; Alesina and Ardagna, 1998; Alesina et al., 1999). The current research focuses on the long term impact of fiscal policy on prices and hence ignores the direct impact of taxes as it is relevant for short term analysis.

4.1.2c The New Keynesian Approach (NK)

The New Keynesian model is one of the most commonly used models in monetary economics as it provides a convenient framework to examine theoretical and empirical issues for monetary policy and inflation and output determination. This model is based on rational expectations. This approach suggests a relationship between money growth, inflation and budget deficit through the system of aggregate supply and aggregate demand. This system is based on a closed economy model and is obtained with a dynamic stochastic general equilibrium framework based on maximization of the agent’s behaviour, with imperfect competition.

According to the New Keynesian approach, the demand equation is affected by the output gap and real interest rate expectations. The supply equation corresponds to a NK version of the Phillips curve based on maximization of the firm’s profits, which adjust its prices temporarily, in a staggered way. The New Keynesian Phillips curve implies that increased inflation can lower unemployment temporarily, but cannot lower it permanently (Clarida, Galí, and Gertler, 1999 and Blanchard and Galí, 2007)

In the new Keynesian model the quantity of money is endogenous to the nominal interest rate (or inflation), and becomes in an irrelevant variable for policy purposes. According to Woodford (2007), because the system is self-contained, the
money-demand function is not required to solve the model for inflation. Expectations about the current and future level of government expenditure determine the impact of fiscal policy on the real economy. Given an output gap and inflation expectations for t+1, if individuals expect government expenditure to increase in t+1, with respect to its current level, it is reasonable to expect that private consumption will fall in t+1. Because families have to save, at present, to finance added public spending in t+1, consumption in t will have to be reduced (Barro,1979). With a Keynesian multiplier, the lower current consumption level implies a contemporary decline in output, the output gap and inflation. Hence, individual expectations about current and future fiscal action affect inflation directly and induce money expansion through a higher price level. Pioneers of the New Keynesian’s “deficit caused inflation” approach include Mankiw (1985), Blanchard and Kyotaki (1987),Yun(1996), Goodfriend and King (1997), Rotemberg and Woodford (1997,2003), Clarida et al. (1999) and Galí (2007).

4.2 Literature Overview on Testing the Type of Regime – Monetary versus Fiscal Dominance

There are two approaches to analyse the interaction between monetary and fiscal policy. The first approach uses game-theoretic tools, where fiscal and monetary authorities are viewed as playing a “game” against each other. The second approach evaluates the interaction between monetary and fiscal authorities through the dynamic equilibrium models that have become a staple of macroeconomic theory since the real business cycle- RBC revolution. It focuses on a government budget constraint that involves both fiscal and monetary interactions. Our research concentrates on this second way of considering monetary-fiscal interactions. In this model, there are two agents: a fiscal authority that controls government spending and taxes, and a monetary authority that controls the money supply. We describe each agent’s action and then evaluate the implications if a certain authority gets to “set policy first” on the policy choice of the other authority.
A. The Fiscal Authority’s Budget Constraint

To model the fiscal authority, all we need to do is to specify its flow budget constraint. In period $t$, the fiscal authority has a flow budget constraint:

$$ p_t g_t + B_t^{T} = T_t + t^p B_t^T + RCB_t $$  \hspace{1cm} (4.1) 

The left side of equation (4.1) indicates the nominal amount of government spending ($g_t$ is the real amount of spending) plus the nominal quantity of government bonds that must be redeemed (i.e., paid back) in period $t$ (which is simply the value of bonds outstanding at the beginning of period $t$). The right side of the equation includes the lump-sum taxes collected by the government $T_t$; the nominal value of new bonds sold to the public in period $t$- $p_t B_t^T$; and nominal receipts from the central bank-$RCB_t$, which are the profits earned by the central bank and transferred to the fiscal authority. Although in developed countries, even though the monetary authorities and fiscal authorities are distinct institutions, profits earned by the central bank (from its normal operations as well as from the act of printing money, over which the central bank has control) are turned over to the fiscal authority on a regular basis (on the grounds that the central bank is a non-profit organization and is ultimately chartered by the fiscal authority). These profits that the fiscal authority receives from the monetary authority are captured by the term in $RCB_t$ above. Hence, in the above budget constraint, the left-hand-side represents outlays for the fiscal authority in period $t$, while the right-hand-side represents income items for the fiscal authority in period $t$.

B. The Monetary Authority’s Budget Constraint

The monetary authority, or central bank, also has a budget identity that links changes in its assets and liabilities. Most often these changes are induced by altering the quantity of the nominal money supply in the economy, mainly through conducting the open market
operations, in which the central bank trades some of its holdings of government (i.e., fiscal-issued) bonds for money. If $B_t^M$ denotes the monetary authority’s holdings of government bonds (as distinct from $B_t^T$ above). The flow budget constraint of the monetary authority is thus:

$$P_t^bB_t^M + RCB_t = B_{t-1}^M + M_t - M_{t-1}$$ (4.2)

The left-hand-side represents outlays of the monetary authority, which consist of purchases of government bonds and the profits that must be turned over the fiscal authority. The right-hand-side represents income for the monetary authority, which consists of maturing bonds $B_{t-1}^M$ and the printing of new money, which is the term $M_t - M_{t-1}$. $M_{t-1}$ is the quantity of money outstanding in the economy at the end of period t-1 (equivalently, at the beginning of period t) and $M_t$ is the quantity of money outstanding in the economy at the end of period t. Thus, $M_t - M_{t-1}$ is the amount by which the nominal money supply changes during period t. From the money authority’s budget constraint, it is easy to see that $RCB_t = B_{t-1}^M - P_t^bB_t^M + M_t - M_{t-1}$ is the amount that the monetary authority ends up turning over to the fiscal authority.

C. Consolidated Government Budget Constraint

The consolidated government budget constraint-GBC for both the monetary authority and the fiscal authority is:

$$P_t^b g_t + B_{t-1}^T = T_t + P_t^b B_t^T + B_{t-1}^M - P_t^b B_t^M + M_t - M_{t-1}$$ (4.3)
This budget constraint links the activities of the fiscal authority – taxing, spending, and issuing bonds – with the activities of the monetary authority – changing the supply of money. This link fundamentally comes through the RCB that the central bank is required to turn over to the fiscal authority. The consolidated GBC is a condition which must always hold in the economy. It thus makes clear that fiscal policy and monetary policy must be “consistent” with each other.

However, monetary policy is just reactive (passive) to fiscal policy if the fiscal authority ignores the consolidated GBC and selects a particular combination of spending, taxes, and debt (\( g_t \), \( T_t \), and \( B_t \)). In such a situation, after committing to its particular fiscal policy, the onus is then on the central bank to make the consolidated GBC hold by printing some appropriate quantity of money. In literature such a scenario is known as active fiscal policy/passive monetary policy case.

On other hand, if the monetary authority gets to move first and sets a specific level of money supply \( M_t \) (motivated, perhaps, by some inflation stabilization goal), the fiscal authority must “react” by setting some appropriate combination of \( g_t \), \( T_t \), and \( B_t \). Here we say that monetary policy is active and fiscal policy is passive.

D. The Inter-temporal Government Budget Constraint

To analyse the interaction between fiscal-monetary authorities, we can write the above flow budget constraint GBC into the lifetime (or inter-temporal) government budget constraint, which is the more typical form of the government budget constraint used in analyzing dynamic fiscal-monetary interactions. First, take the flow GBC above and divide through by the period-\( t \) price level, which gives:

\[
g_t + \frac{B_{t-1}}{P_t} = \frac{T_t}{P_t} + \frac{P_t B_t}{P_t} + \frac{M_t - M_{t-1}}{P_t}
\]  

(4.4)
The last term on the right-hand-side $\frac{M_t - M_{t-1}}{P_t}$ measures the real resources, in units of period-t goods, accruing to the government from the act of money creation: the amount of money created during period t is $M_t - M_{t-1}$ and dividing by $P_t$, which yields the amount of period-t goods the government earns by expanding the money supply (or loses if it contracts the money supply). These real resources are known as seigniorage revenue, formally,

$$sr_t = \frac{M_t - M_{t-1}}{P_t} \quad (4.4a)$$

We can rearrange GBC as following:

$$\frac{B_{t-1}}{P_t} = \left( \frac{T_t}{P_t} - g_t + \frac{P_t^b B_t}{P_t} \right) + sr_t \quad (4.4b)$$

The left-hand-side shows the real amount of government debt that comes due in the beginning of period t, and the right-hand-side is the real amount of (net) government revenue. This net revenue comes from monetary sources (the seigniorage revenue) and fiscal sources (the difference between tax revenue plus proceeds of new bond sales and government spending). Defining $t_t \equiv \frac{T_t}{P_t}$ as real tax collections in period t, and $bt \equiv \frac{B_t}{P_t}$ as the real amount of government debt outstanding at the end of period t, we can express the preceding as $\frac{B_{t-1}}{P_t} = \left( t_t - g_t + p_t^b b_t \right) + sr_t$. This expression is of course simply still the period-t GBC. The period-t+1 GBC is analogous,
\[ \frac{B_t}{P_t} = \left(t_{t+1} - g_{t+1} + P_{t+1}b_{t+1}\right) + sr_{t+1} \]  \hspace{1cm} (4.4c)

\[ B_t = \left(P_{t+1}t_{t+1} - P_{t+1}g_{t+1} + P_{t+1}A_{t+1}\right) + P_{t+1}sr_{t+1} \]  \hspace{1cm} (4.4d)

\[ \frac{B_t}{P_t} = \left(P_{t+1}t_{t+1} - P_{t+1}g_{t+1} + P_{t+1}A_{t+1}\right) + P_{t+1}sr_{t+1} \]  \hspace{1cm} (4.4e)

The left-hand-side, by our definitions, is simply \( b_t \). Further, the inflation between period \( t \) and \( t+1 \) is defined by \( \pi_{t+1} = \frac{P_{t+1} - P_t}{P_t} \) which means that \( 1 + \pi_{t+1} = \frac{P_{t+1}}{P_t} \). Using these definitions in the last expression, we have:

\[ b_t = \left(1 + \pi_{t+1}\right)t_{t+1} - \left(1 + \pi_{t+1}\right)g_{t+1} + P_{t+1}\left(1 + \pi_{t+1}\right)b_{t+1}\]  \hspace{1cm} (4.4f)

Which, despite all the manipulations, is still just the period-\( t+1 \) GBC. Finally, we insert this expression into the equation (4.4b), the period-\( t \) flow GBC; doing so gives:

\[ \frac{B_{t-1}}{P_t} = sr_t + \left[t_t - g_t + P_t\left(1 + \pi_{t+1}\right)sr_{t+1} + P_t\left(1 + \pi_{t+1}\right)t_{t+1} - \left(1 + \pi_{t+1}\right)g_{t+1} + P_{t+1}\left(1 + \pi_{t+1}\right)b_{t+1}\right]\]  \hspace{1cm} (4.5a)

Pulling the terms \( 1 + \pi_{t+1} \) together, we get:

\[ \frac{B_{t-1}}{P_t} = sr_t + \left[t_t - g_t + P_t\left(1 + \pi_{t+1}\right)sr_{t+1} + \left(t_{t+1} - g_{t+1} + P_{t+1}b_{t+1}\right)\right]\]  \hspace{1cm} (4.5b)

And if we group the seignorage terms together and the fiscal terms together, then:
\[
\frac{B_{t-1}}{P_t} = \left[ sr_t + P_t^b (1 + \pi_{t+1})sr_{t+1} \right] + \left[ (t_t - g_t) + P_t^b (1 + \pi_{t+1})(t_{t+1} - g_{t+1}) \right] + \frac{P_t^b (1 + \pi_{t+1})P_{t+1}b_{t+1}}{1 + r_t} \tag{4.5c}
\]

The relation between the nominal price of a bond and the nominal interest rate is 

\[ p_t^b = \frac{1}{1 + r_t} \] and also recall the Fisher equation, 

\[ 1 + r_t = \frac{1 + i_t}{1 + \pi_{t+1}}. \] These two facts imply that, in the last equation, 

\[ P_t^b (1 + \pi_{t+1}) = \frac{1 + \pi_{t+1}}{1 + r_t} = \frac{1}{1 + \eta}; \] replacing the 

\[ P_t^b (1 + \pi_{t+1})^i \] in the last equation, the period \( t \) GBC can be written as:

\[
\frac{B_{t-1}}{P_t} = \left[ sr_t + \frac{sr_{t+1}}{1 + r_t} \right] + \left[ (t_t - g_t) + \frac{(t_{t+1} - g_{t+1})}{1 + r_t} \right] + \frac{P_t^b b_{t+1}}{1 + \eta} \tag{4.5d}
\]

In this representation of the period-\( t \) GBC, seigniorage revenue, tax revenue, and government spending in periods \( t \) and \( t+1 \) appear. If we were to substitute out the term \( b_{t+1} \) on the far right of the last expression using the period-\( t+2 \) GBC, we would have:

\[
\frac{B_{t-1}}{P_t} = \left[ sr_t + \frac{sr_{t+1}}{1 + r_t} + \frac{sr_{t+2}}{(1 + r_t)(1 + r_{t+1})} \right] + \left[ (t_t - g_t) + \frac{(t_{t+1} - g_{t+1})}{1 + r_t} + \frac{(t_{t+2} - g_{t+2})}{(1 + r_t)(1 + r_{t+1})} \right] + \frac{P_t^b b_{t+2}}{(1 + \eta)(1 + r_{t+1})} \tag{4.5e}
\]

If we then substituted \( b_{t+2} \) out using the period - \( t+3 \) GBC, and then continued successively substituting out future real bond terms using successive flow GBCs, we would ultimately arrive at the infinite-period version of the GBC.
\[ \frac{B_{t-1}}{P_t} = \sum_{s=0}^{\infty} \left[ \frac{sT_{t+s}}{\prod_{s=0}^{\infty} (1 + r_{t+s})} + \frac{t_{t+s} - s_{t+s}}{\prod_{s=0}^{\infty} (1 + r_{t+s})} \right] \] (4.6)

Eq.(4.6) involves both an infinite product and an infinite summation. The successively growing products – the first term of which is \( \frac{1}{1 + r_t} \), the second term of which is \( \frac{1}{(1 + r_t)(1 + r_{t+1})} \), the third term of which is \( \frac{1}{(1 + r_t)(1 + r_{t+1})(1 + r_{t+2})} \), and so on – are discount factors. We will refer to this last expression as the inter-temporal government budget constraint, which is an infinite-period version of the flow GBC.

The right-hand-side of Eq.(4.6) is a function of all current (period-\( t \)) and future seigniorage revenue as well as all current and future primary budget surpluses. This equation helps to distinguish between Ricardian fiscal policy regime and non-Ricardian fiscal policy regime. In a non-Ricardian fiscal policy regime the current and future path of “regular” fiscal instruments (i.e., taxes and spending) is not adjusted to ensure that the inter-temporal GBC holds. By contrast, a Ricardian fiscal policy is then one in which the fiscal authority does pay heed to the inter-temporal GBC when setting current and future policy. Under a Ricardian fiscal policy, the fiscal authority views itself as being constrained by the inter-temporal GBC.

### 4.2.1 The Fiscal Theory of the Price Level

If the fiscal authority independently sets its path of \( t_t - g_t \) and price level \( P_t \) is determined by factors other than the inter-temporal government budget constraint, then active fiscal policy requires that the path of seigniorage revenue adjusts to ensure intertemporal government solvency. In view of the intertemporal government budget constraint, it is not necessarily the case that current (period-\( t \)) money creation must
change if there is a change in period t primary fiscal policy, but rather that current and/or future seigniorage generation must change.

In a situation, with an active fiscal policy and fixed price level, then the quantity-theoretic link operates and changes in current or future seigniorage generation – which is fuelled by money creation, translates into higher inflation. Such a regime is defined as “Polar-Ricardian” by Aiyagari-Gertler (1985), “accommodative fiscal policy” by Sims (1994, 1997), “dominant monetary policy” by Sargent-Wallace (1981) and “Ricardian regime” by Woodford (1994, 1995) and Cochrane (1999, 2003). Under a Ricardian fiscal policy, the fiscal authority views itself as being constrained by the inter-temporal GBC. According to this view, when equation (4.6) is disturbed, the government must alter its expenditures or its taxes to restore equality. However, non-Ricardian fiscal policy advocates argue whenever something threatens to disturb the equation, the market-clearing mechanism moves the price level, $P$, to restore equality. Alternatively, non Ricardian fiscal policy assumes that if the real value of government debt were to grow explosively, no adjustments to fiscal and monetary policy would be made to keep it in line. The idea of a Ricardian fiscal policy is deeply rooted in the Sargent and Wallace’s (1981) famous paper, “Some Unpleasant Monetarist Arithmetic.” which suggests that in case of a loose fiscal policy, the monetary authority must increase seigniorage. However, in a situation when despite the active fiscal policy, the monetary authority does not blink. Rather, the central bank is strong enough and committed enough to its own “independent” monetary policy then intertemporal government budget constraint must be satisfied somehow. Thus, in this case when neither regular fiscal policy nor monetary policy adjusts appropriately, then it must be that $P_t$ which adjusts to satisfy the intertemporal budget constraint, for a given $B_{t-1}$.

Suppose that, relative to its original plans for the sequence of $(t_{t+s} - g_{t+s})_{s=0}$ the fiscal authority decides to lower $(t_{t} - g_{t})$ but leaves $(t_{t+s} - g_{t+s})_{s=1}$ unchanged. That is, suppose the government decides to lower the primary fiscal surplus in period t, but leave all future surpluses unchanged. Furthermore, the “independent” central bank remains committed to its plan for the money stock, which means it will not be induced
to deviate from its plan for the sequence \( s_t^{(s)} \), \( s = 0, 1, 2, \ldots, \infty \). The government cannot/does not default on its nominal debt repayment obligation \( B_{t-1} \). The only way, then, for the intertemporal GBC to hold is for the period-t price level \( P_t \) to rise; it must rise because the right-hand-side of the intertemporal GBC has fallen, which requires that the left-hand-side falls, too. With \( B_{t-1} \) fixed, this requires a rise in the price level in the current period. This mechanism, by which a change in fiscal policy translates into a direct change in \( P_t \) is termed the fiscal theory of the price level.

The empirical literature distinguishes between fiscal theory of the price level and the fiscal theory of inflation. Under the fiscal theory of the price level, any “shock translates immediately and fully into a one-time change in the nominal price level. If fiscal policy never changes again, there need be no future unanticipated change in the nominal price level. On the other hand, under the fiscal theory of inflation, the period-t price level has nothing to do with fiscal policy from period-t onwards; instead, a change in current or future fiscal policy translates into a change in money creation at some time in the present or future, implying additional inflation in the future (Cocharane, 2010). In some sense, the fiscal theory of inflation and the fiscal theory of the price level are the polar opposite theories. The former effectively states that surprise changes in fiscal policy leads only to future changes in inflation but current inflation is unaffected. The latter effectively states that surprise changes in fiscal policy leads only to changes in current inflation, but future inflation is unaffected. In reality, one might (probably naturally) expect that fiscal pressures are relieved through both channels – that surprise changes in fiscal policy lead to changes in both current and future inflation. Such a division of fiscal pressure on nominal prices into current pressure versus future pressure is in practice hard to disentangle, and, indeed, probably plays out in different ways in different countries and in different time periods.

**4.2.1a Literature Review on Fiscal Theory of Price level**

The fiscal theory of price level is a rather new approach to monetary economics and offers an attractive perspective for the recent financial recession (2008) and the
literature on the impact of fiscal policy on inflation has been growing rapidly. The FTPL has been set out and developed in Leeper (1991), Sims (1994, 1997), Woodford (1996, 1998a, 1998b, 2001), Schmitt-Grohe and Uribe (2000) and Cochrane (2000, 2001). This theory provides the answer to the question as to how the price level is determined in an interest rate pegged regime when money becomes endogenous, and either monetisation is a significant financial tool for the government which does not depend on seigniorage revenues. Woodford (1995) tries to explain the rationale for the weak relation between monetary aggregates and the inflation rate in the U.S and the incident of stable inflation rate in US, although it follows an endogenous money policy.

The FTPL model tries to capture the impact of fiscal policy on the price level, which is believed to be the missing point of the conventional monetarist view. Woodford (1995) suggests the equilibrium conditions of the quantity theory of price level as incomplete rather than irrelevant. He argues that the price level is determined from the government budget constraint as the ratio of the nominal value of debt to the present value of expected future surpluses. Woodford suggests that the money market defines the equilibrium interest rate differential (in case money is exogenous) or the money supply (in case money is endogenous) rather than the equilibrium price level. Hence, the price level is determined by the present value of government liabilities in a non-Ricardian fiscal policy combined with pegged interest rate monetary policy. In this case, “the current money supply and its expected future path are irrelevant for the determination of the equilibrium price level (Woodford, 1995). A monetary shock will affect the price level eventually “……only as a result of the eventual effects of monetary policy upon the size of the total government liabilities, which then affects the price level through the fiscal policy rule. And even in this case, it is arguable that such effects upon the price level as occur are due to fiscal effects of policy change, rather than upon the mere fact that households are forced to hold a different quantity of money; for the price level grows in proportion to the growth of total government liabilities, and not in proportion to growth of the monetary component of those liabilities” (Woodford, 1995)

The traditional theory considers the stock of money as the sole determinant of the price level. The FTPL argues that if fiscal policy is free to set primary surpluses
independently of government debt, fiscal shocks may well have an impact on the price level. Furthermore, the traditional theory assumes that fiscal authorities adjust primary surpluses to guarantee solvency of the government for any price level, the FTPL considers the possibility that fiscal policy is able to set primary surpluses independently of government debt accumulated. As a result the price level will adjust to make the government’s intertemporal budget constraint hold at any point of time.

In FTPL, the outcomes of both fiscal and monetary policies depend on which policy has dominant characteristics. In a regime where monetary policy is active and fiscal policy accommodates the monetary policy, such a regime defined as “Polar-Ricardian” by Aiyagari-Gertler (1985), “accommodative fiscal policy” by Sims (1994, 1997), “dominant monetary policy” by Sargent- Wallace (1981) and “Ricardian regime” by Woodford (1994, 1995) and Cochrane (1999, 2003). On the contrary, when monetary policy is under the pressure of budget deficit, then fiscal policy shocks, are viewed in the literature as Non- Ricardian (Woodford 1994, Sims 1994), fiscal dominant (Sargent-Wallace 1981), Polar Ricardian or active fiscal policy (Leeper 1991). This type of regime where Ricardian policies lose their validity can be seen commonly in developing markets as well as most periods in developed economies. However in both regimes, the intertemporal budget constraint holds in equilibrium. The crucial difference between the two scenarios is the causal link between prices and surpluses.

Woodford (1996, 1998) argues that fiscal shocks affect aggregate demand in non-Ricardian environments. This is induced, as he says, by the fact that households regard government debt as net wealth affecting their future path of consumption due to the exogeneity of government deficits. Sims (1997) states that government commitments to stable prices can easily turn out to be unsustainable. Furthermore, there are practical bounds for governments on primary surpluses and unpredictable disturbances to fiscal balance, which highlights the possibility of an exogenous path of government deficits. Sims (1997) argues that a monetary union can only succeed, if national governments have to commit themselves to a deficit or surplus rule, Hence, theoretically there seems to be at least some evidence for a causal link between public debt and prices. Sims (2002) argues that both intertemporal budget constraints and the equation of exchange
hold in both the regimes; Ricardian and Non-Ricardian and both relations propose two equations and one independent variable \( p \); as a result, monetary and fiscal policies act according to the “who moves first” characteristics as the active and passive policy rules suggested by Leeper (1991).

### 4.2.1b Empirical Findings on the FTPL

This theory has found mixed empirical support, to test the FTPL’s plausibility on real data, Canzoneri, Cumby and Diba (2001) employ the post World War II data in the United States and investigate the accessibility of Ricardian equivalence in accordance with the FTPL theory. They conclude that a positive shock in budget surpluses results in a decrease in current debt and an increase in future budget surpluses which is expected to be in accordance with Ricardian regimes. Using VAR approaches for US economy, Erdogdu (2002), Creel et al. (2002) and Mikek (1999) analyze the responses of primary surpluses to domestic debt and observe that the Ricardian policies in the U.S accommodate the dominant monetary policy. Creel and Bihan (2006) find the similar results for European countries, although their analysis is based on a modified VAR analysis that makes a distinction between cyclically-adjusted and non-cyclically-adjusted deficits.

Cochrane (1998) argues that the US data from 1960 are consistent with the fiscal theory of the price level determination. Also Sala (2003) finds that the fiscal theory of the price level characterizes at least one phase of the post-war US history, specifically the period 1960–79. For the EMU, Afonso (2002) demonstrates, applying a panel data approach, that the FTPL is not supported for the EU-15 countries during the period 1970-2001. The Member States of EMU tend to react with larger future surpluses to increases in the government liabilities. Therefore, fiscal policy may considered to be Ricardian. So far, there seems to be empirical evidence that Ricardian fiscal policies are possible and plausible. Janssen et al. (2002) analyze the impacts of monetary and fiscal policy on the path of inflation in UK. This paper is especially remarkable as it is built on almost 300 years of data starting in 1705. They also conclude that there is little econometric
evidence that fiscal policy has significantly affected the price level or the overall money supply.

To distinguish between active and passive behaviour for monetary and fiscal authorities, Davig et al. (2006) and Davig and Leeper (2005) analyse regime switches in both fiscal and monetary policy for the U.S. They model regime change as an on-going process and show that as long as agents are allowed to place probability on both kinds of regimes happening, and if active fiscal policy were expected to occur next period, then tax changes would have wealth effects and lead to non-Ricardian outcomes. Therefore, their work may be interpreted as evidence in favour of the FTPL mechanism. Favero and Monacelli (2005) follow a similar approach and they examine fiscal policy regimes in the light of Markov-switching processes for U.S. data for the period 1960-2002 and come to the conclusions that fiscal policy has switched between active and passive regimes. Other work on regime changes includes Daniel (2003) and Weil (2003) who consider one-time changes in fiscal regime with fixed monetary policy behaviour.

The empirical literature on testing the validity of FTPL for developing and emerging economies is very little. These studies include the work of Tanner and Ramos (2002), who evaluate whether the policy regime in Brazil during the 1990s can be better characterized as fiscal or monetary dominant. Their study examines that either the primary deficit adjusts itself to the changes in liabilities or real interest payments. They suggest an evidence of a monetary dominant regime for most of the sample period. However, Loyo (2000) finds evidence consistent with the fiscal theory of the price level for late 1970s and early 1980s where a tight monetary policy along with lose fiscal policy resulted in hyperinflation even without seignorage increase.

For emerging economies, Zoli (2005) analyses the role of fiscal policy to affect monetary policy and finds that the evidence points clearly to a regime of fiscal dominance in the case of Argentina and Brazil during the 1990s and early 2000s, while for the other countries in the sample, the results are mixed. The findings indicate that in
the emerging markets under consideration, the conduct of monetary policy is not directly affected by changes in real primary balances.

To overcome the “observational equivalence” problem proposed by Cochrane (1998, Ersin (2005) employs VEC regression methods to identify the short run and long run dynamics of the characteristics of fiscal policies in Turkey. This paper suggests that Turkish fiscal authorities were generally found to be following non-Ricardian fiscal rules. World Economic Outlook(2003) estimates a separate fiscal policy reaction function for a group of developed economies and a set of emerging markets and finds that primary surpluses respond much more strongly to public debt in the developed countries.

For Sub-Saharan Africa, Baldini and Ribineiro (2008) find mixed results, as some countries are dominated by fiscal regime; some by monetary regime and other have no clear result. They also find that the changes in nominal debt affect price variability via aggregate demand effects, which suggests that fluctuations in the inflation rate can be a possible outcome of fiscal decisions, this is theoretically consistent with the fiscal theory of price level. To examine fiscal sustainability in Pakistan, Cashin et al. (2003) employ Barro’s tax-smoothing model for the period 1956 -1995. The empirical results indicate that in Pakistan taxes remained relatively constant in response to anticipated changes in expenditure. They argue that Pakistan’s fiscal behavior has been dominated by the stagnation of revenues, large tax-tilting-induced deficits, and the consequent accumulation of excessive and unsustainable public liabilities. Earlier Tayyab and Ahmed (1994) find a direct relationship between the fiscal deficit and inflation in Pakistan for the period 1971 to 1988. They suggest that budget deficits may influence the formation of price expectations which is a viable channel of transmission.
4.2.1c Criticism of the FTPL

However the theoretical relevance of the FTPL is doubted by some contributions, such as Cochrane (1998) and Buiter (2002). Cochrane (1998) states that the “FTPL per se has no testable implications for the time series of debt, surplus and price level”. The budget constraint of the government written in nominal terms holds in both Ricardian and non-Ricardian regimes. Whether this equilibrium is restored by price or surplus adjustments remains unclear. Hence, all we observe are equilibrium points, but not the fundamentals behind them. Buiter (1999) states that “the government’s intertemporal budget constraint is a constraint on the government’s instruments that must be satisfied for all admissible values of the economy-wide endogenous variables.” So what really matters for the characterisation of fiscal policy behaviour is the question, whether prices or future surpluses of the government adjust to make the government budget constraint hold. Buiter (2002) argues that FTPL confuses the roles of budget constraints and equilibrium conditions in models of a market economy. But more interesting, Buiter (2002) criticizes FTPL as a theory of price level determination because it explicitly rules out default. Equilibrium price-level changes each period in response to the (stochastic) fiscal shocks. And with price level changes in each period providing the capital gains and losses on public debt level necessary for equilibrium, default is never necessary. Once the possibility of explicit default is properly allowed for, non-Ricardian regimes become Ricardian regimes and the Fiscal Theory of the Price Level vanishes. Buiter shows that under a non-Ricardian fiscal-monetary programme with an exogenous nominal interest rate rule, the equilibrium conditions are the same as under the Ricardian fiscal-monetary programme without contract fulfillment and with an exogenous nominal interest rate rule. Niepelt (2004) criticizes the fiscal theory on the grounds that, under rational expectations, the value of the outstanding government debt at the beginning of a period cannot be given arbitrarily. Instead, this value must be derived as an equilibrium outcome for the economy in the previous (possibly) unrepresented periods.

Christiano and Fitzgerald (2000) argue that for the FTPL to be an interesting positive theory, it need not hold in all situations. Often governments do seem ready to adjust
fiscal policy when the debt gets too large. In the 1980s and 1990s, the US government introduced a combination of a tax increase and expenditure decrease to reduce the debt in the economy. Woodford (1998) emphasizes that FTPL provides a useful characterization of actual policies in some contexts and the FTPL can serve as an input into policy design. Even if, in practice, policy has never been non-Ricardian, the FTPL might still hold interest as FTPL can be used to articulate a rationale for the type of debt limitations imposed by the IMF and other international agencies.

4.3 Fiscal Policy Regime Testing Procedure

Although the empirical literature on the relevance of Ricardian versus non-Ricardian fiscal regimes is rather scarce, there are few studies available which describe formal ways to test the nature of the fiscal policy regime. One of the few attempts is related to those of Canzoneri et al. (1997, 2000), Melitz (2000), Cochrane (1999) and Afonso (2002). All approaches are quite similar, since they focus on the relationship between the primary balance and the government liabilities.

Canzoneri et al. (1997, 2000) employ a bivariate VAR model to test for the existence of a Ricardian regime in the US. They examine that if the primary budget surplus as a percentage of GDP negatively influences the government liabilities, which are also as a ratio of GDP, these government liabilities consist of both the public debt and the monetary base. A Ricardian regime expects an inverse relationship between the primary budget surplus and government liabilities, as any positive change in the budget surplus is used to pay back some of the outstanding public debt. In a Ricardian regime, there is an active Central Bank and a passive Treasury.

Debrun and Wyplosz (1999) and Mélitz (2000) provide additional empirical work related to this discussion and estimate reaction functions for monetary and fiscal authorities for the EU and OECD countries respectively. They find a positive response of the primary budget balance to positive innovations in the government liabilities.
which is consistent with the Ricardian framework. Cochrane (1999) also uses a VAR model with the following variables: public debt as a percentage of private consumption, the budget surplus-private consumption ratio, the consumption rate of growth and the real interest rate implicit in the stock of public debt. With annual data for the US, he concludes that positive changes in the budget surplus reduce the stock of public debt. Woodford (1999) reaches the same conclusions as Cochrane (1999), with the same data and variables, with the exception that the real interest rate is discarded on the basis that it should be implicit in the evolution of the other three variables (Woodford, 1999). Creel and Sterdyniak (2001) follow a similar approach with panel data and reaction function estimation, they judge that fiscal policy could be characterised by a Ricardian regime in Germany and in the US, and by a non-Ricardian regime in France.

Using a different approach for somehow related research, Favero (2002) jointly models the effects of monetary and fiscal policies on macroeconomic variables in structural models for France, Germany, Italy and Spain, and reports that fiscal policy reacts to increases in debt. Additionally, for the US, Favero and Monacelli (2003) and Sala (2004), report the existence of Ricardian fiscal regimes after the end (beginning) of the 1980s (1990s), while Sala concludes for the existence of non-Ricardian regime in the 1960s and 1970s. A Ricardian regime is also reported by Rocha and Silva (2004) for Brazil, a country where past high inflation and fiscal problems would have seem to be a good ground for fiscal predominance.

For Pakistani data, earlier studies (Hussain, 1982; Massood and Ahmad, 1980; and Saqib and Yasmin, 1987) try to investigate the relative importance of fiscal and monetary policy on aggregate economic activity. Therefore, there is a need to empirically discriminate between these two regimes as monetary dominant and fiscal dominant by estimating simple and parsimonious model such as autoregressive system proposed by Canzoneri et al. (2000)..
4.3.1 Empirical Assessment of Fiscal Policy Regime in Pakistan

The current research employs variables such as government expenditure, government revenues, the consumer price index, reserve money, the discount rate, and gross domestic product for the period 1977Q1-2009Q4. Data for both the fiscal variables and the GDP is not available at high frequency. Following Chow and Lin (1971), who set out a procedure to generate higher frequency estimates for the series for which data is available at a low frequency using data on a related series at the higher frequency (Hayes and Turner, 2003), this research develops quarterly GDP figures from annual GDP for Pakistan covering the time period 1977Q1 to 2009Q4. Series for the fiscal variables of government expenditure, government revenues are interpolated using a commonly used measure of Cubic match last method in Eviews. This inserts the low observation value into the last period of the high frequency data, and then uses a cubic spline on the missing values. It is a widely used method for macroeconomic data and cubic spline interpolation provides estimates of data between known data points, however, changing any one point (or adding an additional point) to the source series will affect all points in the interpolated series.

4.3.2 Testing Ricardian versus Non Ricardian Regime in Pakistan

In every economy, the one period government budget constraint is given as:

\[
\frac{M_t + B_t}{P_t} = \left[\frac{r_{t+1} + S_{t+1} - G_{t+1} + (M_{t+1} + B_{t+1})/P_{t+1}}{1 + r}\right]^{1/1}
\]

(4.7)

where \(G_t\) and \(T_t\) are real government expenditures and revenues, \(P_t\) is the price level, \(B_t\) is interest bearing debt held by the public, \(M_t\) is the monetary base (government debt

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19 See Appendix for details

20 See Appendix for details
held by the central bank), and where \( S_{t+1} = \frac{iM}{P_{t+1}} \) is the forgone interest payments on the public’s money holdings that accrue to the government (seigniorage), where \( i \) is the nominal interest rate, and \( r \) is the real interest rate \( (r=\frac{1+i}{P_{t-1}/P_t}-1) \). In equation (4.7) \( \frac{M_t+B_t}{P_t} \) represents the net public sector liabilities in real terms. Substituting equation (4.13) forward over an infinite horizon, using the identities \( LIAB_t = \frac{M_t+B_t}{P_t} \) and \( PDEF_t = G_t - T_t - S_t \) yields the intertemporal budget constraint:

\[
LIAB_0 = -E\left\{ \sum_{t=1}^{\infty} PDEF_t (1+r)^{t-1} + \lim_{t \rightarrow \infty} LIAB_t (1+r)^{t-1} \right\} \tag{4.8}
\]

where \( E\{ \} \) is the expectations operator. The transversality condition is:

\[
\lim_{t \rightarrow \infty} LIAB_t (1+r)^{t-1} = 0 \tag{4.9}
\]

Thus equations (4.8) and (4.9) represent intertemporal solvency. In equation (4.9), the discounted value of government liabilities approaches zero over an infinite horizon. Although equations (4.8) and (4.9), as identities, are not directly testable, however it is possible to ask whether equation (4.9) would be satisfied if the relevant fiscal variables \( G, T, M, B, \) and \( P \) were to continue their historically observed relationships into the indefinite future. If so, equation (4.9) is satisfied and fiscal policy is said to be sustainable. By contrast, if fiscal policy is not sustainable, an adjustment to one or more fiscal variables will be required at some future date. One test for sustainability, suggested by Trehan and Walsh (1991) and others, is for the stationarity of the real operational deficit \( (ODEF, \text{which is defined as } LIAB_t - LIAB_{t-1}) \). Results of this test suggest that the Pakistan’s real operational deficit is stationary for the period 1977–2009, indicating long-run sustainability. Moreover, Equation (4.8) implies that all current information about future primary surpluses is contained in current real
government liabilities \( LIAB_0 \). Thus, if the market forecasts a one unit fall in discounted primary surpluses, \( LIAB_0 \) must also fall today, through price level increases. This idea is known as the fiscal theory of the price level (FTPL). However, some empirical literature, including Cochrane (1999), Christiano and Fitzgerald (2000), and Woodford (2001), have suggested that (4.8) and (4.9) should be interpreted as equilibrium conditions.

The evolution of the undiscounted debt is also important. As McCallum (1984), Hakkio and Rush (1991) and others suggest, growing debt in undiscounted terms provides an incentive for the government to inflate away the debt or otherwise default and, as Calvo (1978) suggests, the government may be unable to credibly rule out a default through surprise inflation (a time consistency problem).

### 4.3.3a Testing the Regime

When the primary deficit responds to changes in the real value of liabilities through changes in \( G \) and/or \( T \), thus satisfying Equation (4.9), in this case, monetary policy is not subordinated to fiscal financing requirements. For this reason, such a regime has been called ‘monetary dominant (MD)’ or ‘Ricardian’ (see Canzoneri et al. (2001). Alternatively, if there is no such response, the primary deficit is set independently of either liabilities or real interest payments. In this case, monetary policy, or more precisely money creation, is determined by fiscal needs, under a ‘fiscal dominant’ (FD) (or non- Ricardian) regime. Whether an economy operates under an MD or FD regime depends on the authority’s reaction function. To restrain inflation, Woodford (2001) suggests that a fiscal rule is required (in addition to a monetary rule). Such a rule conditions current fiscal behaviour on past debt\(^{21}\):

\[
PDEFT = \kappa + \beta_0 LIAB_{t-1}
\]

\(^{21}\) Tanner (2002)
In equation (4.10), $\kappa$ is an exogenous component of the primary deficit which corresponds to the non-discretionary components of the budget, whereas $\beta$ summarizes the authorities’ adjustment of the primary deficit to past liabilities. To evaluate that either an infinitesimal adjustment of the primary surplus to increased liabilities ($\beta < 0$) is sufficient to maintain intertemporal solvency (Equation 4.8), we note that regardless of the value of $\kappa$, undiscounted liabilities evolve according to:

$$\lim_{t \to \infty} LIAB_t = LIAB_0 Z^t + \kappa_0 \left\{ 1 + Z + Z^2 + Z^3 + Z^4 + \ldots \right\}$$  

(4.10)’

where $Z = (1 + r + \beta_0)$. Thus if $\beta < 0$, $Z < (1 + r)$ and hence Equation (4.8) holds (a MD regime). However, there are several cases – specific combinations of $\kappa$ and $\beta$ are also of interest to policy makers. Whether the undiscounted value of liabilities explodes, stays constant, or tends to zero depends critically on the values of $\kappa$ and $\beta$.

4.3. 3b Empirical Estimates: a Backward-Looking Approach

This section explores several questions; either the Pakistani government adjusts the primary deficit to ensure long-term solvency $\beta < 0$ or the fiscal authority reacts vigorously enough to limit the undiscounted debt.

A. Data Definition

This study employs primary deficit and public sector liabilities to evaluate the type of regime in Pakistan covering the time period 1977q1-2009q4. The primary deficit measures the difference between total revenue and non-interest total expenditure. Pakistan’s consolidated public sector includes the central government (the federal government, central bank, and social security system for private sector workers), provincial and municipal governments, and public enterprises at all three levels of
government. Public liabilities include debt (B) and the monetary base (M). Both the variables are in real terms and these are divided by the consumer price index. Real interest payments are defined as $r^* \text{Liabb}$ (real interest rate into liabilities), where $r$ is the real interest rate $(r = (1+i)P_{t-1}/P_t - 1)$.

**B. Primary Deficits and Liabilities**

As a first step, we evaluate equation (4.10) as an empirical reaction function and express equation (4.10) at first difference as both the real primary deficit (PDEF) and real liabilities are not stationary (Table 4.1).

**Table 4.1 Augmented Dickey Fuller - Unit Root Test Results**

<table>
<thead>
<tr>
<th>Variables</th>
<th>At level</th>
<th>At First Difference*</th>
<th>Order of Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liabb</td>
<td>1.792</td>
<td>-3.172</td>
<td>I(1)</td>
</tr>
<tr>
<td>PDEF</td>
<td>2.130</td>
<td>-3.94</td>
<td>I(1)</td>
</tr>
<tr>
<td>ODEF</td>
<td>-3.173</td>
<td>-14.192</td>
<td>I(0)</td>
</tr>
<tr>
<td>RIP</td>
<td>-5.305</td>
<td>-14.651</td>
<td>I(0)</td>
</tr>
</tbody>
</table>

* Note: ADF test critical values are: $-3.481217, -2.883753, -2.578694$ at 1%, 5% and 10% respectively

\[ \Delta(\text{PDEF}) = \kappa_0 + b_0 * \text{ODEF}_{t-1} + \text{error} \]  

Equation (4.11) indicates that the primary deficit responds to the changes in liabilities (the real operational deficit) in case of MD regime and $b_0$ is expected to be negative hence a MD regime is ruled out if $b_0$ is either not different from zero or significantly positive.
Table 4.2  
Response of ΔPDEF\textsuperscript{22} to ODEF\textsubscript{t-1}\textsuperscript{23}

<table>
<thead>
<tr>
<th>Period:</th>
<th>(k_0)</th>
<th>(b_0)</th>
<th>F</th>
<th>F Critical Values (5%)</th>
<th>DF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977Q3-2009Q4</td>
<td>-0.3199\textsuperscript{22} (-1.084)</td>
<td>0.02521\textsuperscript{22} (1.0025)</td>
<td>4.7886</td>
<td>3.94</td>
<td>129</td>
</tr>
<tr>
<td>1977Q3-1986Q4</td>
<td>0.0683\textsuperscript{22} (-1.1069)</td>
<td>-0.0408\textsuperscript{22} (-1.4579)</td>
<td>2.0823</td>
<td>3.25</td>
<td>37</td>
</tr>
<tr>
<td>1987Q1-1996Q4</td>
<td>-0.3919\textsuperscript{22} (-0.8621)</td>
<td>0.0579\textsuperscript{22} (0.8935)</td>
<td>2.1085</td>
<td>3.23</td>
<td>40</td>
</tr>
<tr>
<td>1997Q1-2009Q4</td>
<td>-1.7495\textsuperscript{22} (-1.6366)</td>
<td>0.0961\textsuperscript{22} (1.5579)</td>
<td>2.9306</td>
<td>3.18</td>
<td>52</td>
</tr>
</tbody>
</table>

Note: \(t\) values are given in parenthesis

The estimates of equation (4.11) are presented for both the entire 1977:01–2009:04 period and for five sub periods in the above Table 4.2. According to the estimates in Table 4.2, the null hypothesis of \(b_0=0\) that PDEF(primary deficit) does not respond to ODEF(liabilities) – cannot be rejected at the conventional 90% level for either the entire period and for the sub period 1987Q1 -1996Q4. Furthermore, \(k_0\) value is insignificant at 90% and negative for all entire period and for the sub period 1987Q1 -1996Q4. In the case when \(b_0 = k_0 = 0\), it implies a FD regime when initial outstanding stock of liabilities is positive and undiscounted debt grows boundlessly at the rate \((1+r)\) in each period, hence the intertemporal solvency condition is not satisfied (Tanner and Ramos, 2002). In the case where \(k_0=0\), all outstanding debt is backed by the monetary authority, which fully accommodates the fiscal authority whenever budget deficit is financed with debt. This accommodation takes the form of an increase in current or future seigniorage revenues to back the principal and interest payments on the newly issued debt. The fiscal authority is insensitive to monetary policy in the sense that neither taxes nor expenditure react (now or in the future) to changes in the stock of outstanding government debt. Sargent (1982), and Aiyagari and Gertler (1985) refer to this case as a polar Non-Ricardian regime. Leeper (1991) calls it one of passive monetary/active fiscal policy

\textsuperscript{22} \(\Delta PDEF\) implies changes in current level of primary deficit
\textsuperscript{23} ODEF\textsubscript{t-1} is the change in the level of liabilities last year
In addition, for the sub period 1997Q3 - 2009Q4, the relationship between PDEF and ODEF is positive \((b_0>0)\) which again indicates FD regime for the period and it is statistically significant. However, for the sample period 1977Q3 - 1986Q4, \(b_0<0\) but it is statistically significant, \(\kappa_0\) value is positive but insignificant at 90% reflecting a FD regime.

C. Primary Deficits and Real Interest Payments

\[
\Delta(PDEF_t) = \kappa_1 + b_1 RIP_{t-1} + error
\]  \hspace{1cm} (4.12)

Table (4.3) reflects a positive and statistically insignificant relationship between \(RIP_{t-1}\) and \(PDEF\) for the time period of highly controlled financial sector (from 1977 till 1995). It indicates that if \(\kappa_1 = b_1 = 0\) which implies that primary deficit \((PDEF)\) does not respond to real interest payments \((RIP)\). These estimations indicate that lower interest rates permit the government to borrow more and indicate the presence of a fiscal dominant regime. These findings are consistent and F statistics is significant as compared with the previous model.

<table>
<thead>
<tr>
<th>Period:</th>
<th>(\kappa_1)</th>
<th>(b_1)</th>
<th>F</th>
<th>F Critical Values (5%)</th>
<th>DF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977Q3 - 2009Q4</td>
<td>-0.72</td>
<td>0.01</td>
<td>27.099</td>
<td>3.94</td>
<td>129</td>
</tr>
<tr>
<td></td>
<td>(-0.946)</td>
<td>(0.311)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1977Q3 - 1986Q4</td>
<td>0.23</td>
<td>0.027</td>
<td>8.62</td>
<td>3.25</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>(-1.566)</td>
<td>(0.648)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1987Q1 - 1996Q4</td>
<td>-1.0547</td>
<td>-0.756</td>
<td>6.027</td>
<td>3.23</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>(-0.437)</td>
<td>(-0.041)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996Q1 - 2009Q4</td>
<td>-3.882</td>
<td>0.079</td>
<td>11.027</td>
<td>3.18</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>(-1.126)</td>
<td>(-0.871)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: t values are given in parenthesis

\(RIP_{t-1}\) is the level of last year Real interest payments, another indicator of liabilities.
Although the backward-looking approach is simple and intuitive, such a framework cannot distinguish between ex-post adjustments of primary deficits to liabilities (consistent with an MD regime) and ex-ante adjustments of liabilities to primary deficits (consistent with an FD regime and the FTPL). This section analyses fiscal adjustment in a forward-looking manner through a vector autoregression (VAR) framework (however, the standard specification of the VAR model is based on the information summarized in the contemporaneous and lagged values of the variables included and does not permit the modelling of any forward-looking expectation formation process). This approach is based on the assumptions that either the current reductions in the primary deficit help pay down the debt (reduce future liabilities and/or interest payments), as implied by an MD (but not FD) regime. If so, we should observe a positive relationship between current innovations to the primary deficit today and liabilities in the future. In addition, the ordinary least squares (OLS) approach also suffers from well-known problem of endogeneity. Sims (1980) argued that there are no variables that can be deemed as exogenous in the presence of forward looking agents whose behaviors depends on the solution of an intertemporal optimization model. Therefore the use of vector autoregression (VAR) approach, removes the endogeneity problem of the simple OLS approach.

**A. Primary Deficits and Liabilities**

To develop the VAR framework, several steps are required. First, recall that equations (4.8) and (4.9) imply that the current value of liabilities $LIAB_0$ equals (-1 times) the expected present value of future primary deficits $PDEF_t \sum_{t=1}^{\infty} \frac{PDEF_t}{(1+r)^{t-1}}$. Second, multiply both sides of Equation (4.8) by the real interest rate, $r$. Third; add the current primary deficit $PDEF_t$ from both sides of equation and note that $ODEF = rLIAB_{t-1} + PDEF_t = LIAB_t - LIAB_{t-1}$. Then after manipulation equation (4.9) is rewritten as
Equation (4.13) has a clear interpretation: today’s operational deficit equals to the sum of discounted changes in the primary deficit last year. In fact, equation 4.13 is similar to Campbell’s (1987) version of the permanent income hypothesis. Furthermore, following Campbell’s logic, the VAR implied by theory is:

$$
X_t = a_0 + a_1 X_{t-1} + a_2 X_{t-2} + \ldots + \nu_t
$$

(4.14)

where $X = [\Delta PDEF, ODEF]$, $a_i$ is a vector of coefficients and $\nu_t = (\nu_{PDEF}, \nu_{LIAB})$ is a vector of error terms. Expression (4.20) is similar to a VAR system developed by Canzoneri et al. (2001). In standard fashion, assume that each element of the error vector $\nu_t$ is in turn composed of ‘own’ error terms $w_t = (w_{PDEF}, w_{LIAB})$:

$$
\nu_t = Bw_t
$$

(4.15)

where B is a 3 x 3 matrix whose diagonal elements (‘own correlations’) equal one and whose nonzero off-diagonal elements reflect contemporaneous correlations among the error terms. Also, equation (4.15) yields impulse response functions (IRFs) that summarize the effects of current innovations $w_t$ on values of $X$. Like any VAR framework, equation (4.14) estimates relationships of time-series causality that run in both directions. The economic interpretations of these time-series relationships are summarised in the Table 4.4.

First, consider temporal relationships that run from the current operational deficit $ODEF_t$ to the future primary deficits $PDEF_{t+1}$. A negative relationship may either indicate that primary deficits compensate for the changes in liabilities ($ODEF_t$) to help
limit debt accumulation (consistent with an MD regime) or that the price level (and hence the operational deficit) anticipate future primary deficits (consistent with an FD regime and the FTPL). By contrast, a positive relationship indicates that primary deficits respond to liabilities in an unstable fashion (consistent with an FD regime) or that real interest rates (and hence ODEF) respond positively to anticipated future primary deficits. If there is no relationship, the primary deficit is exogenous (an FD regime). Second, consider relationships in Equation (4.14) that run from the current primary deficit $PDEF_t$ to future operational deficits $ODEF_{t+1}$. Under an MD regime, current innovations to the primary deficit $PDEF_t$ should be positively related to future government debt and hence ODEF: when the government reduces the primary deficit, it pays down the debt and hence reduces future operational deficits. But, if real interest rates vary, a negative relationship between shocks to the primary deficit $PDEF_t$ and future operational deficits (ODEF) might reflect a response by the government to lower (higher) expected future interest payments by borrowing more (less) – running higher (lower) primary deficits today. By contrast, under an FD regime, $PDEF_t$ would be uncorrelated with future ODEF.

Table 4.4 Summary of Interpretation, System (Equation 4.14), $X = \{ODEF, PDEF\}$ or $X = \{RIP, PDEF\}$

| Current liabilities (RIP, or ODEF)<sub>t</sub> → future primary deficit PDEF<sub>t+1</sub> | Positive → Unstable policy, consistent with FD regime; or interest rates anticipate future primary deficits. |
| Zero → Primary deficit exogenous, consistent with FD regime |
| Negative → Government pays down past debt, consistent with MD regime; or price level anticipates future primary deficits, consistent with FD regime and FTPL. |

| Current primary deficit PDEF<sub>t</sub> → future liabilities (RIP<sub>t+1</sub>, or ODEF<sub>t+1</sub>) | Positive → Government pays down future debt, consistent with MD regime |
| Zero → Primary deficit exogenous, consistent with FD regime |
| Negative → Government anticipates future interest bill or other obligations, consistent with MD regime. |
Table 4.5  Granger Causality Test Results – System (4.14)

<table>
<thead>
<tr>
<th></th>
<th>1 lag model</th>
<th>2 lag model</th>
<th>1977q1- 2009q4</th>
<th>1977q1-1986q4</th>
<th>1987q1-1996q4</th>
<th>1997q1-2009q4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔPDEFt → ODEFt+1</td>
<td>F Stat (P value)</td>
<td>0.026 (0.878)</td>
<td>0.955 (0.335)</td>
<td>0.296 (0.589)</td>
<td>0.026 (0.871)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.208 (0.648)</td>
<td>1.203 (0.280)</td>
<td>0.218 (0.642)</td>
<td>1.963 (0.167)</td>
<td></td>
</tr>
<tr>
<td>ODEFt→ ΔPDEFt+1</td>
<td>F Stat (P value)</td>
<td>1.485 (0.230)</td>
<td>0.682 (0.512)</td>
<td>0.724 (0.491)</td>
<td>0.562 (0.573)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.147 (0.863)</td>
<td>1.005 (0.378)</td>
<td>0.853 (0.434)</td>
<td>1.216 (0.305)</td>
<td></td>
</tr>
</tbody>
</table>

The Granger Causality tests are summarised in Table 4.5. These tests are estimated with 1 and 2 lags for both the entire period and the selected subsamples. The estimates are similar to the estimates of system (4.11) and reflect little evidence of statistically significant relationship between the changes in primary deficit and liabilities (ODEF), thus confirming the presence of a fiscal dominant regime in Pakistan.

To identify the monetary or fiscal dominant regimes, we estimate the impulse response functions and variance decomposition from an unstructured VAR. We consider the two possible ordering of the variables i.e. PDEF and LIABB because the VAR methodology reveals possible inconsistency in the results due to the ordering adopted in the model. The ordering of variables is important for impulse response functions, specially when using Cholesky method which imposes a Wold causal order on the variables. The Choleski decomposition is based on zero lower triangle matrix and so the ordering is set according to the economic theory. Therefore, in the first ordering when the real
primary deficit comes first, it allows for a contemporaneous effect on real operational deficit (liabilities), which is consistent with a fiscal dominant regime. However, the order in which operational deficit comes first does not allow the contemporaneous effect on the liabilities, which makes more sense in the Ricardian regime. Since our focus is on the responses of both variables to primary deficit shocks. These VAR estimates are with eight lags (LR, AIC, FPE, Akaike, SC and HQ criteria were minimized at eight lags for both the entire 1977:01–2009:04 period and the selected subsamples).

Figure 4.2 Impulse Response Function - System (4.13)

First Ordering – PDEF - ODEF  Second Ordering –ODEF- PDEF,

Figure 4.2 represents the plots of impulse response function estimated for both ordering of variables, however the results seem similar in both the cases. In the first ordering where the real primary deficit comes first, the response of operational deficit to an innovation in PDEF is negative and significant. In fact, the response of liabilities is negative for 5 years, regardless of the ordering used and these results are in conformity with a fiscal dominant regime. The significance is determined by the use of confidence intervals representing ±2 standard deviations. At points where the confidence bands do not straddle zero, the impulse response is considered to be different from zero. Furthermore if a positive innovation in PDEF increases the expected future deficit that also confirms the presence of an FD regime.
To confirm these estimates, we can evaluate that how changes in the government budget and public liabilities exert an effect on aggregate demand. In a fiscal dominant regime, fiscal shocks create fluctuations in aggregate demand which in turn affect the level of real economic activity, the real interest rate, as well as the inflation rate. For this purpose, we examine whether a positive innovation in PDEF increases the real income in the same period and reduces government liabilities, VAR is estimated with PDEF, ODEF and the natural logarithm of GDP. As real GDP is expected to respond to the innovation in PDEF in case of non-Ricardian regime, the impulses response functions are analyzed with ordering ODEF→ PDEF→ln(GDPq).

**Figure 4.3a  Impulse Response Function-- ordering ODEF→ PDEF→ GDP**

The results of impulse response in Figure 4.3 indicate that the innovation in the PDEF increases the nominal income and liabilities after a time period of one year, although not sustainable for longer time period. This suggests the existence of a non-Ricardian regime in Pakistan.

Canzoneri *et al.* (2001) suggest a VAR involving PDEF, ODEF and discount factor (the real interest rate-$rr$) to ensure that the impulse responses presented in Figure 4.2 can survive once we control for a discount factor. In a fiscal dominant regime, an innovation in PDEF is positively correlated with the future discount factor. Figure 4.3b presents impulse responses to an innovation in PDEF and the ordering of variables goes from...
PDEF→ODEF → RR which is in line with non-Ricardian regime. The estimates show that the response of PDEF and ODEF is as persistent as obtained without including discount factor, which implies that basic results are robust to controlling for a discount factor. Hence a fiscal dominant regime exists in Pakistan.

**Figure 4.3b  Impulse Response Function-- ordering ODEF→ PDEF→ RR**

Chaudhary and Ahmad (1995) suggest a positive relationship between the budget deficit and inflation during acute inflation periods, i.e., 1970s. They also find that the money supply is not exogenous; rather it depends on the position of international reserves and the fiscal deficit. In an empirical investigation of a group of emerging market countries, Zoli (2005) finds that there is fiscal dominance in both Brazil and Argentina. He explores that, fiscal policy actions appeared to have contributed to movements in the exchange rates more than unanticipated monetary policy manoeuvres, establishing the fact that fiscal policy does affect monetary variables. Moreover, our findings are consistent with Agha and Khan (2006), who also concluded that inflation is a fiscal phenomenon in Pakistan. Their study also reveals that fiscal policy significantly influences monetary policy conduct, and they suggest that for better performance of the economy, there needs to be coordination in the policy makers. However, these results are contrary to the results estimated by Javid et al(2008) for the Pakistan economy.
4.4 Fiscal Explanations for Inflation in Pakistan

4.1 Introduction

In this section an empirical examination is undertaken of the extent to which inflation has been affected by the fiscal deficits in Pakistan. Several specifications of vector error correction models (VECM) of consumer prices, budget balance, money growth, exchange rate, and output (GDP) are examined to see how inflation reacts to the budget deficits given other possible determinants of inflation. We also consider how large a share of the forecast-error variance in the price level can be attributed to changes in the fiscal balance for the given sample period of 1977Q1 to 2009Q4.

Analysing such models may provide indirect evidence of the presence of a fiscal-dominant regime, if fiscal policy influences the development of the price level in the system. Likewise, if inflation is completely independent of fiscal developments, it is fair to conclude that this would support the traditional monetary dominant regime.

The purpose of this section is to examine the inflationary response to budget deficits, when associated variables, such as money growth and exchange rate movements are taken into account. The premise holds that if an economy is in a fiscal-dominant regime, fiscal deficits should have some impact on inflation, whereas in a monetary-dominant regime, inflation would be driven primarily by the money supply. In addition to analyse the inflationary response, we considered the shares explained in the variation of inflation by fiscal deficits and money growth. If the money supply dominates the inflation process but deficits have no influence on inflation, then indirect evidence that supports the monetary-dominant regime can be obtained. Our method to test the regime dominance is of course an indirect one. It seems however, that it may serve at least as a way of rejecting the fiscal-dominant regime if fiscal deficits are not at all connected to inflation.
4.4.2 Data and Methodology

4.4.2.1 Data

To evaluate the inflationary response to budget deficits we use quarterly data for the variables- consumer prices, budget balance, money growth, exchange rate, and output (nominal GDP). The Consumer Price Index (CPI) is used to measure inflation in Pakistan. Although CPI has limited coverage, it is the most reliable measure of inflation and is widely used in empirical studies. The overall consolidated budget deficit (BDS) has been used to assess the relationship between inflation and fiscal sector and it is defined as the gap between total revenue receipts and total expenditure. Other variables include a money aggregate (M2S), and the nominal exchange rate (NEER). These variables are in nominal values and we also take logs of all the series except the budget deficit. All the data series are collected from the International Financial Statistics, covering the time period 1977Q1 to 2009Q4.

4.4.2.2 Model Specification

We examine a number of different empirical specifications of the VECM models. In the first set-up, the endogenous variables include the price level, a money aggregate (M2S), an exchange rate(NEER), and the fiscal balance(BDS).

\[ z_{1t} = (\text{CPI}, \text{M2S, NEER, BDS}) \quad \text{Model 1} \]

This specification is intended to capture the impact of the fiscal balance on prices and exchange rate—with the latter providing a means to address the open-economy version of the fiscal theory.
Because of the high correlation between the price level and exchange rate movements (therefore undermining the role of domestic macroeconomic factors), we also analyse a three variable VECM which excludes the exchange rate variables i.e. includes prices, money, and fiscal deficits.

\[ z_{2t} = (\text{CPI}, M2, BDS) \]  

Model 2

The purpose of this approach is to determine whether the additional efficiency in estimation helps produce sharper conclusions about the key issue addressed and the impact of deficits on prices.

The third formulation includes prices, money, fiscal deficits, and GDP (the quarterly estimates are constructed through Chow Lin procedure and we use the log of nominal GDP).

\[ z_{3t} = (\text{CPI}, M2, GDP, BDS) \]  

Model 3

A demand side variable is included to determine whether the dynamics of the model change when possible impacts from the aggregate demand are taken into account. Further, GDP variable is also used because the basis for the monetary regime, the quantity equation, includes output.

4.4.2.3 Estimation Techniques

Before estimating the system to examine the relationship between the budget deficit, exchange rate, GDP, money supply and inflation, first we check the order of integration of these variables.
A. Unit Root Test

This test helps to determine the order of integration of the individual series. Several procedures for the test of order of integration have been developed. The most popular ones are Augmented Dickey-Fuller (ADF) test due to Dickey and Fuller (1979, 1981), and the Phillip-Perron (PP) due to Phillips (1987) and Phillips and Perron (1988). The augmented Dickey-Fuller test relies on rejecting a null hypothesis of unit root (the series are non-stationary) in favor of the alternative hypotheses of stationarity. The tests are conducted with and without a deterministic trend (t) for each of the series. The general form of ADF test is estimated by the following regression.

\[
\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{i=1}^{n} \alpha \Delta y_i + \delta_t + e_t
\]  

(4.16)

where \( y_t \) is a time series, \( t \) is a linear time trend, \( \Delta \) is the first difference operator, \( \alpha_0 \) is a constant, \( n \) is the optimum number of lags in the dependent variable and \( e \) is the random error term.

B. The Cointegration Test

The purpose of the cointegration test is to determine whether a group of non-stationary series are cointegrated or not. Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be cointegrated. The stationary linear combination is called the cointegrating equation and may be interpreted as a long-run equilibrium relationship among the variables as the difference between them is stationary (Hall and Henry, 1989).

As explained below, the presence of a cointegrating relation forms the basis of the VEC specification. We employ the maximum likelihood test procedure established by Johansen and Juselius (1990) and Johansen (1991). Specifically, if \( y_i \) is a vector of \( n \)
stochastic variables, then there exists a p-lag vector auto regression with Gaussian errors of the following form:

Consider a VAR of order $p$:

$$y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + B x_t + \varepsilon_t$$  \hspace{1cm} (4.17)

where $y_t$ is a $k$-vector of non-stationary I(1) variables, $x_t$ is a $d$-vector of deterministic variables, and $\varepsilon_t$ is a vector of innovations. This VAR can be rewritten as

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-p} + B x_t + \varepsilon_t$$  \hspace{1cm} (4.17)’

Where

$$\Pi = \sum_{i=1}^{p} A - I$$

$$\Gamma = -\sum_{j=i=1}^{p} A_j$$

To determine the number of co-integrating vectors, Johansen (1988, 1989) and Johansen and Juselius (1990) suggest two statistical tests, the first is the trace test ($\lambda$ trace). The trace statistic tests the null hypothesis of $r$ cointegrating relations against the alternative of $k$ cointegrating relations, where $k$ is the number of endogenous variables, for $r=0,1,\ldots,k-1$. The test can be calculated as follows:

$$\lambda_{\text{trace}}(r) = -\Gamma \sum_{j=i=1}^{p} \ln(1 - \lambda_{1,i}^2)$$  \hspace{1cm} (4.18a)

where $\Gamma$ is the number of usable observations, and the $\lambda_{1,i}$ are the estimated eigenvalue from the coefficient matrix $\Pi$. The second statistical test is the maximum eigenvalue test ($\lambda_{\text{max}}$) which tests the null hypothesis of $r$ cointegrating relations against the alternative of $r+1$ cointegrating relations. This test statistic is computed as:
C. The Error Correction Model

If cointegration is proven to exist, then the third step requires the construction of an error correction mechanism to model dynamic relationship. The purpose of the error correction model is to indicate the speed of adjustment from the short-run equilibrium to the long-run equilibrium state. The greater the coefficient of the parameter, the higher is the speed of adjustment of the model from the short-run to the long-run. We represent the model specification equation with an error correction form that allows for inclusion of long-run information thus, the error correction model (ECM) can be formulated as follows:

\[
\Delta z_{ijt} = \alpha \beta' z_{it-1} + \Gamma_1 z_{it-1} + \cdots + \Gamma_{k-1} z_{it-k+1} + \varepsilon_t
\]  

(4.19)

where \( \alpha \) and \( \beta \) are matrices of full column rank representing adjustment coefficients and cointegrating vectors, respectively.

4.4.3 Empirical Results and Analysis

A. Determination of the Stationarity of Data

The integration properties of the variables are investigated by conducting augmented Dickey–Fuller (1981) unit root test. The results reported in Table 1 suggest that each of the variables in \( Z_{it} \) is integrated of order 1, \( I(1) \) and they become stationary at first differences with an intercept and trend.
Table 4.6  ADF Unit Root Test Statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>At level</th>
<th>At First Difference*</th>
<th>Order of Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPIS</td>
<td>-1.84</td>
<td>-8.745</td>
<td>I(1)</td>
</tr>
<tr>
<td>EXRS</td>
<td>0.120</td>
<td>-8.994</td>
<td>I(1)</td>
</tr>
<tr>
<td>M2S</td>
<td>-1.996</td>
<td>-4.554</td>
<td>I(1)</td>
</tr>
<tr>
<td>BDS</td>
<td>1.293</td>
<td>-3.943</td>
<td>I(1)</td>
</tr>
</tbody>
</table>

* Note: ADF test critical values are; -3.481217, -2.883753, -2.578694 at 1%, 5% and 10% respectively

Model 1

The first model includes the endogenous variables include the price level, a money aggregate (M2S), an exchange rate(NEER), and the fiscal balance(BDS).

\[ z_{1t} = (\text{CPIS, M2S, NEER, BDS}) \]

B.1 Cointegration Analysis for Model 1

The cointegration test is carried out assuming an intercept in the cointegrating equation. The cointegrating relationship among \(LCPIS, EXRS, M2S\) and \(BDS\) has been investigated using the Johansen technique. Table 2 reports results based on Johansen’s maximum likelihood method. The trace statistics \(\lambda_{trace}\) indicates that there are at least two cointegrating vectors among these four variables. We can reject the null hypothesis of no cointegrating vector in favor of two cointegrating vectors under the trace test statistics at the 5 percent significance level. Consequently, we can conclude that there is a long-run equilibrium relationship among inflation, exchange rate, money supply and budget deficit in Pakistan.

Table 4.7 Cointegration Test Based on Johansen’s Maximum Likelihood Method- Model 1

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Alternative</th>
<th>Critical</th>
<th>p-values</th>
</tr>
</thead>
</table>

155
<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Eigenvalues</th>
<th>( \lambda_{\text{trace}} )</th>
<th>Value 5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>( H_0 : r=0 )</td>
<td>( H_1 : r=1 )</td>
<td>0.317</td>
<td>55.497</td>
</tr>
<tr>
<td>( H_0 : r=1 )</td>
<td>( H_1 : r=2 )</td>
<td>0.252</td>
<td>30.313</td>
</tr>
<tr>
<td>( H_0 : r=2 )</td>
<td>( H_1 : r=3 )</td>
<td>0.144</td>
<td>11.148</td>
</tr>
<tr>
<td>( H_0 : r=3 )</td>
<td>( H_1 : r=4 )</td>
<td>0.012</td>
<td>0.81</td>
</tr>
</tbody>
</table>

**B.2 Cointegrating Equation for Model 1**

\[
\text{Log (CPIS)} = 0.14\log (\text{EXRS}) + 0.175\log (M2S) - 0.003 (\text{BDS}) - 0.46
\]

(4.26) \hspace{2cm} [2.32] \hspace{2cm} [4.66] \hspace{2cm} [0.66]

The above cointegrating equation is normalized for \( \text{LCPIS} \) (setting its coefficient to unity) in order to interpret the estimated coefficients (the t values are reported in parenthesis). It indicates that exchange rate variations bring a positive change in the price level and it is statistically significant. An increase of one percent in \( \text{NEER} \) (reduction in the value of Rupee) brings 0.14% increase in domestic inflation. Pakistan’s market is based on imported commodities, which implies that, depreciation of the exchange rate will be transmitted to an increase on the price of the consumer’s basket of commodities.

Similarly, an increase of one percent in reserve money is associated with 0.175 percentage increase in the price level in Pakistan (holding the budget deficit constant) and this relationship is statistically significant. Moreover a one million change in budget deficit will increase the price level by 0.39% and this relationship is statistically significant. It implies that there is significant long-run relationship between inflation, the exchange rate, money supply and budget deficit in Pakistan. This result is in line with Chaudhary and Ahmad (1995), and Agha and Khan (2006) but contrary to the findings of Bilquees (1988) and Neyapti (1998).
B.3 Vector Error Correction Mechanism

The second step in the cointegration involves constructing an error correction model. Since there are four variables in the cointegrating system, a valid error correction model can be constructed, which is given by the following equations:

\[
\Delta LCPI_t = \alpha_0 + \sum \alpha_i \Delta LCPI_{t-i} + \sum \beta_i \Delta EXRS_{t-i} + \sum \beta_i \Delta M 2S_{t-i} + \sum \beta_i \Delta BDS_{t-i} + \varphi_1 t_{t-i} + \nu_{t1} \tag{4.20a}
\]

\[
\Delta EXRS_t = \alpha_0 + \sum \alpha_i \Delta EXR_{t-i} + \sum \beta_i \Delta LCPI_{t-i} + \sum \beta_i \Delta M 2S_{t-i} + \sum \beta_i \Delta BDS_{t-i} + \varphi_2 t_{t-i} + \nu_{t2} \tag{4.20b}
\]

\[
\Delta M 2S_t = \alpha_0 + \sum \alpha_i \Delta M 2S_{t-i} + \sum \beta_i \Delta LCPI_{t-i} + \sum \beta_i \Delta EXRS_{t-i} + \sum \beta_i \Delta BDS_{t-i} + \varphi_3 t_{t-i} + \nu_{t3} \tag{4.20c}
\]

\[
\Delta BDS_t = \alpha_0 + \sum \alpha_i \Delta BDS_{t-i} + \sum \beta_i \Delta LCPI_{t-i} + \sum \beta_i \Delta EXRS_{t-i} + \sum \beta_i \Delta M 2S_{t-i} + \varphi_4 t_{t-i} + \nu_{t4} \tag{4.20d}
\]

In this system of equations, \( \Delta \) is the first difference operator, \( \varphi \) is the error correction coefficient and the remaining variables are as defined above. When \( \varphi \neq 0 \), it implies a valid error correction representation of the underlying variables as well as for cointegration to exist between these variables. The coefficient on the lagged value of the errors (representing the long run relationship) determines the speed of adjustment or size of correction towards the long run relationship in the short run. Since there is long-run relationship among the variables, the short-run corrections in the equilibrium are presented in Table 4.8. This table reports only those coefficients which are statistically significant.

<table>
<thead>
<tr>
<th>Table 4.8 Vector Error Correction (VEC) Model 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>CointEq1</td>
</tr>
<tr>
<td>D(LOG(CPIS(-1)))</td>
</tr>
<tr>
<td>D(LOG(CPIS(-2)))</td>
</tr>
<tr>
<td>D(LOG(EXRS(-2)))</td>
</tr>
<tr>
<td>D(LOG(EXRS(-3)))</td>
</tr>
<tr>
<td>D(LOG(M2S(-1)))</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>R-squared</td>
</tr>
<tr>
<td>Adj. R-squared</td>
</tr>
<tr>
<td>Sum sq. resid</td>
</tr>
<tr>
<td>S.E. Equation</td>
</tr>
<tr>
<td>F-statistic</td>
</tr>
</tbody>
</table>
The VECM is estimated with 3 lags as suggested by FPE, AIC and HQ criteria (the lag selection criteria is persistent for all three models). The estimated coefficient of the error-correction term in the inflation variable equation has the expected sign and it is statistically significant at the 5 percent level, with the speed of convergence to the equilibrium of 68 percent. In the short-run, inflation adjusts by 68 percent of the previous quarter’s deviation from equilibrium. When error-correction term is negative, it means that in last period the equilibrium value of the relevant variable is less than its actual value, or actual value exceeds the equilibrium. If “error correction” occurs, then that variable should fall towards its equilibrium value. In other words, the coefficient $\phi$ should be negative. [Furthermore, the estimated VECM suggests that we may exclude from the equation exchange rate, money supply and budget deficit. This decision is on the basis of Wald test which concludes that these variables seem to be exogenous in the system]. In Wald test, the null hypothesis of block exogeneity is not rejected for all variables (together) which indicate that money supply and budget deficit and exchange rate are exogenous in the system (Table 4.9).

Table 4.9 Chi-Square-Wald Tests--Model 1

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>D(LCPIS)</th>
<th>D(EXRS)</th>
<th>D(M2S)</th>
<th>D(BDS)</th>
<th>All Variables Together</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(LCPIS)</td>
<td>39.5995* (0.0000)</td>
<td>9.7438* (0.1915)</td>
<td>5.2628 (0.4380)</td>
<td>54.20277* (0.0000)</td>
<td></td>
</tr>
<tr>
<td>D(EXRS)</td>
<td>3.4268 (0.4900)</td>
<td>6.0809 (0.3404)</td>
<td>1.4609 (0.9437)</td>
<td>12.7634 (0.8026)</td>
<td></td>
</tr>
<tr>
<td>D(M2S)</td>
<td>14.159013** (0.0260)</td>
<td>6.1915 (0.3809)</td>
<td>3.4835 (0.6853)</td>
<td>19.6814 (0.3576)</td>
<td></td>
</tr>
<tr>
<td>D(BDS)</td>
<td>7.3710 (0.2414)</td>
<td>5.8243 (0.4622)</td>
<td>1.9751 (0.9162)</td>
<td>14.2531 (0.7452)</td>
<td></td>
</tr>
</tbody>
</table>

NOTES: The values in each box represents chi-square (wald) statistics for the joint significance of each other lagged endogenous variables in that equation. The statistics in the last column is the chi-square statistics for joint significance of all other lagged endogenous variables in the equation. The critical values (for individual excluded variables) with 5 df at 1,5& 10 percent are 15.086,11.07 and 9.236 respectively. The critical values (for all excluded variables) with 15 df at 1,5& 10 percent are 30.578, 24.996 and 22.307 respectively.

The estimates in the VECM reveal that in Pakistan inflation is affected by the changes in exchange rate and money supply and there exists a statistically significant relationship between these variables. These analyses are further comprehended by the evaluation of impulse response functions and the variance decomposition. The impulse-
response functions (IRF) associated with the estimated VECM from Model 1 are given in Figure 4.4. A twenty-period horizon is employed to allow the dynamics of the system to work out. The IRF measures the response to a one standard deviation shock to one of the system’s variables on other variables in the system. Therefore, the IRF shows how the future path of these variables changes in response to the shock. The IRFs can also be viewed as dynamic multipliers giving the size and the direction of the effect of shocks to the system. The analysis of these impulse responses reveal that an innovation in the exchange rate has transitory effects on the price level whereas an innovation in the money supply has positive and permanent effect on the price level. In addition, an innovation in the budget deficit causes a positive and permanent shock to money growth, although it is smaller in magnitude. Therefore, there seems to be an indirect relationship between inflation and the budget deficit. An increase in the budget deficit affects money growth which in turn leads to higher inflation.

Variance decomposition shows the percentage of forecast error variance for each variable that may be attributed to its own shocks and to fluctuations in the other variables in the system. The results of VDCs show that about 53% of variation in inflation is accounted by the exchange rate and money growth. However, about 3 percent variation in money growth is explained by the budget deficit. Therefore inflation and money growth variables seem to be endogenous variables in the system while the budget deficit and the exchange rate seem to be effectively exogenous variables as most of the forecast error is explained by their own shocks compared to the other variables (Table 4.10).
Figure 4.4 Impulse Response Function (IRF) -- Model 1

Table 4.10 Forecast Error Variance Decomposition - Model 1

<table>
<thead>
<tr>
<th>Period</th>
<th>S.E.</th>
<th>LOG(CPIS)</th>
<th>LOG(EXRS)</th>
<th>LOG(M2S)</th>
<th>BDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.002</td>
<td>100.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5</td>
<td>0.009</td>
<td>80.629</td>
<td>5.047</td>
<td>14.110</td>
<td>0.214</td>
</tr>
<tr>
<td>10</td>
<td>0.017</td>
<td>60.330</td>
<td>3.722</td>
<td>35.665</td>
<td>0.283</td>
</tr>
<tr>
<td>15</td>
<td>0.023</td>
<td>49.449</td>
<td>2.776</td>
<td>47.540</td>
<td>0.235</td>
</tr>
<tr>
<td>20</td>
<td>0.028</td>
<td>46.763</td>
<td>2.246</td>
<td>50.825</td>
<td>0.166</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Period</th>
<th>S.E.</th>
<th>LOG(CPIS)</th>
<th>LOG(EXRS)</th>
<th>LOG(M2S)</th>
<th>BDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.015</td>
<td>7.480</td>
<td>0.076</td>
<td>92.444</td>
<td>0.000</td>
</tr>
<tr>
<td>5</td>
<td>0.062</td>
<td>8.201</td>
<td>1.126</td>
<td>90.326</td>
<td>0.348</td>
</tr>
<tr>
<td>10</td>
<td>0.101</td>
<td>16.104</td>
<td>2.946</td>
<td>79.173</td>
<td>1.777</td>
</tr>
<tr>
<td>15</td>
<td>0.127</td>
<td>26.159</td>
<td>3.708</td>
<td>67.396</td>
<td>2.738</td>
</tr>
<tr>
<td>20</td>
<td>0.148</td>
<td>31.704</td>
<td>3.696</td>
<td>61.766</td>
<td>2.835</td>
</tr>
</tbody>
</table>
B. Model 2

Model 2 is a three variable VECM with prices, money, and fiscal deficits. This model excludes the exchange rate to allow potential additional efficiency in estimation.

C.1 Cointegration Analysis for Model 2

The cointegration test indicates three long term cointegrating relationships between these variables.

Table 4.11 Cointegration Test Based on Johansen’s Maximum Likelihood Method- Model 2

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Alternative Hypothesis</th>
<th>Critical Value 5%</th>
<th>p-values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Eigenvalues</td>
<td>$\lambda_{max}$</td>
</tr>
<tr>
<td>$H_0: r=0$</td>
<td>$H_1: r=1$</td>
<td>0.182</td>
<td>46.661</td>
</tr>
<tr>
<td>$H_0: r=1$</td>
<td>$H_1: r=2$</td>
<td>0.126</td>
<td>21.571</td>
</tr>
<tr>
<td>$H_0: r=2$</td>
<td>$H_1: r=3$</td>
<td>0.037</td>
<td>4.735</td>
</tr>
</tbody>
</table>

C.2 Cointegrating Equation for Model 2

The estimated cointegrating vector in model 2 shows that budget deficit and money supply changes have a positive impact on price level.

\[
\text{Log (CPIS)} = 0.048 \text{log (M2S)} + 0.124 \text{(BDS)} - 0.134 \\
\begin{bmatrix}
2.51 \\
4.47 \\
(4.28)
\end{bmatrix}
\]
It indicates that 1 percent increases in money supply by the central bank would increase by 0.048 percentage points in the price level and similarly, an increase in BDS by one million raises the price level by 0.124 percentage points.

**C.3 Vector Error Correction Mechanism**

Then we estimate an error correction model though the following equations:

\[
\Delta LCPI_t = \alpha_0 + \Sigma \alpha_i \Delta LCPI_{t-i} + \Sigma \beta_i \Delta M_{t-i} + \Sigma \beta_i \Delta BDS_{t-i} + \phi_1 u_{t-i} + \nu_{t1} \quad (4.21a)
\]

\[
\Delta M_{t} = \alpha_0 + \Sigma \alpha_i \Delta M_{t-i} + \Sigma \beta_i \Delta LCPI_{t-i} + \Sigma \beta_i \Delta BDS_{t-i} + \phi_2 u_{t-i} + \nu_{t3} \quad (4.21b)
\]

\[
\Delta BDS_{t} = \alpha_0 + \Sigma \alpha_i \Delta BDS_{t-i} + \Sigma \beta_i \Delta LCPI_{t-i} + \Sigma \beta_i \Delta M_{t-i} + \phi_3 u_{t-i} + \nu_{t4} \quad (4.21c)
\]

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>CointEq1</td>
<td>-0.746</td>
<td>-0.007</td>
</tr>
<tr>
<td>D(LOG(CPIS(-1)))</td>
<td>0.268</td>
<td>-0.086</td>
</tr>
<tr>
<td>D(LOG(CPIS(-2)))</td>
<td>0.265</td>
<td>-0.085</td>
</tr>
<tr>
<td>D(LOG(M2S(-1)))</td>
<td>0.016</td>
<td>-0.005</td>
</tr>
<tr>
<td>D(BDS(-2))</td>
<td>-0.003</td>
<td>0.000</td>
</tr>
<tr>
<td>C</td>
<td>0.002</td>
<td>-0.001</td>
</tr>
</tbody>
</table>

**Table 4.12 Vector Error Correction (VEC) Model 2**

The VECM estimates in the Table 4.12 indicate that the error-correction term in the inflation variable equation is statistically significant with the speed of convergence to the equilibrium of 74 percent and its sign is negative which implies that if actual inflation is greater than its equilibrium value then over time it will fall to attain equilibrium. In the short-run, inflation adjusts by 74 percent of the previous quarter’s deviation from the equilibrium. An analysis of Wald test reveals that inflation is affected by the changes in budget deficit and the null hypothesis of block exogeneity is not rejected for other two equations which means that the money supply and the budget deficit are exogenous in the system (Table 4.13).
Table 4.13 Chi-Square-Wald Tests --Model 2

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Independent Variables</th>
<th>Block Exogeneity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D(LCPIS)</td>
<td>D(M2S)</td>
</tr>
<tr>
<td>D(LCPIS)</td>
<td></td>
<td>3.720</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.7196)</td>
</tr>
<tr>
<td>D(M2S)</td>
<td>8.540</td>
<td>3.620</td>
</tr>
<tr>
<td></td>
<td>(0.2039)</td>
<td>(0.726)</td>
</tr>
<tr>
<td>D(BDS)</td>
<td>6.442</td>
<td>1.268</td>
</tr>
<tr>
<td></td>
<td>(0.37461)</td>
<td>(0.79)</td>
</tr>
</tbody>
</table>

NOTES: The values in each box represent chi-square (wald) statistics for the joint significance of each other lagged endogenous variables in that equation. The statistics in the last column is the chi-square statistics for joint significance of all other lagged endogenous variables in the equation. The critical values (for individual excluded variables) with 5 df at 1,5 & 10 percent are 15.086, 11.07 and 9.236 respectively. The critical values (for all excluded variables) with 10 df at 1,5 & 10 percent are 23.209, 18.307 and 15.987 respectively. *, significant at 1 percent, **, significant at 5 percent & ***, significant at 10 percent.

The Impulse-response functions (IRF) associated with the estimated VECM from Model 2 are given in the Figure 4.5. Like model 1, a twenty-period horizon is employed to allow the dynamics of the system to work out. The analysis of these impulse response shows that an innovation in the budget deficit and the money supply causes a positive shock to inflation; however the innovation in money supply causes a permanent effect whereas an innovation in the budget deficit causes a transitory effect on inflation. Hence the IRF for model 2 appears to be broadly consistent with the earlier VECM results which show that money growth and budget deficit are the major contributors to the inflation in Pakistan.

The results of VDCs show that about 56% variation in the inflation is caused by budget deficit and money supply changes. Therefore inflation variable seems to be an endogenous variable (Table 4.14).
Figure 4.5  Impulse Response Function (IRF) – Model 2

Table 4.14 Forecast Error Variance Decomposition- Model 2

<table>
<thead>
<tr>
<th>Period</th>
<th>S.E.</th>
<th>LOG(CPIS)</th>
<th>LOG(M2S)</th>
<th>(BDS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.003</td>
<td>100.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5</td>
<td>0.009</td>
<td>91.921</td>
<td>2.923</td>
<td>5.157</td>
</tr>
<tr>
<td>10</td>
<td>0.015</td>
<td>76.641</td>
<td>14.512</td>
<td>8.848</td>
</tr>
<tr>
<td>15</td>
<td>0.022</td>
<td>55.668</td>
<td>24.302</td>
<td>20.031</td>
</tr>
<tr>
<td>20</td>
<td>0.029</td>
<td>42.884</td>
<td>28.517</td>
<td>28.599</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Period</th>
<th>S.E.</th>
<th>LOG(CPIS)</th>
<th>LOG(M2S)</th>
<th>(BDS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.003</td>
<td>100.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5</td>
<td>0.009</td>
<td>91.921</td>
<td>2.923</td>
<td>5.157</td>
</tr>
<tr>
<td>10</td>
<td>0.015</td>
<td>76.641</td>
<td>14.512</td>
<td>8.848</td>
</tr>
<tr>
<td>15</td>
<td>0.022</td>
<td>55.668</td>
<td>24.302</td>
<td>20.031</td>
</tr>
<tr>
<td>20</td>
<td>0.029</td>
<td>42.884</td>
<td>28.517</td>
<td>28.599</td>
</tr>
</tbody>
</table>
D. Model 3

The third model includes a real sector variable to determine whether the dynamics of the model are consistent in the presence of an impact from the real sector. This model consists of prices, money, fiscal deficits, and GDP (the quarterly estimates are constructed through Chow Lin procedure).

D.1 Cointegration Analysis for Model 3

Table 4.15 Cointegration Test Based on Johansen’s Maximum Likelihood Method

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Alternative Hypothesis</th>
<th>Eigenvalues</th>
<th>$\lambda_{\text{trace}}$</th>
<th>Critical Value 5%</th>
<th>p-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>$H_0: r=0$</td>
<td>$H_1: r=1$</td>
<td>0.241</td>
<td>69.584</td>
<td>55.246</td>
<td>0.002</td>
</tr>
<tr>
<td>$H_0: r=1$</td>
<td>$H_1: r=2$</td>
<td>0.128</td>
<td>30.181</td>
<td>35.011</td>
<td>0.048</td>
</tr>
<tr>
<td>$H_0: r=2$</td>
<td>$H_1: r=3$</td>
<td>0.118</td>
<td>17.989</td>
<td>18.398</td>
<td>0.057</td>
</tr>
<tr>
<td>$H_0: r=3$</td>
<td>$H_1: r=4$</td>
<td>0.019</td>
<td>2.337</td>
<td>3.841</td>
<td>0.126</td>
</tr>
</tbody>
</table>

The cointegrating relationship among these variable is examined through Johansen’s maximum likelihood method and the results are reported in the Table 4.15. The trace statistics ($\lambda_{\text{trace}}$) indicates that there are at least two cointegrating vectors among the four variables. In sum, there is a long-run equilibrium relationship among inflation, GDP, money supply and the budget deficit in Pakistan.

D.2 Cointegrating Equation for Model 3

The estimated cointegrating vector in model 3 shows that GDP, money supply and budget deficit have a positive impact on price level.

$$\log(\text{CPIS}) = 0.437\log(\text{GDPQ}) + 0.376\log(\text{M2S}) + 0.104(\text{BDS}) - 0.926$$

(4.30) [3.96] [4.85] [5.192]
A one percent increase in GDP increases the price level by 0.437 percent (some variability can be attributed to the co-movements in the nominal GDP and price level) and this relationship is statistically significant. In addition, one percent increase in money supply by the central bank would increase 0.37 percentage points in the price level and similarly, an expansion of one million in BDS raises the price level by 0.1 percentage points. Both of these relationships are statistically significant.

D.3 Vector Error Correction Mechanism

Then we construct an error correction model through the following equations;

\[
\Delta \text{LCPI}_t = \alpha_0 + \sum \alpha_i \Delta \text{LCPI}_{t-i} + \sum \beta_i \Delta \text{GDP}_{t-i} + \sum \gamma_i \Delta \text{BDS}_{t-i} + \phi_i \mu_{t-i} + \nu_{i1} \tag{4.22a}
\]

\[
\Delta \text{GDP}_t = \alpha_0 + \sum \alpha_i \Delta \text{GDP}_{t-i} + \sum \beta_i \Delta \text{LCPI}_{t-i} + \sum \gamma_i \Delta \text{BDS}_{t-i} + \phi_i \mu_{t-i} + \nu_{i1} \tag{4.22b}
\]

\[
\Delta \text{LM}_2S_t = \alpha_0 + \sum \alpha_i \Delta \text{LM}_2S_{t-i} + \sum \beta_i \Delta \text{LCPI}_{t-i} + \sum \gamma_i \Delta \text{GDP}_{t-i} + \phi_i \mu_{t-i} + \nu_{i1} \tag{4.22c}
\]

\[
\Delta \text{BDS}_t = \alpha_0 + \sum \alpha_i \Delta \text{BDS}_{t-i} + \sum \beta_i \Delta \text{LCPI}_{t-i} + \sum \gamma_i \Delta \text{GDP}_{t-i} + \phi_i \mu_{t-i} + \nu_{i4} \tag{4.22d}
\]

The VECM estimates in the Table 4.16 show that the error correction term in inflation equation is negative and statistically significant. The adjustment coefficient on inflation is quite rapid and its speed of convergence to the equilibrium is 68 percent. The results indicate that a large variation in inflation is explained by nominal GDP, budget deficit and money supply. An analysis of Wald test reveals that inflation is affected by the changes in GDP and budget deficit. However, the Wald test suggests that money supply and budget deficit as exogenous and GDP and inflation as endogenous in the system (Table 4.17).
### Table 4.16 Vector Error Correction (VEC) Model 3

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>CointEq1</td>
<td>-0.682</td>
<td>-0.015</td>
<td>[-3.56405]</td>
</tr>
<tr>
<td>D(LOG(CPIS(-1)))</td>
<td>0.176</td>
<td>-0.097</td>
<td>[1.82599]</td>
</tr>
<tr>
<td>D(LOG(CPIS(-2)))</td>
<td>0.243</td>
<td>-0.098</td>
<td>[2.48853]</td>
</tr>
<tr>
<td>D(LOG(GDPQ(-2)))</td>
<td>0.015</td>
<td>-0.012</td>
<td>[3.29811]</td>
</tr>
<tr>
<td>D(LOG(M2S(-1)))</td>
<td>0.012</td>
<td>-0.024</td>
<td>[2.51309]</td>
</tr>
<tr>
<td>D(BDS(-1))</td>
<td>0.003</td>
<td>-0.006</td>
<td>[2.91365]</td>
</tr>
<tr>
<td>C</td>
<td>0.005</td>
<td>-0.002</td>
<td>[3.85863]</td>
</tr>
</tbody>
</table>

| R-squared | 0.448 | Log likelihood | 572.225 |
| Adj. R-squared | 0.302 | Akaike AIC | -8.724 |
| Sum sq. resids | 0.001 | Schwarz SC | -8.113 |
| S.E. Equation | 0.003 | Mean dependent | 0.005 |
| F-statistic | 3.063 | S.D. dependent | 0.003 |

### Table 4.17 Chi-Square-Wald Tests – Model 3

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>D(LCPIS)</th>
<th>D(LGDP)</th>
<th>D(M2S)</th>
<th>D(BDS)</th>
<th>All Variables Together</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(LCPIS)</td>
<td>11.136** (0.008)</td>
<td>0.431 (0.806)</td>
<td>24.891* (0.088)</td>
<td>0</td>
<td>37.868</td>
</tr>
<tr>
<td>D(LGDP)</td>
<td>4.768 (0.413)</td>
<td>9.250 (0.884)</td>
<td>15.859 (0.088)</td>
<td>0</td>
<td>33.628</td>
</tr>
<tr>
<td>D(M2S)</td>
<td>5.890 (0.198)</td>
<td>1.530 (0.767)</td>
<td>3.195 (0.907)</td>
<td>0</td>
<td>8.643</td>
</tr>
<tr>
<td>D(BDS)</td>
<td>2.357 (0.025)</td>
<td>1.953 (0.590)</td>
<td>0.482 (0.868)</td>
<td>0</td>
<td>5.698</td>
</tr>
</tbody>
</table>

**NOTES:** The values in each box represent chi-square (wald) statistics for the joint significance of each other lagged endogenous variables in that equation. The statistics in the last column is the chi-square statistics for joint significance of all other lagged endogenous variables in the equation. The critical values (for individual excluded variables) with 5 df at 1, 5, & 10 percent are 15.086, 11.07 and 9.236 respectively. The critical values (for all excluded variables) with 15 df at 1, 5, & 10 percent are 30.578, 24.996 and 22.307 respectively. *, significant at 1 percent, **, significant at 5 percent & ***, significant at 10 percent.

The impulse-response functions (IRF) associated with the estimated VECM from Model 3 are given in the Figure 4.6. A twenty-period horizon is employed to allow the dynamics of the system to work out. The analysis of these impulse response shows that an innovation in GDP and money supply causes a positive shock to inflation and these impacts are permanent, however an innovation in the budget deficit causes a transitory effect on inflation. Therefore, the IRF appears to be broadly consistent with earlier VECM results which show that money supply, budget deficit and GDP are the major determinants of inflation in Pakistan.
The results of VDCs show that about 38% variation in inflation is accounted for GDP, money supply and budget deficit. The fiscal variable contributes to GDP variation by 14.4%, money supply by 7% and inflation contributes with the percentage of 33 (Table 4.18). However, budget deficit and money supply both seem to be exogenous in the system.

**Figure 4.6 Impulse Response Function (IRF) Model 3**

![Impulse Response Function](image)

**Table 4.18a Forecast Error Variance Decomposition - Model 3**

<table>
<thead>
<tr>
<th>Period</th>
<th>S.E.</th>
<th>LOG(CPIS)</th>
<th>LOG(GDPQ)</th>
<th>LOG(M2S)</th>
<th>(BDS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.003</td>
<td>100.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5</td>
<td>0.010</td>
<td>86.414</td>
<td>5.719</td>
<td>3.968</td>
<td>3.899</td>
</tr>
<tr>
<td>10</td>
<td>0.017</td>
<td>72.385</td>
<td>10.069</td>
<td>12.371</td>
<td>5.175</td>
</tr>
<tr>
<td>15</td>
<td>0.024</td>
<td>63.968</td>
<td>11.347</td>
<td>16.403</td>
<td>8.283</td>
</tr>
<tr>
<td>20</td>
<td>0.030</td>
<td>61.490</td>
<td>11.811</td>
<td>17.793</td>
<td>8.906</td>
</tr>
</tbody>
</table>
Table 4.18b  Forecast Error Variance Decomposition - Model 3

<table>
<thead>
<tr>
<th>Period</th>
<th>S.E.</th>
<th>LOG(CPIS)</th>
<th>LOG(GDPQ)</th>
<th>LOG(M2S)</th>
<th>BDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.022</td>
<td>0.673</td>
<td>99.327</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5</td>
<td>0.046</td>
<td>11.405</td>
<td>85.223</td>
<td>1.146</td>
<td>2.226</td>
</tr>
<tr>
<td>10</td>
<td>0.063</td>
<td>26.870</td>
<td>70.111</td>
<td>0.751</td>
<td>2.268</td>
</tr>
<tr>
<td>15</td>
<td>0.079</td>
<td>32.683</td>
<td>53.671</td>
<td>3.733</td>
<td>9.914</td>
</tr>
<tr>
<td>20</td>
<td>0.093</td>
<td>33.286</td>
<td>45.354</td>
<td>6.988</td>
<td>14.373</td>
</tr>
</tbody>
</table>

C. Fiscal Deficits and Seigniorage

The long run relationship between seigniorage and fiscal deficit is evaluated through the Johansen cointegration test (Table 4.19) and seigniorage is defined as

\[
s_{rt} = \frac{M_t - M_{t-1}}{P_t}
\]  \hspace{1cm} (4.23)

Where \(s_{rt}\) is seigniorage \(M_{t-1}\) is the last year money supply and \(P_t\) is the price level. The Johansen cointegration test results reveal a long term equilibrium relationship between the seigniorage and fiscal deficit.

Table 4.19 Cointegration Test Based on Johansen’s Maximum Likelihood Method - System 4.23

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Alternative Hypothesis</th>
<th>Critical Value 5%</th>
<th>(\lambda_{\text{trace}})</th>
<th>p-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>(H_0: r=0^*)</td>
<td>(H_1: r=1)</td>
<td>0.278397</td>
<td>41.94966</td>
<td>15.49471</td>
</tr>
<tr>
<td>(H_0: r=1)</td>
<td>(H_1: r=2)</td>
<td>0.001451</td>
<td>0.185857</td>
<td>3.841466</td>
</tr>
</tbody>
</table>
VECM estimates suggest that there is a unidirectional relationship between the two variables (the seignorage - LSI and the budget deficit - BDS) which flows from the fiscal deficits to seigniorage. The following equations are estimated for VECM.

\[ \Delta LSI_t = \alpha_0 + \sum \alpha_i \Delta LSI_{t-i} + \sum \beta_i \Delta BDS_{t-i} + \varphi_1 \mu_{t-i} + \nu_{t1} \]  \hspace{1cm} (4.24a)

\[ \Delta BDS_t = \alpha_0 + \sum \alpha_i \Delta BDS_{t-i} + \sum \beta_i \Delta LSI_{t-i} + \varphi_2 \mu_{t-i} + \nu_{t2} \]  \hspace{1cm} (4.24b)

The estimated cointegrating vector shows that the fiscal deficits affect changes in seigniorage rather than the other way round which is a sufficient condition for the fiscal dominance in Pakistan. Hence, it is concluded that inflation is a fiscal phenomenon in Pakistan.

\[ S1 = 4.03 * BDS + 4.77 \]
\[ (5.621) \hspace{1cm} (1.412) \]

\[ BDS = 1.03 * S1 + 2.351 \]
\[ (1.572) \hspace{1cm} (1.096) \]

<table>
<thead>
<tr>
<th>Table 4.20 Vector Error Correction (VEC) Model --System 4.23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient</td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td>CointEq1</td>
</tr>
<tr>
<td>D(LOG(S1(-1)))</td>
</tr>
<tr>
<td>D(BDS(-1),2)</td>
</tr>
<tr>
<td>D(BDS(-2),2)</td>
</tr>
<tr>
<td>C</td>
</tr>
</tbody>
</table>

R-squared 0.178
Adj. R-squared 0.144 Mean dependent 0.001
Sum sq. resid 0.173 S.D. dependent 0.041
S.E. Equation 0.038 Akaike information criterion -3.155
F-statistic 5.241 Schwarz criterion -2.842
Log likelihood 238.754

The analysis of these impulse response shows that an innovation in the budget deficit causes a positive shock to seigniorage, and this impact is permanent. Therefore, the IRF appears to be broadly consistent with earlier VECM results which show that budget
deficit affects seigniorage in Pakistan (Figure 4.7). The results of VDCs show that about 21% variation in seigniorage is explained by the budget deficit (Table 4.21).

Figure 4.7 Impulse Response Function (IRF) -System 4.23

Table 4.21 Forecast Error Variance Decomposition

<table>
<thead>
<tr>
<th>Period</th>
<th>S.E.</th>
<th>LOG(S1)</th>
<th>BDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.246</td>
<td>100.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5</td>
<td>0.376</td>
<td>95.623</td>
<td>4.377</td>
</tr>
<tr>
<td>10</td>
<td>0.465</td>
<td>86.221</td>
<td>13.779</td>
</tr>
<tr>
<td>15</td>
<td>0.543</td>
<td>77.596</td>
<td>22.404</td>
</tr>
<tr>
<td>20</td>
<td>0.613</td>
<td>71.779</td>
<td>28.221</td>
</tr>
</tbody>
</table>

To sum up the findings, in this section we establish that Pakistan economy can be categorised as a fiscal dominant regime whereas monetary policy remains accommodative to the needs of fiscal authority. We also explore the long-term relationship between inflation, the exchange rate, GDP, the money supply and the fiscal deficit in Pakistan through the specification of three vector error correction models covering the time period 1977q1-2009q4. The purpose of the error correction model is to estimate the speed of adjustment from the short-run disequilibrium to the long-run equilibrium state. The results indicate a strong role of budget deficit to exogenously determine the money growth, which is consistent with the Sargent and Wallace (1981) argument that inflation is a fiscal-driven monetary phenomenon.
4.5 The Effects of Exogenous Fiscal Policy Shocks in Pakistan

4.5.1 Introduction

This section empirically evaluates the effects of discretionary fiscal policy shocks on economic variables in Pakistan, using a structural vector autoregression framework. It is relevant in the sense that Pakistan is facing a rise in public debt and fiscal imbalances which poses concerns about fiscal sustainability of the economy. The earlier literature revolved around the discussion about the relative importance of fiscal and monetary policy on aggregate economic activity (Hussain, 1982; Massood and Ahmad, 1980; and Saqib and Yasmin, 1987) which investigates the relative importance of fiscal and monetary policy on aggregate economic activity. Hence there is a need to examine the effects of exogenous fiscal policy shocks on a set of key macroeconomic variables within a SVAR framework which relies on institutional information about the tax and transfer systems and the timing of tax collections to identify the automatic response of taxes and spending to activity, and, by implication, to infer fiscal shocks. Blanchard and Perotti (2002) suggest that the structural VAR approach seems more suitable for the study of fiscal policy than of monetary policy. They argue that there are many factors which contribute to the movement in budget variables, in other words, there are exogenous (with respect to output) fiscal shocks. In addition, decision and implementation lags in fiscal policy imply that, at high enough frequency—say, within a quarter—there is little or no discretionary response of fiscal policy to unexpected movements in activity. Thus, with enough institutional information about the tax and transfer systems and the timing of tax collections, one can construct estimates of the automatic effects of unexpected movements in activity on fiscal variables, and, by implication, obtain estimates of fiscal policy shocks. Earlier Yasmin et.al (2008) evaluate fiscal policy effects for Pakistan but the current research differs from their study as it employs a different set of variables and uses structural VAR identifications. Their study is based on the methodology suggested by Canzoneri e tal. (2001), and Tanner and Ramos (2002), which employs an unrestricted Vector Autoregressive Model (VAR) model. They use the cyclically-adjusted primary deficit as a measure of fiscal policy stance. Although the adjusted deficit does deliver information about current
policy, it is inappropriate in dynamic macro-econometric analysis because all of the competing theories implies that spending increases and tax cuts have different effects on the economy.

4.5.2 Data and Methodology

A. Data

This research employs quarterly data on public expenditure \( g_t \), net taxes \( n_t \) and GDP \( y_t \) in real terms, the consumer price index \( p_t \) and interest rate of government bonds \( r_t \). \( g_t \) is defined as the sum of public consumption and public investment, whereas \( n_t \) includes public revenues net of transfers, excluding interest payments on government debt. The data for the fiscal variables is available in annual series so these data series are interpolated from annual to quarterly series. All variables are seasonally adjusted and enter in logs except the interest rate, which enters in levels. The sample covers the period 1973:1-2009:4.

B. The Model

The reduced-form VAR can be written as

\[
X_t = u_0 + u_1(t) + A(L)X_{t-1} + \nu_t
\]  

(4.25)

where \( u_0 \) is a constant, \( t \) is a linear time trend, \( X_t = (g_t, y_t, p_t, n_t, r_t) \) is the vector of endogenous variables and the only the \( A(L) \) is an autoregressive lag polynomial. The vector \( \nu_t = (u^g_t, u^y_t, u^p_t, u^{nt}_t, u^r_t) \) contains the reduced-form residuals, which in general will have non-zero correlations. We follow Blanchard and Perotti (2002) and choose a
lag length of two quarters on the basis of leg length selection criteria i.e. SC(Schwarz information criterion) and HQ (Hannan-Quinn information criterion). The use of a higher lag order as in Mountford and Uhlig (2005) does not affect the results.

As the reduced-form disturbances will in general be correlated it is necessary to transform the reduced-form model into a structural model. Pre-multiplying the equation (4.25) by the (kxk) matrix $A_0$ gives the structural form:

$$A_0X_t = A_0u_t + A_0u_{t-1} + A_0A(L)X_{t-1} + Be_t$$

(4.26)

where $Be_t = A_0u_t$ describes the relation between the structural disturbances $e_t$ and the reduced-form disturbances $u_t$. In the following, it is assumed that the structural disturbances $e_t$ are uncorrelated with each other, i.e., the variance-covariance matrix of the structural disturbances $\Sigma e$ is diagonal. The matrix $A_0$ describes the contemporaneous relation among the variables collected in the vector $X_t$. In the literature this representation of the structural form is often called the $AB$ model (Lütkepohl, 2005). Without restrictions on the parameters in $A_0$ and $B_t$ this structural model is not identified.

### 4.5.3 Identification of Fiscal Policy Shocks

The empirical literature classifies four approaches to identify a structural VAR to analyse the fiscal policy effects on macro variables. These approaches include; first, the recursive approach introduced by Sims (1980) and applied to study the effects of fiscal shocks by Fatas and Mihov (2001); second, the structural VAR approach proposed by Blanchard and Perotti (2002) and extended in Perotti (2005, 2007); third, the sign restrictions approach developed by Uhlig (2005) and applied to fiscal policy analysis by Mountford and Uhlig (2005); and, fourth, the event-study approach introduced by Ramey and Shapiro (1998) to study the effects of large unexpected increases in government defence spending and also used by Edelberg et al. (1999), Eichenbaum and Fisher (2005), Perotti (2007) and Ramey (2007). In this paper we use two identification
approaches i.e. the recursive approach and the structural VAR approach proposed by Blanchard and Perotti (2002).

A. The Recursive Approach

The recursive approach restricts $B$ to a $k$-dimensional identity matrix and $A_0$ to a lower triangular matrix with a unit diagonal, which implies the decomposition of the variance-covariance matrix $\Sigma_u = A_0^{-1} \Sigma_e (A_0^{-1})'$. This decomposition is obtained from the Cholesky decomposition $\Sigma_u = PP'$ by defining a diagonal matrix $D$ which has the same main diagonal as $P$ and by specifying $A_0^{-1} = PD^{-1}$ and $\Sigma_e = DD'$ i.e. the elements on the main diagonal of $D$ and $P$ are equal to the standard deviation of the respective structural shock. The recursive approach implies a causal ordering of the model variables, note that there are $k!$ possible orderings in total. In this research we order the variables as follows: spending is ordered first, output is ordered second, inflation is ordered third, tax revenue is ordered fourth and the interest rate is ordered last. This implies that the relation between the reduced-form disturbances $u_t$ and the structural disturbances $e_t$ takes the following form:

$$
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 \\
-\gamma_{y,g} & 1 & 0 & 0 & 0 \\
-\gamma_{p,g} & -\gamma_{p,y} & 1 & 0 & 0 \\
-\gamma_{nt,g} & -\gamma_{nt,y} & -\gamma_{nt,p} & 1 & 0 \\
-\gamma_{r,g} & -\gamma_{r,y} & -\gamma_{r,p} & -\gamma_{r,r} & 1
\end{bmatrix}
\begin{bmatrix}
u^g_t \\
u^l_t \\
u^p_t \\
u^nt_t \\
u^r_t
\end{bmatrix}
= 
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
e^g_t \\
e^l_t \\
e^p_t \\
e^nt_t \\
e^r_t
\end{bmatrix}
$$

(4.27)

Government spending is ordered first as it does not react contemporaneously to shocks to other variables in the system. Movements in government spending, unlike movements in taxes, are largely unrelated to the business cycle. Therefore, it seems plausible to assume that government spending is not affected contemporaneously by shocks originating in the private sector. Output does not react contemporaneously to the shocks in tax, inflation and interest rate but it is affected contemporaneously by
spending shocks. Inflation does not react contemporaneously to tax and interest rate shocks, but it is affected contemporaneously by government spending and output shocks. Taxes do not react contemporaneously to interest rate shocks, but are affected contemporaneously by government spending, output and inflation shocks, and the interest rate is affected contemporaneously by all shocks in the system. Ordering the interest rate last can further be justified on the grounds of a central bank reaction function implying that the interest rate is set as a function of the output gap and inflation and given that spending and revenue are not sensitive to interest rate changes. This ordering is unique as in the recursive approach the ordering of the variables determines the contemporaneous effects of shocks: the variable ordered first in the VAR system is only affected contemporaneously by the first shock but not by the second shock, whereas the variable ordered second is contemporaneously affected by both shocks. Therefore if the model is disorded, it will change the economic interpretation of the relationships between the variables.

B. The Blanchard-Perotti Approach

The identification approach introduced by Blanchard and Perotti (2002) relies on institutional information about tax and transfer systems and about the timing of tax collections in order to identify the automatic response of taxes and government spending to economic activity. This chapter follows the identification scheme introduced by Perotti (2005) as he employs a five variable VAR model. The relationship between the reduced form disturbances $u_t$ and the structural disturbances $e_t$ can be written as:

\[ u_t^g = \alpha_{g,y} u_t^y + \alpha_{g,p} u_t^p + \alpha_{g,r} u_t^r + \beta_{g,t} e_{nt}^t + e_t^g \]  \hspace{1cm} (4.28)

\[ u_t^{nt} = \alpha_{nt,y} u_t^y + \alpha_{nt,p} u_t^p + \alpha_{nt,r} u_t^r + \beta_{nt,g} e_t^g + e_{nt}^t \]  \hspace{1cm} (4.29)

\[ u_t^y = \gamma_{y,g} u_t^g + \gamma_{y,t} u_t^t + e_t^y \]  \hspace{1cm} (4.30)

\[ u_t^p = \gamma_{p,g} u_t^g + \gamma_{p,y} u_t^y + \gamma_{p,nt} u_t^{nt} + e_t^p \]  \hspace{1cm} (4.31)
The variance-covariance matrix of the reduced-form disturbances in the above system of equations has ten distinct elements whereas it has 17 unknown parameters to estimate so it is not identified. To achieve identification Blanchard and Perotti suggest some additional restrictions on these seven parameters. Given that interest payments on government debt are excluded from the definitions of expenditure and net taxes, the semi-elasticities of these two fiscal variables to interest rate innovations, i.e. $\alpha_{g,r}$ and $\alpha_{nt,r}$, were set to zero. While this assumption appears justified for government expenditure and plays no role when analyzing its effects, it is more controversial for net taxes. As government expenditure comprises of notably public consumption and investment which do not respond automatically to the changes in economic activity hence we can set $\alpha_{g,y} = 0$. The case of the price elasticity is different, though, some share of government purchases of goods and services are likely to respond to the price level. Following Perotti (2005), an eclectic approach is adopted and the price elasticity of government expenditure is set to $-0.5$. However, setting this price elasticity to zero does not seem to affect the results significantly (Perotti, 2004). This paper uses external information on the output and price elasticities of net taxes and employs the elasticity values of net taxes estimated by Bilquees (2004). Finally, we set the parameter $\beta_{g,n,t}$ equal to zero, which implies that government decisions on spending are taken prior to the decisions on revenue. Imposing these restrictions on the parameter values the relation between the reduced-form and the structural disturbances can be written in matrix form $\Gamma U_t = BV_t$ where $V_t$ is the vector containing the orthogonal structural shocks.

\[
\Gamma U_t = \begin{bmatrix}
1 & 0 & 0.5 & 0 & 0 \\
-\gamma_{y,g} & 1 & 0 & -\gamma_{y,nt} & 0 \\
-\gamma_{p,g} & -\gamma_{p,y} & 1 & -\alpha_{p,t} & 0 \\
-\gamma_{nt,g} & 0.96 & -0.71 & 1 & 0 \\
-\gamma_{r,g} & -\gamma_{r,y} & -\gamma_{r,p} & -\gamma_{r,r} & 1 \\
\end{bmatrix}
\begin{bmatrix}
u^g_t \\ u^y_t \\ u^p_t \\ u^{nt}_t \\ e^r_t \\
\end{bmatrix} = BV_t
\]

\[
= \begin{bmatrix}
1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 \\
\end{bmatrix}
\begin{bmatrix}
\beta_{gnt, g} \\ e^g_t \\ e^y_t \\ e^p_t \\ e^{nt}_t \\ e^r_t \\
\end{bmatrix}
\]

(4.33)
Accordingly, the reduced-form residuals are linear combinations of the orthogonal structural shocks of the form: $U_t = \Gamma^{-1} B V_t$.

4.5.4 Estimation and Results

A. The Recursive Approach

Table 4.22 gives the estimated coefficients of the contemporaneous relations between fiscal and monetary shocks and economic variables.

<table>
<thead>
<tr>
<th></th>
<th>$\beta_{nt,g}$</th>
<th>$\gamma_{y,g}$</th>
<th>$\gamma_{p,g}$</th>
<th>$\gamma_{r,g}$</th>
<th>$\gamma_{r,y}$</th>
<th>$\gamma_{p,y}$</th>
<th>$\gamma_{r,u}$</th>
<th>$\alpha_{nt,p}$</th>
<th>$\gamma_{r,p}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Z$ value</td>
<td>4.844</td>
<td>-1.077</td>
<td>0.195</td>
<td>0.561</td>
<td>-0.002</td>
<td>1.095</td>
<td>0.462</td>
<td>0.031</td>
<td>7.788</td>
</tr>
<tr>
<td></td>
<td>0.412</td>
<td>-0.091</td>
<td>0.016</td>
<td>0.052</td>
<td>-0.001</td>
<td>0.092</td>
<td>0.039</td>
<td>0.003</td>
<td>0.661</td>
</tr>
</tbody>
</table>

These coefficients are estimated through the recursive approach suggested by Sims (1980). The first is the contemporaneous effect of government spending on taxes $\beta_{nt,g}$ which is positive and is highly significant. It suggests that a positive one percent shock in government expenditure increases the taxes by 0.41%. This reflects the long-term multiplier effect of government spending. An increase in expenditure leads to an increase in output which translates into higher government revenues over the long term. However, a negative value of $\gamma_{y,g}$ suggests the presence of crowding out effect in the short run and a positive one percent shock in government expenditure reduces the output by 0.09 percents but it is statistically insignificant. The positive coefficient of $\gamma_{p,g}$ indicates that a positive shock in government expenditure contributes to high inflation but again it is statistically insignificant. $\gamma_{r,g}$ also captures a theoretically consistent sign which implies that a positive shock in government spending will increase the interest rate and there is a crowding out effect but it is statistically insignificant. A negative value of $\gamma_{y,u}$ is theoretically consistent but statistically insignificant indicates that increase in taxes will reduce the output. The positive and statistically significant value
of $\alpha_{nt,p}$ supports the hypothesis that tax revenues are mostly from indirect taxes. A one percent shock in prices increases tax revenues by 0.66%.

The positive value of $\gamma_{p,y}$ suggests a direct relationship between inflation and output. A positive value of $\gamma_{r,y}$ suggests that an increase in output will lead to higher output. This estimate is theoretically consistent. It is also statistically significant. $\gamma_{r,nt}$ suggests a strong supply - side effect of taxes on output. A tax cut is assumed to increase the output and hence reduces the inflationary pressure which in turn leads to lower real interest rate. A positive value of $\gamma_{r,p}$ implies a direct relationship between inflation and interest rate but this relationship is statistically insignificant. As in the recursive approach, all elements of $A_0$ above the principal diagonal are restricted to zero and it estimates the size of automatic stabilizers while imposing a zero restriction on the contemporaneous effect of taxes on output and inflation. Perotti (2005) fixes the size of automatic stabilizers and estimates the contemporaneous effect of taxes on output and inflation.

### B. The Blanchard and Perotti Approach

Table 4.23 presents the coefficients estimated through the Blanchard and Perotti (2002) approach. In this case, the estimated coefficient of a government shock to tax revenue is negative but statistically insignificant which implies that in short run government expenditure multiplier is ineffective to raise tax revenues. It suggests that a positive one percent shock in government expenditure decreases the tax revenues by 0.12%.

<table>
<thead>
<tr>
<th></th>
<th>$\beta_{nt,g}$</th>
<th>$\gamma_{y,g}$</th>
<th>$\gamma_{p,g}$</th>
<th>$\alpha_{p,nt}$</th>
<th>$\gamma_{r,p}$</th>
<th>$\gamma_{r,y}$</th>
<th>$\gamma_{r,nt}$</th>
<th>$\alpha_{p,nt}$</th>
<th>$\gamma_{r,p}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Z$ value</td>
<td>-0.4594</td>
<td>16.697</td>
<td>3.113</td>
<td>3.006</td>
<td>-20.915</td>
<td>2.026</td>
<td>-0.002</td>
<td>5.573</td>
<td>5.190</td>
</tr>
</tbody>
</table>

However a positive and statistically significant value of $\gamma_{y,g}$ explains that an increase in government spending leads to higher output and a positive one percent shock in
government expenditure increases output by 6 percent. The positive coefficient of $\gamma_{p,g}$ indicates that a positive shock in government expenditure contributes to high inflation and again it is statistically significant. $\gamma_{r,g}$ also captures a theoretical consistent sign which implies that a positive shock in government spending will increase the interest rate and there is a crowding out effect and it is statistically significant. A positive and significant value of $\alpha_{y,nt}$ indicates that increase in taxes will increase the output. The positive and statistically significant value of $\alpha_{p,nt}$ further supports this hypothesis. A one percent shock in taxes increases prices by 2.3 percents; hence taxes are inflationary as most of the tax revenues are generated through indirect taxes.

A negative value of $\gamma_{p,ty}$ suggests an inverse relationship between inflation and output. An increase in output reduces inflation and this relationship is highly significant. A positive value of $\gamma_{r,ty}$ augments that an increase in output will lead to higher interest rate and this estimate is theoretical consistent and statistically significant. The estimated coefficient of $\gamma_{r,nt}$ suggests an inverse relationship between interest rate shocks and tax revenues and in empirical literature it is considered as a supply side effect of taxes. A tax cut is assumed to increase output and hence reduces the inflationary pressure which in turn leads to lower real interest rate. A positive value of $\gamma_{r,p}$ implies a direct relationship between inflation and interest rate and this relationship is statistically significant.

We find the strongly divergent results as regards to the effects of the fiscal multipliers depending on the identification approach. These fiscal multipliers are statistical insignificant in case of recursive approach which requires a causal ordering of the model variable. Whereas estimates through Blanchard and Perotti(2002) approach, which relies more on institutional information about tax and transfer systems and about the timing of tax collections are statistically significant. Hence the Blanchard and Perotti approach suggests a strong role of government expenditure and taxes in explaining output and inflation in Pakistan.
4.5.5 Results for Pure Fiscal Shocks

In this section we present the analysis of fiscal policy shocks through impulse response function generated through the Blanchard and Perotti (2002) SVAR identification i.e. shocks to one fiscal variable at a time without constraining the response of the other respective fiscal variable.

A. The Effects of Government Expenditure Shocks

Figure 4.8 shows the responses of endogenous variables to a positive shock in government expenditure (Shock 1)

![Figure 4.8 Impulse Response Functions for Government Expenditure Shocks](image)

It reflects that an increase in government expenditure has a positive and long-run effect on GDP, the real GDP rises after the second quarter and this result is persistent over five years time. This evidence is further supported by the cumulative output multipliers which reflect that output increases by 70% over the time span of five years but the multiplier value is still less than one. The government expenditure shock affects the endogenous variables through the following channels. First, due to the crowding in effect of government expenditure, the increase in government spending tends to raise the private investment. Second, the rise in the total investment tends to increase the real GDP and the effects of the higher real GDP will transmit into higher inflation. In general, government spending shocks are found to yield positive output responses in the short-term (Perotti, 2004; Neri, 2001; Mountford and Uhlig, 2009), although the size
and persistence of output multipliers varies significantly across studies. In addition, this result is further consistent with the findings of Looney (1995) and Hyder (2001) findings which confirm the complementary relationship between public and private investment. Higher government expenditure also brings about a significantly positive long run impact on Consumer Price Index (CPI) for 20 quarters. Such an increase in the price level implies higher inflation in the quarters following a positive shock in government expenditure. Likewise, a positive shock to government expenditure has different transitory and long run effects on real interest rate. The real interest rate increases persistently until the tenth quarter, following a positive shock to government expenditure and this positive response of the interest rate in the short term might be due to higher demand and inflationary pressures. However, it decreases persistently in the long run (till the end of twentieth quarter).

While impulse response functions trace the effects of a shock to one endogenous variable on to the other variables in the VAR, variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR. Tables 4.24a & 4.24b reveal that during the time period of twenty quarters, 99% of the unexpected variation in output and inflation is explained by the shocks in government expenditure (Tables 4.24a & 4.24b).

<table>
<thead>
<tr>
<th>Period</th>
<th>S.E.</th>
<th>Govt. Expenditure Shock</th>
<th>Tax Revenues Shocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.140235</td>
<td>42.54451</td>
<td>15.518</td>
</tr>
<tr>
<td>5</td>
<td>2.027906</td>
<td>99.16878</td>
<td>0.758593</td>
</tr>
<tr>
<td>10</td>
<td>7.179780</td>
<td>99.01250</td>
<td>0.912465</td>
</tr>
<tr>
<td>15</td>
<td>10.97056</td>
<td>98.99932</td>
<td>0.923977</td>
</tr>
<tr>
<td>20</td>
<td>12.63101</td>
<td>99.06832</td>
<td>0.864758</td>
</tr>
</tbody>
</table>
Table 4.24b Variance Decomposition of LCPI

<table>
<thead>
<tr>
<th>Period</th>
<th>S.E.</th>
<th>Govt Expenditure Shocks</th>
<th>Tax Revenues Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.009447</td>
<td>99.21882</td>
<td>0.747474</td>
</tr>
<tr>
<td>5</td>
<td>1.471837</td>
<td>99.12708</td>
<td>0.83747</td>
</tr>
<tr>
<td>10</td>
<td>5.043053</td>
<td>99.02579</td>
<td>0.937736</td>
</tr>
<tr>
<td>15</td>
<td>8.228884</td>
<td>98.954</td>
<td>1.009933</td>
</tr>
<tr>
<td>20</td>
<td>11.2102</td>
<td>98.91732</td>
<td>1.047535</td>
</tr>
</tbody>
</table>

The positive role of government expenditure in explaining the output variation can be attributed to such factors as excess liquidity in the banking system, relatively sustainable public debt scenario, government expenditures for transfer payment program, significant development expenditure for producing those goods and services which has the potential to discharge positive externalities, government micro-credit program and black money linkages.

A. The Effects of Net Taxes

Figure 4.9 represents the response of the endogenous variables to a positive shock in tax revenues.

**Figure 4.9 Impulse Response Functions for a Positive Shock in Tax Revenues**

Figure 4.9 suggests that unanticipated net tax increases have strong distortionary effects since GDP falls in response to an increase in the net tax revenues. Likewise, prices, and consequently inflation, fall in the quarters following the shock, presumably due to
lower demand pressures. and also interest rates fall on impact, although the response remains for three quarters after the shock

4.5.6 Robustness Checks

In order to evaluate as to whether the estimated results are consistent with the assumptions made about the some coefficients in matrices $\Gamma$ and $B$, some alternative specifications are tried. First about the ordering of the fiscal variables; to justify that either taxes are before government expenditure (which implies the exogeneity of tax structure) or the opposite, the alternative model is reestimated with the assumption $\beta_{nt,g} = 0$ and estimate $\beta_{g,nt}$ in (4.33) and the differences are minimal with the identical output multipliers. The model also assumes the price elasticity of government expenditure exogenously and sets $\alpha_{g,p} = 0.5$, to check its robustness we try to estimate $\alpha_{g,p}$.

Table 4.25 Robustness Checks

<table>
<thead>
<tr>
<th>$B_{g,nt}$</th>
<th>$\gamma_{t,y}$</th>
<th>$\gamma_{t,r}$</th>
<th>$\alpha_{nt}$</th>
<th>$\gamma_{p,t}$</th>
<th>$\gamma_{r,t}$</th>
<th>$\alpha_{y,t}$</th>
<th>$\gamma_{y,t}$</th>
<th>$\gamma_{p,y}$</th>
<th>$\gamma_{r,y}$</th>
<th>$\alpha_{p,y}$</th>
<th>$\alpha_{y,t}$</th>
<th>$\alpha_{p,p}$</th>
<th>$\alpha_{y,r}$</th>
<th>$\alpha_{p,r}$</th>
<th>$\alpha_{r,t}$</th>
<th>$\alpha_{y,r}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.08</td>
<td>3.25</td>
<td>10.12</td>
<td>0.02</td>
<td>-3.48</td>
<td>-12.38</td>
<td>0.26</td>
<td>-0.01</td>
<td>4.35</td>
<td>0.62</td>
<td>-0.22</td>
<td>0.89</td>
<td>-0.61</td>
<td>1.98</td>
<td>2.54</td>
<td>0.98</td>
<td></td>
</tr>
<tr>
<td>Z-value</td>
<td>-0.97</td>
<td>4.56</td>
<td>2.32</td>
<td>2.11</td>
<td>-2.52</td>
<td>-10.92</td>
<td>2.12</td>
<td>0.00</td>
<td>3.26</td>
<td>4.23</td>
<td>-0.16</td>
<td>2.54</td>
<td>1.98</td>
<td>2.54</td>
<td>1.98</td>
<td></td>
</tr>
</tbody>
</table>

In addition, in the first model we assume output and price elasticities of taxes as $\alpha_{nt,y} = 0.96$ and $\alpha_{nt,r} = 0.71$ (estimated by Bilquees, 2004). In order to check the consistency of these values we try to estimate $\alpha_{nt,y}$ and $\alpha_{nt,r}$ and the results are almost identical to the first specification (Table 4.25) and the output multipliers (the response of output to a positive shock in government expenditure) of government expenditure are mostly similar those reported in the first row of Table 4.26, thus confirming that model is correctly specified.

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Table 4.26 Output Multiplier

<table>
<thead>
<tr>
<th>Period</th>
<th>1</th>
<th>4</th>
<th>8</th>
<th>12</th>
<th>16</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRF</td>
<td>0.016</td>
<td>0.246</td>
<td>0.367</td>
<td>0.486</td>
<td>0.603</td>
<td>0.699</td>
</tr>
</tbody>
</table>

In order to account for the monetary policy response to fiscal policy the discount rate is replaced by the short term interest rate (call money rate), the results show only the marginal difference and the main conclusions remain valid. The impulse responses generated through this new identification also reflect the consistent patterns in the endogenous variables to fiscal policy shocks.

Figure 4.10 Impulse Response Functions for Government Expenditure shocks (New Identification)
4.6 Conclusions

This chapter examines the role of fiscal policy in Pakistan using different analytical approaches and empirically evaluates the relative effectiveness of the fiscal authorities to enhance economic growth in the economy.

At first, it traces out the relative importance of fiscal and monetary sources of inflation and analyses the dynamic response of inflation to different shocks, including the nominal public debt. It examines the intertemporal solvency conditions and related fiscal adjustment in Pakistan, using quarterly data for the sample period 1977q1-2009q4. This chapter explores the answers that either fiscal regime in Pakistan can be characterized as “fiscal dominant” or monetary dominant and does the primary deficit adjust itself to the changes in liabilities/interest payments. Primary deficit - PDEF measures the difference between total revenue and non-interest total expenditure and Public liabilities include debt (B) and the monetary base (M). A monetary dominant regime exists when the relationship between primary deficit and operational deficit - ODEF (defined as the changes in liabilities) is negative that fiscal authorities take into account the liabilities accumulation and therefore reduce the primary deficit. We estimate the model using two approaches; a backward looking and a forward looking approach, both for the entire sample as well for the five subsample periods. The estimates in the backward looking approach reveal that the null hypothesis that Primary deficit - PDEF does not respond to operational deficit - ODEF cannot be rejected at the conventional 90% level for either the entire period and for the subsample periods, which implies that the fiscal authority is insensitive to monetary policy in the sense that neither taxes nor expenditure react (now or in the future) to changes in the stock of outstanding government debt, hence there exists a passive monetary/active fiscal policy scenario.

Then we examine fiscal adjustment in a forward-looking manner through vector autoregression (VAR) framework. For example, under MD regime, current reductions in the primary deficit help reduce future liabilities. If so, we should observe a positive
relationship between current innovations to the primary deficit today and liabilities in the future. The Granger Causality tests are estimated with 1 and 2 lags for both the entire period and for the selected subsamples. The estimates reflect little evidence of statistically significant relationship between the changes in primary deficit and liabilities (ODEF). To identify the monetary or fiscal dominant regimes, we also use the impulse response functions and variance decomposition from an unstructured VAR. We consider the two possible ordering of the variables i.e PDEF and Liabb(liabilities). In the first ordering when real primary deficit comes first, it allows for a contemporaneous effect on real operational deficit (liabilities), which is consistent with a fiscal dominant regime. Since our focus is on the responses of both variables to primary deficit shocks. These VAR estimates are with eight lags (LR, AIC, FPE, Akaike, SC and HQ criteria were minimized at eight lags for both the entire 1977:01–2009:04 period and the selected subsamples). ordering where the real primary deficit comes first, the response of operational deficit to an innovation in PDEF is negative and significant. In fact, the response of liabilities is negative for 5 years, regardless of the ordering used and these results are in conformity with a fiscal dominant regime. Furthermore if a positive innovation in PDEF increases the expected future deficit that also confirms the presence of an FD regime. The univariate autocorrelations and the corresponding Q-statistics for PDEF indicate that there is significant positive autocorrelation for all first lags of PDEF.

To confirm these estimates further, we evaluate that how changes in the government budget and public liabilities exert an effect on aggregate demand. In a fiscal dominant regime, fiscal shocks create fluctuations in aggregate demand which in turn affect the level of real economic activity, real interest rate, as well as the inflation rate. For this purpose, we estimated VAR with PDEF, ODEF and natural logarithm of GDP to examine that if a positive innovation in PDEF increases the nominal income in the same period and reduces the government liabilities. We also analyse the related impulses response functions with ordering ODEF → PDEF → ln(GDPq), and observe the existence of a non-Ricardian regime in Pakistan since the innovation in the PDEF increases the nominal income and liabilities (after a time period of one year). We also confirm our results through a VAR specification with a discount factor and the estimates show that the response of PDEF and ODEF is as persistent as obtained without including discount factor; hence a fiscal dominant regime exists in Pakistan. These results are consistent with some of the earlier studies on Pakistan i.e. Chaudhary and Ahmad (1995) and Agha and Khan (2006).
After establishing the type of regime in Pakistan, in the second section we try to identify the sources of inflation in Pakistan through the evaluation of long term relationship between inflation, the exchange rate, GDP, the money supply and the fiscal deficit in Pakistan covering the time period 1977q1-2009q4. The test for stationarity - Augmented Dickey-Fuller (ADF) suggests that the all these variables are stationary in first differences. Then we employ Johansen’s maximum likelihood method to evaluate the existence of long term equilibrium relationship between the variables and the trace statistics \( \lambda_{trace} \) indicates that there exists a long term relationship between these variables. After establishing the existence of cointegration, we estimate error correction specifications to model the dynamic relationship and we examine three different empirical specifications of the VECM models. The first model includes, the price level, a money aggregate M2, an exchange rate (NEER), as the endogenous variables whereas in the second model we exclude the exchange rate due to the reason that might be there is a high correlation between price and exchange rate movements. In the third VECM specification, we include a real sector variable (GDP) with prices, money and the fiscal deficit to gauge the possible impacts from the real sector on prices. The results in all the specifications are consistent and endorse that the selected variables are the major determinants of inflation in Pakistan. Furthermore, analysis of IRF and VDCs reveal that the budget deficit exogenously determines money growth, which is consistent with the Sargent and Wallace (1981) argument that inflation is a fiscal-driven monetary phenomenon. To confirm this hypothesis we also estimate a two variables model consisting of fiscal deficit and seigniorage which shows a statistical significant relationship between the two variables, indicating the monetization of fiscal deficit and hence an indirect evidence of a fiscal dominant regime. Thus, the findings of this section suggest that in order to control inflation in Pakistan, policies should be aimed at reducing the fiscal deficit and the focus should be the on the sources of deficit financing.

In third section, we evaluates the macroeconomic effects of fiscal policy in Pakistan using SVAR methodology for the period 1973:1-2008:4, drawing on a new set of quarterly data built from the annual data series taken from International Financial Statistics. It employs the recursive approach introduced by Sims (1988) and the
Blanchard and Perotti(2002) approach to identify the SVAR model. We find a statistically insignificant role of government expenditure shocks in explaining the variation in output and inflation through the recursive approach. However, the estimates from Blanchard and Perotti (2002) approach indicate a significant role of government expenditure and taxes in explaining the changes in output and inflation in Pakistan. The empirical evidence reveals a positive effect of government spending shocks on output and inflation. These results can be summarized as following: (i) the increasing output multipliers of government expenditure over the time period of five years. ii) positive shocks in government spending yield significant effects on prices; iii) in short run interest rate also rises due to these government shocks; iv) positive shocks in tax revenues have strong distortionary effects since GDP falls in response to an increase in the net tax revenues, consequently interest rates and price level falls presumably due to lower demand pressures.

We can derive two main policy conclusions from these results. Firstly, fiscal policy is able to stimulate economic activity through expenditure expansions at the cost of higher inflation and public deficits and lower output in the medium term. Secondly, attempts to achieve fiscal consolidation by increasing the tax burden will result into lower output but help to reduce inflation in the economy in short term and medium term.

Although VARs are a useful forecasting tool in the short term but their use is limited on the basis of two caveats. Firstly, their accuracy declines at longer horizons. Therefore, the conclusions obtained regarding the long-term responses to fiscal policy shocks, in general, have to be interpreted with caution. Secondly, the econometric model employed in this section ensures the symmetry of the responses to shocks of equal absolute value with opposite signs. However, the real economy may not be symmetric and, accordingly, reactions to fiscal expansions might be of very different magnitude to fiscal retrenchments, with the size of the difference depending on a complex set of variables, including the initial state of public finances. This potential asymmetries cannot, however, be captured by our estimates. In addition fiscal variables data series are interpolated due to no availability of quarterly data so they are not free from econometric issues associated with interpolation of data.
To sum up, Pakistan economy is dominated by the fiscal authority’s requirements to finance its deficit and financing of this deficit through the borrowing from the banking sector and/or printing of new money affects the price level in the economy. As the fiscal policy stance is based on the objective to achieve higher and sustainable growth whereas monetary policy target is to achieve price stability so there is a potential for a conflict between these two macroeconomic policies. Therefore coordination between these two aforementioned policies as well as better management of fiscal sector can improve the macroeconomic performance of Pakistan economy.
Chapter Five

The Development of a Macroeconometric Model for Pakistan

5.1 Introduction

Macroeconometric modelling aims at explaining the empirical behaviour of an actual economic system. Such models are a system of inter-linked equations estimated from time-series data using statistical or econometric techniques. The history of macroeconomic modelling starts with the Dutch economist Jan Tinbergen who built and estimated the first macroeconometric models in the mid-1930s. Tinbergen identifies the mechanism to develop an econometric model using economic theory combined with behaviourally motivated dynamic equations and statistical methods. However, there is a consensus that the Norwegian economist Trygve Haavelmo’s probabilistic revolution changed the econometrics (Jansen, 2002).

It is through his contributions that statistics enters into the discipline of economics and econometrics. His thoughts were immediately adopted by Jacob Marschak – and he organised a special team at the Cowles Commission by Trygve Haavelmo, T.W. Anderson, Lawrence R. Klein, G. Debreu, Leonid Hurwitz, Harry Markowitz, and
Franco Modigliani (Diebold, 1998). Since then macroeconometric modelling has undergone major changes.

Before moving to the historical context of the development of macroeconometric modelling, we need to define a macroeconometric model (MEM) and the way we can classify these macroeconometric model (MEMs). A macroeconometric model is a set of behavioural equations, as well as institutional and definitional relationships representing the main behaviours of economic agents and the operations of an economy. The equations, or behavioural relations, can be empirically validated to capture the structure of an economy, and can then be used to simulate the effects of policy changes. Klein (1983) emphasises the simplifying characteristic of MEM and defines a macroeconometric model as "a schematic simplification that strips away the non-essential aspects to reveal the inner working, shapes, or design of a more complicated mechanism". Challen and Hagger (1983) highlight the technical properties of MEM and define it as "a macroeconometric system is a macro system whose relationships are numerical. This means: (a) that all relationships have specific mathematical form characterised by various parameters (intercepts, coefficients of variables, exponents of variables, etc.); and (b) that all parameters appear as specific numbers, having been estimated in one way or another from the relevant statistical data". Pesaran and Smith (1985:128) define macroeconomic modelling as “modelling is an instrumental activity [involving], the explanation of some particular data set of interest [and] is designed to contribute to better decisions as a result of greater economic understanding”.

Hence macroeconomic modelling involves quantitative analysis of an economy through the estimation of a system of equations using economic theory, data and a good knowledge of econometrics. This combination helps to do the structural analysis, forecasting and policy evaluation. Bautista (1988) and Capros, Karadologlou and Mentzas (1990) classify macroeconomic models into Macroeconometric models-MEM and computable general equilibrium (CGE) models, as Pagan (2003) claims that ’state of the art modelling’ in economic would entail a dynamic stochastic general equilibrium model (DSGE) which is a micro founded optimization-based model. Challen and Hagger (1983) classify the Macroeconometric models into five categories; the KK (Keynes- Klein) model, the PB (Phillips-Bergstrom) model, the WJ (Walras-Johansen) model, the WL (Walras-Leontief) model, and finally the MS (Muth-Sargent) model.
The KK model is based on the Keynesian demand-oriented macroeconomic fluctuations. This model deals with the problems of short-run instability of output and employment using mainly fiscal policy. This model is criticised on the basis that primarily it does not consider the supply side or the incorporation of the neoclassical production function. In addition, this model ignores the role of money market, relative prices and expectations. Then the monetarist critics [Anderson and Carlson (1970)] introduced the St Louis model to highlight the impacts of money on the real variables in the economy. The main characteristic of KK (Keynes- Klein) models are: the assumption that equilibrium in the product market is restored through the demand side measures; this model is formulated on the basis of discrete time (i.e. annually, quarterly, monthly etc.) not on the basis of continuous time; the incorporation of dynamics by using lagged dependent and independent variables; introduction of non-linear relationships and the emphasis on the stochastic nature of relationships.

This model is mainly used by the model builders in developing countries to explain the macroeconomic fluctuations in the Keynesian demand-oriented model. The KK models mostly deal with the problems of short-run instability of output and employment using mainly stabilisation polices.

The PB (Phillips-Bergstrom) model combines both the Keynesian and the neoclassical theories within a dynamic and continuous time model to analyse stabilisation policy. The PB model is also a demand- oriented model. Generally speaking, the PB model mainly employs differential or difference equations to estimate the structural parameters of a stochastic model. Thus, in this approach the steady state and asymptotic properties of models are examined in a continuous time framework. However, this method is difficult to implement especially for large scale models.

Walrus (1954) introduces the third type of MEM which is mainly a multi-sector model. This model assumes that the economy consists of various interdependent competitive markets which attain an equilibrium state by the profit maximising behaviour of producers and utility maximising of consumers. This model is highly non-linear and uses logarithmic differentiation. This means, given the percentage changes in the predetermined variables at a point of time, the percentage changes in the endogenous
variables can be computed. However the reliability of this model is subject to the calibrated values of the predetermined variables.

A fourth class of model was introduced by Challen and Hagger, (1983) and it is known as WL (Walras-Leontief) model. This model incorporates an input-output table into the Walrasian general equilibrium system. By using an input output table, given the values of the sectoral, or aggregate, final demand components, the sectoral output (or value added) can be obtained.

Highlighting the role of the supply - side and expectations in the MEM, the New Classical School aims at interpreting the inadequacy of demand management policies. On these grounds, Sargent (1976) devised a forward-looking MEM - the MS (Muth-Sargent) model which is based on the evolution of the theory of rational expectations. It is similar to the KK model with regard to being dynamic, non-linear, stochastic and incorporating the use of discrete time. The formation of expectations is one of the distinguishing features of the MS model. In this model the formation of expectations is no longer a function of previous values of dependent variables. In fact, the expectation variables are not observed values, but can be obtained when the complete model is solved. Variants of this model indicate that there is no trade-off between inflation and unemployment in the short term, which is in contrast to both the Keynesian and Monetarist modelling perspective.

It is also important to mention that the second type of macroeconomic model- the CGE modelling as a consequent of the improvements in the WJ and WL models. The main objectives of CGE models are to conduct policy analysis on resource economics, international trade, efficient sectoral production and income distribution (Capros, Karadeloglou and Mentzas, 1990). The distinction between MEMs and CGE models can be related to the time horizon. The (early) CGE models involve comparative statics. This means that the CGE models generate the values of endogenous variables, but only for an initial equilibrium and a new equilibrium aftershocks are imposed. The CGE models do not convey information on the adjustment process and only provide a snapshot of the macro economy. More recently, some CGE models, for example Dixon and Malakellis (1995), involve a dynamic adjustment process which can be used for short-term (3 to 5 years) and medium-term (5 to7 years) analysis.
However, MEMs provide information on the dynamics of the adjustment process, which is useful for short-term and medium-term forecasting and policy analysis. But it has been stated that neither CGE models nor other approaches such as vector autoregression (VAR) models "can replace the approach of structural modelling and the formal use of econometrics as the best tool for policy analysis at the macro level" (Hall, 1995: 983). Although, currently, the Dynamic Stochastic General Equilibrium (DSGE) models are attracting policy makers and central bankers for comparing possible impact of different policy scenarios. In the last two decades significant progress has been made regarding specification and estimation of these models according to the need and features of the economy at hand. However, in case of developing and emerging economies like Pakistan, the adoption of such models require a significant micro evidence and it is difficult to obtain the information about micro foundations of Pakistan economy as there is an inherent lack of micro-based surveys and even appropriate frequency data of major macroeconomic variables is mostly unavailable. In addition, the unavailability of forward - looking variables further complicates the situation.

Macroeconometric models are constructed for a number of different objectives; first for describing the structure and functioning of the economy and for explaining its development, second, for searching the means of influencing its development in the desired direction. The persistent economic predicaments of stagflation, trade and budget deficits, and enormous debt burdens have motivated the developing countries to develop macroeconometric models and hence these countries also have a relatively long history in the construction of MEM. Narasimham (1956) introduces the first MEM for a developing country- India, under the supervision of Tinbergen. The earliest models for developing countries were mainly small versions of the KK model capturing the demand side of the economy. ECAFE (1968) and UNCTAD (1973) constructed a series of MEMS for about 40 developing countries to assist them in forecasting the foreign capital needs of the member countries. Shourie (1972) criticises these models on the basis of insufficient sample size, multicollinearity, and misspecification of the models. However, these deficiencies may not only be true in the context of developing countries, but might also be relevant in the case of developed countries. Sastry (1975) argues that the UNCTAD models “exhibit a fair measure of stability and provide a reasonable basis for projections and he suggests that MEMs are useful if the value of the key parameters are checked and compared with those of other countries with a similar economic
structure. Adams and Vial (1991) evaluate some simulations for the ten MEMs of the ten different countries (Brazil, Chile, Hong Kong, India, Korea, Mexico, the Philippines, Taiwan, Thailand, and Venezuela) and their findings are summarised below. First, inflation was found to be mainly a monetary phenomenon. Second, the effect of government investment on economic growth was less than that of the government consumption. Third, the simulation performance of the MEMs was more accurate in the short-term than the long term. Adams and Vial (1991) suggest that the majority of these models suffered from excessive “Keynesianism”, which means the modellers gave insufficient attention to the role of the supply side in the long run.

Seers (1963) criticises the application to developing countries of models which were appropriate for developed countries, since they had been designed for different purposes and totally different economic structures. However Klein (1965, 1989) argues that a Keynesian MEM which is appropriate for developed countries can also be relevant for developing countries provided that necessary modifications are undertaken particularly in the specification of investment and production functions. In this context, Bodkin, Klein and Marwah (1986) recommend that the equations for price, wage, interest rate and exchange rate, unemployment, channels of distribution and demographic characteristics should be specified more thoughtfully.

The availability of data in most developing countries is a restrictive factor, making model-building an arduous task since there are relatively few reliable databases and they are often subject to frequent revisions. To cope up with this problem, Klein (1989) suggests the usage of robust and simple methods such as the 2SLS method which are based on less restrictive assumptions in a system of simultaneous equations. Behrman and Hanson (1979) also argued that macroeconometric modelling is useful for developing countries if the appropriate modifications are undertaken. In their view, the use of a fixed and overvalued exchange rate is a clear example. In most cases when the financial sector in a developing country is modelled, the interest rate is not always an appropriate variable to link the real sector to the financial sector. The use of some other variables as proxies like banking credit, output or inflation is more appropriate (Khayum, 1991). Fair (2004) estimates a multi-country model which includes 39
countries (including India, Malaysia, Pakistan, the Philippines and Thailand). This model employs the 2SLS method with a set of stochastic equations using the available (annual or quarterly) data for the time period of 1959-2002. The U.S economy is modelled with 31 stochastic equations and there are also up to 15 equations for the other 38 countries. Given the increasing importance of trade and globalisation among countries, Fair has incorporated the trade share data (a 59 by 59 matrix) for 59 countries into his MC model. For 14 countries quarterly equations and for the remaining 25 countries annual equations have been estimated and then the model is used in many interesting policy simulations.

Since the late 1970s, macroeconometric modelling has been subject to severe criticism predominantly on academic grounds. Pesaran (1995) classifies the major criticisms into six issues: forecasting inadequacy; theoretical contrasts with rational expectations theory; structural instability (Lucas critique); arbitrary assumption of zero restrictions (i.e. causal ordering) or the endogenous-exogenous division of the model variables in order to pass the identification conditions; and finally the existence of the problem of unit roots and ignorance of cointegration and the time-series properties of the data. The Lucas (1976) critique led to a new area of research which is known as analysis of “deep structural parameters” (Fair, 1987). It is mentioned that under alternative policy formulations, because all the economic agents base their decisions on the full information, “any change in policy will systematically alter the structure of econometric models” (Lucas, 1976: 40). Therefore, it is highly likely that the estimated coefficients of a MEM will change as a result of agents anticipating and knowing policy measures. Klein (1989) acknowledges the importance of the Lucas critique, but adds that: “I believe that there is more persistence than change in the structure of economic relationships. The world and the economy change without interruption, but that does not mean that parametric structure is changing. Random errors and exogenous variables may be the main sources of changes (p.290).

Bodkin and Marwah (1988) criticise the assumption of the rational expectations theory that economic agent have complete access to the raw data and know the true model of the economy. They contend that these assumptions are most unrealistic and, while acknowledging the New Classical School for raising such a vital issue, suggest further
clarification and research on expectations formation. Fair (2004) has already tested the rational expectations hypothesis and in most cases he has rejected it. Macro econometric models with optimising agents have already adopted rational forward-looking expectations resulting in a set of Euler equations e.g. see Willman et al (2000) and Hunt et al. (2000) for models from the central banks of Finland and New Zealand, respectively. As seen from the literature, the Lucas-type critiques resulted in an upgrading of the theoretical knowledge and in better empirical achievements by econometricians. This is to say, the significant advances in the macroeconometric literature including rational expectations theory, supply-side economic policy, and open economy macroeconomics have given rise to further research in this field.

5.2 Macroeconometric Model of Pakistan

Macroeconometric modelling remains the most promising approach to understand the macroeconomic behaviour of a developing economy such as Pakistan. It provides a conceptual framework, embedded with accounting identities and behavioural relationships which can help to understand macroeconomic problems. Empirical macro models provide a quantitative tool to assess the magnitude of the impact of different policies on the main variables that are of interest in the conduct of macroeconomic policy. Furthermore, these models can help to assess the consistency between the targets of macroeconomic policy (such as low inflation, external balance and sustainable growth) and the setting of policy instruments to attain these targets. Macroeconomic models can contribute to better forecasts, and to improving policymakers’ attempts to control economic systems. Although the IMF and the World Bank models based on reform agendas (see Atta Mills and Nallari 1992) are often used to model most developing economies, the need for a broad-based macroeconomic model of a developing economy has always existed. Most developing countries in the Asia-Pacific and other regions are in the process of developing and/or searching for an appropriate macroeconometric model.
5.2.1 The Modelling Framework

In spite of recent developments in macroeconomic theory comprising i) sophisticated models of economic growth, ii) models analyzing the interrelationship between the financial and the real economy and iii) models analyzing the channels through which economic reforms affect the economy, the Keynesian IS-LM framework is still the most commonly adopted framework for analyzing fiscal and monetary policy in developing economies. The IS-LM model dominated the macroeconomics for some twenty-five years after the end of the Second World War. Although with the advent of new classical macroeconomics in the early 1970s that dominance was at first challenged and then broken, yet the IS-LM model still lives on.

The Keynesian IS-LM framework is concerned with business cycle fluctuations and how fiscal and monetary policy can be used to smooth such fluctuations. Thus, the framework was developed in order to analyze how the government’s fiscal and monetary policy can be designed such that the economy avoids deep recessions. In developing countries fluctuations in income and production are usually not seen as a business cycle phenomenon. Nevertheless, fluctuations in developing countries have much of the same characteristics as business cycles: They are often caused by fluctuations in commodity prices, which are indeed a business cycle phenomenon. Another cause of fluctuations, particularly in economies dominated by the agricultural sector, is weather conditions. Changes in weather conditions are often cyclical, and are therefore quite easily incorporated into a business cycle-type model.

An alternative to the Keynesian framework is the neoclassical framework. In the "purist" neoclassical model it is assumed that all markets clear at any point in time. However, there is a large body of research incorporating distortions and market imperfections into the neoclassical model in order to adopt it to developing country conditions. An applied research area in this field is the development of computable general equilibrium models (CGE). These models compute aggregate output, sector allocation of resources and income distribution. They usually apply a social accounting matrix for parameter estimations through a method of calibration (see for example...
Bergman et. al. (1990)). In developing countries, the structuralist school has had great influence (Taylor, 1981). The idea here is that every economy is unique, and consequently models need to take the unique features of the economy in question into consideration. Thus, models are tailor-made for the particular economy they are used in, based on empirical research identifying bottlenecks and constraints which block or narrow the channels through which fiscal, monetary, trade, and industrial policy are supposed to work. Structuralist models nevertheless are often based on a core of the IS-LM framework. Hence, they extend the IS-LM model with supply side equations in which the constraints are incorporated. The result is a framework where what is demanded is not necessarily supplied, even if high prices could be charged for the goods and services produced.

When deciding on an appropriate theoretical framework and model structure, we need to take into consideration that the Pakistani economy is relatively open to international trade, and trade constitutes a large share of GDP. In addition, international transactions related to debt servicing and development assistance are large compared to the size of the economy. Therefore, the Pakistan economy is influenced by the global economy to a significant extent and hence a macro model should consequently be a model for an open economy. In addition the following considerations were taken when the choice of a theoretical framework for macro model was made:

- The purpose of the model is to analyse fiscal and monetary policy in relation to the targets of low inflation and modest economic growth.
- The economy is dominated by agriculture and service sectors.
- The forecast time horizon is 10-15 years (to smooth out the fluctuations over long horizon).
- Lack of infrastructure, both physical and economic, results in under-utilization of productive resources and inhibits economic agents from responding fully to market signals.
- To evaluate the interaction between fiscal and monetary authorities through the government budget constraints.
On the basis of these considerations, the IS-LM-BP framework has been chosen as the framework for the core model. Under this model, an economy will be in equilibrium when total withdrawals will equal total injection, and money demand will equal money supply. Aggregate demand is built up of consumption, investment, government expenses and net exports components. Changes in aggregate demand alter the consumption and investment, and the resultant changes in demand for consumption and investment lead to a change in demand for money. Changes in demand for money affect the interest and inflation rates over time. Fiscal expansion (changes in government spending) increases the aggregate demand and, through that route, it affects the demand for money, interest and inflation rates. Any change in interest and inflation rates affects aggregate demand through the investment and consumption function and the changes in aggregate demand influences the levels of employment.

The present model differs from the Mundell–Fleming (MF) model, because of the assumption of imperfect capital mobility that is believed to be appropriate for a developing economy (Dernburg 1985). The present model also differs from the model for developing countries by Haque et al. (1990). Haque et al. assumed rational expectation, made some explicit allowance for capital controls and used a log-linear functional relationship between the variables. Economists agree with rational expectations (RE) when they discuss the stock market, but disagree with RE when modelling the macroeconomy. The RE model may not be suitable for developing economies (Pesaran 1987; Fair 1984) because of the imperfect information and the uncertainty in the economy. The present model is therefore built around naïve expectations and linear relationships.

Realistic formulations of economic relations often require inclusion of lagged explanatory variables and economic theory cannot be expected to yield strong insights about lag structure (Hudson and Dymiotou-Jensen 1989). Greene (1997) suggested a set of model selection tests to determine an appropriate lag structure. However, he cautioned that economic theory must determine that which variables belong to the model. Initially a lag length of \( n \) period is included in the specification and appropriate
lag lengths are subsequently determined using model selection criteria. Structural changes caused by macroeconomic policy changes (especially the introduction of financial reforms in 1990s) and development that might have affected the macroeconomic relationships, are tested using the Chow test.

5.2.2 Specification of the Model

The model is specified around the four well-known macroeconomic identities – national income, a fiscal identity, monetary equilibrium and a BOP identity – and a policy equation related to inflation, and accordingly there are five blocks in the model. These are the minimum requirements of a model to ensure consistency in macroeconomic analysis (Easterly 1989). As the financial market is yet to be developed in a less developed economy, it is not considered to be a key block at this stage. Similarly, the labour market is not included because it is highly fragmented and imperfect and an appropriate data set is not readily available. However, the feedback from the private sector, labour market and financial market are captured by some of the variables of these sectors incorporated in the model.

(a) National Income Accounts Block

The national income identity is the main building block for specifying the real sector of a comprehensive macroeconometric model for the developing economies (World Bank 1995; Bier 1992; Haque et al. 1990; Hudson and Dymiotou-Jensen 1989). It includes the external sector and estimates the private consumption, private investment, total government expenditure, exports and imports to determine an aggregate demand function for the economy.

\[ Y_t = C_t + IP_t + G_t + X_t - Z_t + invt \]  \hspace{1cm} (5.1)

The variables in Equation (5.1) are defined as follows: \( Y_t \) is real GDP, \( C_t \) - the real private consumption expenditure, \( IP_t \) - the real private investment expenditure and \( G_t \) -
real government expenditure. $X_t$ denotes real exports, $Z_t$ the real imports and $\text{invt}$ changes in real inventories stock.

**Private Consumption**

Aggregate consumption is the major component of aggregate demand. Among competing specifications, the following model of consumption is selected as it relatively better explain the behaviour of aggregate consumption over the estimation period for the Pakistan economy.

$$C_t = \alpha_1 + \alpha_2 Y_t^d - \alpha_3 \text{RR}_t + \alpha_4 C_{t-1} + \mu_{1t} \tag{5.2}$$

The consumption function suggests that current consumption is positively correlated to current real personal disposable income ($Yd$), and negatively to current real interest rate ($\text{RR}_t$) (Dernburg 1985; Haque et al. 1990; Easterly and Schmidt-Hebbel 1993). The role of adaptive expectations or ratchet effect (Brown, 1952) is captured through lagged consumption.

$$Y_t^d = Y_t - \text{TAX}_t + \text{TRP}_t \tag{5.3}$$

where $Y_t^d$ is an identity i.e. total income plus net private sector overseas transfer ($\text{TRP}$), minus taxes paid ($\text{TAX}$), all in real terms (Dornbusch and Fischer 1990; Haque et al. 1990). This specification could be improved if reliable data are available to account for the impacts of wealth on disposable income. According to the Keynesian absolute-income hypothesis, the disposable income is assumed to have a positive impact on private consumption. Later theories, such as the life-cycle or the permanent-income hypothesis introduced other explanatory factors like the real interest rate ($\text{RR}_t$) or the inflation rate, whose impact is not clear a priori. As the real interest rate is composed of the nominal interest rate and the inflation rate, so these two variables should not be considered simultaneously. The real interest rate - $\text{RR}$ is (Equation 5.4) the nominal interest rate ($\text{NR}$) minus the actual rate of inflation ($\text{INF}$).
\[ RR_t = NR_t - INF_t \]  \hspace{1cm} (5.4)

**Private Investment**

Private investment \((IP)\) is considered to be a key component of aggregate demand to achieve a sustainable economic growth.

\[ IP_t = \beta_1 + \beta_2 Y_t - \beta_3 RR_t + \beta_4 KA_t + \beta_2 IP_{t-1} + \mu_{2t} \]  \hspace{1cm} (5.5)

The accelerator model of investment is based on the premise that the rate of investment is proportional to the changes in output in an economy (Dornbusch and Fischer 1990). In our model, income and real interest rate have been identified as the two important variables in the investment function (Dernburg 1985; Haque et al. 1990; Limskul 1994; Chou and Lin 1994. \(IP\) is positively correlated to real income and capital account balance \((KA)\) (Haque et al. 1990), and as negatively correlated to lagged real interest rate \((RR)\). We take income at levels since the series is stationary and estimates are consistent with theory (see also Dernburg 1985; Dornbusch and Fischer 1990; Haque et al. 1990; Limskul 1994; Chou and Lin 1994. Since the capital market is not fully developed in Pakistan, and the data on capital stock are not available. With very low domestic savings, investment is generally dominated by overseas capital mobility. Since the domestic interest rate is not strong enough to attract investment. Overseas capital is included as the explanatory variable to capture the impacts of capital flow. It comprises foreign assets, loans and aid.

**Changes in Inventories**

One component of investment—the changes in inventory stock \(,\) is partly determined by how much households decide to buy, which is not under the complete control of firms.

\[ INVT_t = \gamma_1 + \gamma_2 CONS_{t-1} - \gamma_3 INVT_{t-1} + \mu_{3t} \]  \hspace{1cm} (5.6)
Following Fair (1971), we construct an inventory investment equation in which changes in real inventory investment is a function of lagged consumption and lagged inventory stock changes.

**Export of Goods and Services**

The export function is based on the assumption that Pakistan is a small country, which implies that Pakistani exports can not affect the world market prices. However, being a small open economy, it can sell as much as it is capable to do so. Hence, the demand for exports of goods and services is determined by the world demand and the country’s competitiveness. The real effective exchange rate – REER (EX) is used as a proxy for a country’s competitiveness. In addition, the availability of domestic credit (nominal interest rate-NR as the cost of borrowing) and changes in the foreign capital (KAA) also affect the domestic exports. Since the overseas capital leads to more investment which in turns induces more exports. To incorporate partial adjustment, a lagged export term is included in the estimated equation. The export equation may therefore be expressed as follows:

\[ X_t = \chi_1 + \chi_2 Y^*_t - \chi_3 X_{t-1} + \chi_4 EX_{t-1} + \chi_5 KAA + \chi_6 NR + \mu_{4t} \]  

(5.7)

**Imports of Goods and Services**

Imports of goods and services are assumed to be determined by domestic demand that is proxied by gross domestic product. Real imports are related negatively to the real exchange rate. Again, to capture the partial adjustment behaviour, a lagged import term is included in the estimated equation. Furthermore, availability of domestic credit and changes in the foreign capital also affect the domestic demand for imports as the increase in foreign capital inflow can lead to an increase in the demand for imports, especially the intermediate goods. So we can express import function as follows:

\[ Z_t = \delta_1 + \delta_2 Y^*_t - \delta_3 Z_{t-1} + \delta_4 EX_{t-1} + \delta_5 KAA + \delta_6 NR + \mu_{5t} \]  

(5.8)
(b) The Fiscal block

**Government Expenditure**

The fiscal sector constitutes government revenue and government spending. The budget deficit results as the excess of government expenditure over government revenue and is usually financed from both domestic and external sources. Hence, the gross fiscal budget deficit \((BD_t)\) is defined as total government expenditure \((CG_t + IG_t)\) minus \(TAX_t\). If selling and acquiring public assets have been negligible, then they need not be included. However, they might need to be included if they do become significant.

\[
CG_t + IG_t - TAX_t = BD_t
\]  
\[
(5.9)
\]

**Government Revenue**

Total government revenue \((TR)\) is the sum of total direct taxes, total indirect tax and non-tax revenue of the government.

\[
TR_t = TAX_t + NTRN_t
\]  
\[
(5.10)
\]

Total tax revenue will be modelled as endogenous variable, whereas non-tax revenue of the government is taken as exogenous. The tax revenues are expected to be influenced by the changes in real output, in a progressive structure of taxation system, economic agents will have to pay a higher proportion of their income in the form of taxes as their income increases. Again, to capture the partial adjustment behaviour, a lagged term is included in the estimated equation. Hence we can define revenue function as follows:

\[
TAX_t = \xi_0 + \xi_1 YR + \xi_2 TAX_{t-1} + u_{6t}
\]  
\[
(5.11)
\]
(c) The Monetary block

Money market equilibrium is an identity (Equation 5.12) that equates the demand for real money with supply of real money.

\[ M_d^t = M_s^t \]  

(Equation 5.12)

Demand for money \((M^d)\) is specified (Equation 5.13) as positively related to income and negatively related to nominal interest rate (Arize 1994; Haque et al. 1990). If there is an increase in income level, economic agents are expected to hold more money. However, an increase in interest rate will reduce the demand for money. Money supply and demand respond slowly to changes and, therefore, the lagged dependent variable is used as an explanatory variable. Real income is determined as endogenous variable while the nominal interest rate is an exogenous variable. We can express money demand equation as follows:

\[ M_d^t = \kappa_1 + \kappa_2 Y_t - \kappa_3 NR + \kappa_4 M_{d,t-1}^t + \mu_{t} \]  

(Equation 5.13)

Supply of money is specified (Equation 5.14) as the sum of net foreign assets \((NFA)\) and domestic credit \((DC)\) (credit to the private sector and government), both in real terms (BPNG 1995; Haque et al. 1990). Credit provided to the private and public sectors and non-monetary financial institutions are the components of domestic credit \((DC)\). \(DC\) is an exogenous variable determined by the lending and other policies of the banks and monetary and fiscal policies of the government (Haque et al. 1990). We assume that the central bank fixes paths for both total credit and its sectoral allocation as well as for sales in the free exchange market, allowing the money supply to adjust endogenously. The transfers to the government are set by the rule that the government does not tolerate an ever-increasing debt-to-GDP ratio. When the ratio of debt to GDP differs from its baseline value, government spending is adjusted to reduce debt (Haque et al. 1990). \(NFA\) is an endogenous variable determined (Equation 5.15) by the \(NFA\) reserve (exogenous) and the \(BOP\) (endogenous).
\[ M_t = NFA_t + DC_t \]  
(5.14)

\[ NFA_t = NFR_t + BOP_t \]  
(5.15)

(d) The External Block

The overall \( BOP \) is specified (equation 5.16) as the sum of current account (CA) and capital account (KA) balances, an exogenous variable. CA is as an identity (equation 5.17) consisting of exports minus imports plus net transfers (NTR). NTR, an exogenous variable, includes the net invisible transfers and private and public sector net transfers.

\[ BOP_t = CA_t + KA_t \]  
(5.16)

\[ CA_t = X_t - Z_t + NTR_t \]  
(5.17)

(e) The Inflation Block

We estimated the following backward looking Phillips curve equation to model inflation in Pakistan:

\[ \pi_t = \psi_0 + \psi_1 Y_{t-1} Y^*_t - 1 + \psi_2 \pi_{t-1} + \nu_t \]  
(5.18)

where \( \pi_t \) is the inflation rate and \( \pi_{t-1} \) represents last year inflation, \( Y_{t-1} \) denotes last year output, \( Y^* \) stands for potential output. Output is detrended with the Hodrick-Prescott filter. The output gap is defined as actual GDP minus potential GDP. A positive output gap corresponds to excess demand. Phillips curve shows a negative short-run trade-off between price inflation and the output gap, or excess capacity. By Okun’s Law, the output gap is related to the unemployment rate. When unemployment is at the natural rate, output is at potential; when unemployment is above the natural rate, output is below potential, and vice versa. Therefore the Phillips curve of Equation (5.18) is non-vertical in the short-run, by stimulating demand the government can get more output.
and employment, but at the cost of an increase in inflation. However, the long-run Phillips curve is vertical and policy makers have little incentive to inflate output above potential, since inflation could only be stopped by closing the output gap. A reduction in inflation would require a negative output gap, i.e. a recession. $\Psi_1$ captures the impact on inflation of the output gap, a positive output gap leads to higher inflation and vice versa.

We also introduce the following P star model to determine the equilibrium price level in the economy.

$$\pi_t = \pi^e + \eta (p^* - p) + \nu$$  \hspace{1cm} (5.19)

where $\pi_t$ is the inflation rate, $\pi^e$ is the expected inflation rate and $p^* - p$ is the gap between the equilibrium price and actual price level, in this case, the aggregate inflation rate is solely a function of macroeconomic determinants, inflation expectations and the price gap, where price gap captures the inflation potential resulting from disequilibria on the money and goods markets.

5.3 Model Estimation and Evaluation

5.3.1 Estimation of the Model

To estimate the macroeconometric model for Pakistan, annual data covering the time period from 1977 to 2009 is used. The data is primarily collected from various issues of IFS, Economic Survey of Pakistan and from SBP Publications. The current study employs the structural equations model-SEM due to the fact that although alternative methodologies overwhelmingly focussed on macroeconomic problems but none of these has been able to dislodge the structural modelling tradition which can be attributed to two factors. First, many of the valid issues raised against the structural equations model have induced a positive and constructive response. A large proportion of the structural
modelling work today is not on the same lines on which it was in the sixties or even the seventies. It has been able to take account of all major developments in macroeconomic theory as well as in econometric methodology. Second the alternative methodologies have not yet been able to establish a clear superiority either with regard to the macro theory with which they are associated or with the econometric theory they use or their final outcomes as regards forecasting or policy conclusions. Before estimation of the specified model, the time series properties of each variable were tested, ordinary least squares (OLS) method is used to compute individual equations and to correct for the problem of autocorrelation, lagged endogenous variables are included in the models including which has not only solved the autocorrelation problem but also allowed us to incorporate partial adjustment effect.

**Diagnostic Tests**

To evaluate the statistical and theoretical appropriateness of the behavioural equations, we use various diagnostic tests on residuals. In general, for the estimated parameter to have a statistically desirable property, residuals should be independently and identically distributed accompanied by proper specification (which can be checked from Ramsey Reset Test) and normality of residuals is needed for application of most of the testing of hypotheses. Results of model estimation and the various diagnostic tests are presented in the section 5.3.3

The adjusted $R$-square values are greater than 55 per cent in all equations suggest there is no penalty for the number of explanatory variables that are used in the model (This measure is not monotonically increasing in the number of input variables but instead reaches a point of decline after some large number of input variables has been introduced to the regression). All calculated $F$-values are higher than the critical $F$-values at the 5 per cent significance level, thereby indicating a significant degree of reliability of the coefficient of determination. The Augmented Dickey Fuller test reveals that all variables in the model are stationary at levels. The normality condition of residuals is tested through Jarque-Bera test and all are insignificant, indicating that residuals are normally distributed for all estimated equations. Lagrange multiplier (LM)
test accompanied by the Q-stat values reveal that there is no serial correlation in the residuals of all equations; hence LM tests and Q-stat values are not significant at the 5 percent significance level. The disturbance terms in all equations are homoscedastic(except for investment equation), as revealed by ARCH test which is not significant.

In the cases of investment equation, the ARCH test accepts the null hypothesis of homoscedastic disturbance terms but the White test rejects it. However the ARCH test is considered to be more relevant for time series data (Kmenta 1986). For the exports equation, both the ARCH and White test cannot accept the null hypothesis of homoscedastic disturbance term. A Chow test is conducted with pre-(1977–91) and post reforms period (1992–2009) as the breakpoint and the results suggest that all the equations are fairly stable and that there is no significant structural break. The specification of each equation was also checked by performing Regression specification error test (RESET) and results reveal that there is no specification error in all equations.

5.3.2 Forecast Evaluation

To determine the predictive accuracy of the model, we evaluate the forecasting performance of the single equations. The in-sample forecast based on the final equation is computed and the forecast is evaluated through the mean absolute percentage error (MAPE) and Theil's inequality coefficient. These two measures are scale invariant and can therefore be used to assess the forecasting performance directly. Theil's inequality coefficient compares the forecast with a random walk and always lies between zero, where zero indicates a perfect forecast and one is not better than that of a random walk. The MAPE is not normalized, but it should be as small as possible. If the MAPE is zero, there has no error been made while forecasting. Furthermore, we produce both dynamic and static forecasts for each equation, over the sample period. Dynamic method calculates multi-step forecasts starting from the first period in the forecast sample whereas Static method calculates a sequence of one-step ahead forecasts, using actual rather than forecasted values for lagged dependent variables.
5.3.3 Results and Discussion

Private Consumption

Private consumption has been estimated according to the functional form that has been proposed in Equation (5.2). The following equation has been estimated for private consumption (CONS), real disposable income (RYD, defined as the difference between real GDP and total tax) and the real interest rate (RR, defined as the difference between the nominal interest rate and inflation. The estimates are:

\[
\text{LOG(CONS)} = -0.1371 + 0.4205\text{LOG(RYD)} + 0.5902\text{LOG(CONS(-1))} - 0.0029\text{RR(-1)}
\]

\[
\begin{array}{ccc}
\text{Adj } R^2 & 0.996 & \text{S.E.}=0.026 \\
\text{JB} & 1.44 [0.48] & \text{Q(1)} = 0.53 [0.46] \\
[0.745]\text{ARCH(1)}=1.45 [0.12] & \text{RESET(1)}=0.22 [0.85] \\
\end{array}
\]

\[
\begin{array}{ccc}
\text{LM}=0.35[0.71] & \text{Q(2)} = 0.58 \\
\text{T }= 31 \text{ (1977-2009)} & \text{ } & \\
\end{array}
\]

The estimation of consumption function suggests that all the estimated coefficients have anticipated signs and the results suggest the disposable income and real interest rate as the important determinants of private consumption. Consumption responds significantly and negatively to the real interest rate (lagged by one year). However, the estimated coefficient is quite small, suggesting that changes in interest rates would not induce substantial changes in consumption (due to the liquidity constraints that affect the ability to substitute consumption intertemporally). This result confirms Rossi's (1988) finding of significant but small real interest rate elasticity in the consumption function.

The coefficient of lagged consumption is positive and significant as expected in the Hall (1978) specification of the permanent income hypothesis. However, contrary to the Hall hypothesis, disposable income is also significant in explaining consumption behaviour. As a number of studies have shown, current disposable income would be an important determinant of consumption if liquidity constraints are binding for a significant portion of households. The coefficient of disposable income is 0.42 and suggests that about 42
percent of consumption expenditures in Pakistan are liquidity constrained because if consumers are liquidity constrained, then current income becomes a major determinant of current consumption. One possible reason for this excess sensitivity of consumption to income may be the lack of perfect capital markets. Figure 5.1 shows that the estimated

**Figure 5.1  Static and Dynamic Forecast - Consumption**

![Graph showing static and dynamic forecast for consumption.](image)

Investment

\[
\log(\text{IP}) = -0.939 + 0.449\log(\text{RY}) - 0.0025\log(\text{IP}(-1)) + 0.5040\log(\text{KAA})
\]

\[\text{Adj } R^2 = 0.984 \quad \text{S.E.} = 0.0631 \quad \text{LM} = 1.22 [0.01]
\]

\[\text{JB} = 1.44 [0.48] \quad Q(1) = 4.848 [0.028] \quad Q(2) = 4.89 [0.087]
\]

\[\text{ARCH(1)} = 3.63 [0.647] \quad \text{RESET(1)} = 1.85 [0.486] \quad T = 31 (1977-2009)
\]

Changes in Inventory Stock

\[
\log(\text{RINVT}) = -1.502 + 0.631\log(\text{RINVT}(-1)) + 0.385\log(\text{CONS}(-1))
\]

\[\text{Adj } R^2 = 0.897 \quad \text{S.E.} = 0.192 \quad \text{LM} = 0.717 [0.497]
\]

\[\text{JB} = 5.89 [0.05] \quad Q(1) = 0.653 [0.419] \quad Q(2) = 0.669 [0.71]
\]

\[\text{ARCH(1)} = 1.486 [0.77] \quad \text{RESET(1)} = 1.32 [0.617] \quad T = 31 (1977-2009)
\]
The estimated coefficients of investment equation have all their expected signs. National income is an essential determinant of investment, a finding similar to a study of private investment in South Pacific countries by Jayaraman (1996) and consistent with the flexible-accelerator family of investment theories. The estimates reveal that the investment expenditures are induced because business firms are prone to use profits generated by a growing, expanding economy to finance capital investment.

The coefficient of lagged investment is positive and statistically significant which indicates both a stable investment function as well as a fairly protracted period of adjustment. The real interest rate coefficient is negative but very small and statistically insignificant which is consistent with earlier literature on developing countries (e.g. Rama 1990; Serven and Solimano 1992). The estimate for capital account also positive and statistically significant which implies that availability of more capital will lead to higher investment (Haque et al. 1990).

The estimates of changes in inventory stocks equation have expected and statistically significant signs. A positive coefficient for lagged consumption suggests that firms are enough flexible in their production plans to cater an increase in consumption.

Figure 5.2  Static and Dynamic Forecast - Investment
**Foreign Trade**

**Exports**

\[ \text{LOG(EXPT)} = 4.164 - 0.029 \text{LOG(USRY)} + 0.705 \text{LOG(EXPT(-1))} - 0.486 \text{LOG(REER(-1))} + 0.112 \text{LOG(KAA)} - 0.009\text{NR} \]

\[ \begin{align*}
(2.12) & \quad (0.165) & \quad (7.93) & \quad (-2.97) \\
(2.17) & \quad (-1.59)
\end{align*} \]

\[ \text{Adj R}^2 = 0.98 \quad \text{S.E.} = 0.08 \quad \text{LM} = 1.57[0.227] \]

\[ \text{JB} = 1.08[0.58] \quad Q(1) = 2.11[0.153] \quad Q(2) = 2.095[0.23] \]

\[ \text{ARCH (1)} = 0.005[0.95] \quad \text{RESET (1)} = 1.38[0.25] \quad T = 31 \quad (1977-2009) \]

**Imports Demand**

\[ \text{LOG(Z)} = -1.61 + 0.795 \text{LOG(RYD)} + 0.033 \text{LOG(REER(-1))} + 0.229 \text{LOG(KAA)} + 0.063 \text{LOG(Z(-1))} + 0.026\text{NR} \]

\[ \begin{align*}
(-1.105) & \quad (4.26) & \quad (0.235) & \quad (3.09) \\
(0.036) & \quad (3.35)
\end{align*} \]

\[ \text{Adj R}^2 = 0.97 \quad \text{S.E.} = 0.08 \quad \text{LM} = 0.73[0.45] \]

\[ \text{JB} = 0.11[0.71] \quad Q(1) = 1.25[0.263] \quad Q(2) = 1.30[0.52] \]

\[ \text{ARCH (1)} = 0.17[0.69] \quad \text{RESET (1)} = 0.59[0.45] \quad T = 31 \quad (1977-2009) \]

The estimated coefficients of the export function appear to have their expected signs and are statistically significant except for the foreign income level. The coefficient of foreign income is positive (indicating a boom in US economy will increase the demand for imports from Pakistan) but insignificant which indicates that exports are relatively insensitive to the level of U.S. income. The foreign income elasticity of our exports is 0.03 which is very low. The coefficient of REER is negative and statistically significant which suggests that an depreciation of Pakistani Rupee will increase the exports volume significantly. The coefficient of lagged exports is both significant and fairly large in magnitude, suggesting that the response to changes in real effective exchange rate tends to be quite prolonged over time.
Exports are positively related to capital account and the relationship is statistically significant. Exports are also inversely affected by the changes in nominal interest rate, since higher cost of borrowing reduces the investment spending which in turn leads to lower exports. In Pakistan, government has introduced various export finance schemes to encourage the high export volumes so an increase in the nominal interest rate discourages the investors. These results further reveal that availability of both domestic and foreign capital affects the exporters’ capability to export more.

**Figure 5.3  Static and Dynamic Forecast - Exports**

Imports respond positively to private disposable income with an elasticity of 0.80 in the short run. In most developing countries, private disposable (spending) income – dominated by spending on consumption of imports and foreign investment – is more influential in determining the level of imports. The present finding is in line with an earlier study of trade balance issues in Iran by Aghevli and Sassanpour (1982). Imports are also responsive to real exchange rate changes with a short - run elasticity of 0.03 but this relationship is statistically insignificant. In Pakistan, imports are highly concentrated(55 % of the total imports) in few items namely, machinery, petroleum and petroleum products, chemicals).
Figure 5.4  Static and Dynamic Forecast - Imports

To evaluate the impact of foreign exchange availability on imports, the reserve-import ratio lagged by one period was also included in the equation but dropped from the final specification as it turned out to be statistically insignificant. However the income elasticity of imports is higher than income elasticity of exports in Pakistan which indicates that imports will increase higher relative to Pakistan’s GDP while the Pakistan’s exports will increase less proportionally with the rise in the world output.

**Money Demand**

\[
\text{LOG(MM1)} = -0.024 + 0.078 \text{LOG(RYD(-1))} + 0.938 \text{LOG(MM1(-1))} - 0.015 \text{NR}
\]

\[
(-0.055) \quad (0.489) \quad (6.96) \quad (-2.32)
\]

Adj \( R^2 = 0.98 \)  \( \text{S.E.} = 0.07 \)  \( \text{LM} = 0.118[0.89] \)

\( \text{JB} = 0.69[0.71] \)  \( \text{Q(1)} = 0.15 \{0.70\} \)  \( \text{Q(2)} = 0.17[0.92] \)

\( \text{ARCH(1)} = 1.12[0.302] \)  \( \text{RESET} (1) = 2.412 \{0.61\} \)  \( T = 31 \)  \( (1977-2009) \)

The estimated money demand function reveals that money demand responds negatively to nominal interest rate and the response is statistically significant. Although the coefficient of interest elasticity of money demand is just - 0.015 which indicates quite interest-inelastic money demand. The estimated coefficient of real disposable income reflects that there is positive but statistically insignificant relationship between the level of income and the demand for money. However the short - run income elasticity of money demand is 0.13 which is greater than short - run interest elasticity of money demand.
The estimates of tax revenues equation have expected signs. The coefficient of real GDP indicates a positive and significant relationship between real GDP and tax revenues which is consistent with theory.
Inflation

\[ \text{INF}_t = 5.36 + 0.35\text{INF}_{t-1} + 0.67(100(\text{RY/RYTR}-1)) \]

\[
(3.49) \quad (1.99) \quad (2.246)
\]

\[ \text{Adj R}^2 = 0.57 \quad \text{S.E.} = 1.08 \quad \text{LM} = 2.27[0.13] \]

\[ \text{JB} = 0.82[0.66] \quad \text{Q}(1) = 3.32[0.07] \quad \text{Q}(2) = 3.33[0.19] \]

\[ \text{ARCH}(1) = 1.03[0.32] \quad \text{RESET (1)} = 1.41[0.25] \quad T = 31 \quad (1977-2009) \]

We estimate a backward looking Phillips curve to model inflation in Pakistan. The estimated coefficients of the inflation equation indicate that in Pakistan, a positive output gap results into higher inflation as the relationship between inflation and the real GDP gap is positive and statistically significant (at margin).

**Figure 5.7** Static and Dynamic Forecast – Inflation

5.3.4 Simulation Experiments

Two sets of simulation experiments are carried out here. The first set is designed to evaluate the predictive accuracy of the model. The second set is mainly designed to evaluate the policy simulation capacity of the model.
5.3.4.1 Within-sample Performance

The prerequisite for a good macroeconometric model is that it should contain well-specified individual behavioural equations. From a statistical perspective, individual equation estimation should exhibit high goodness of fit, and the coefficient estimates should be statistically significant. However, good statistical properties in individual equations do not necessarily imply a good performance of the model as a whole. Rather, good forecasting performance of the model depends on how well the relations between behavioural equations are linked and if the coefficient estimates are economically reasonable. Tests need to be carried out to determine whether the predicted values from the system trace the actual history of the variables reasonably well to evaluate the forecasting performance of the model.

The predictive accuracy tests suggest that the Mean Absolute Percent Error (MAPE) for both static and dynamic forecasts of most of the behavioural equations lies within the range of 1 to 6 percent (except the nominal interest rate and inflation) and the Theil inequality U-value is less than one in all cases which implies the dynamic stability of the complete model and hence the model is reasonably accurate in prediction. After having specified all single equations and assured that their forecasting performance is good, the model is build on the basis of these stochastic equations. To do so, several identities have to be added to the model. The central identity for the real sector is the national income identity, i.e.

\[ RY_t = CON_t + IP_t + EXPT_t + G_t + RINVT_t - Z_t \]

where \( RY_t \) is the real output, \( CONS_t \) is the private consumption expenditure, \( IP_t \) is the private investment expenditure, \( EXPT_t \) is exports revenues, \( G_t \) is the total expenditure of the government which is the sum of public consumption and public investment and \( Z_t \) is the demand for imports. \( RINVT_t \) accounts for the changes in inventories, which are defined as the difference between the total value of all goods that enter the inventories of producers and the total value of all goods that are withdrawn from them. The model includes 19 variables, out of which 11 endogenous and 8 are exogenous.
Figure 5.8 depicts the trajectories of the static and dynamic *ex post* simulations over the period 1979-2009 along with the actual values of 11 macroeconomic variables. It can be seen from the figures that both static and dynamic simulations track the actual time paths of the variables reasonably well, indicating a good fit. It shows that model captures the direction of the actual values of the endogenous variables and there is less deviation in the dynamically solved values from the values solved in a static scenario.

**Figure 5.8 Static and Dynamic Simulation Results: Selected Fiscal, Monetary and Price Variable**
5.4 Policy Simulations

5.4.1 Simple Monetary and Fiscal Policy Shocks

After the estimation of the model and ensuring the stability of the estimates, we specify the future path of the exogenous variables to do some medium term policy simulation experiments. These policy simulations enable us to evaluate the stability of the model, since the explosive developments after a shock suggest the re-estimation of the model. In addition, by changing the values of some policy variables, we can trace the major macroeconomic transmission channels of the economy. Whenever possible, projections of official sources are taken into account. Where the official projections have been provided by the Ministry of Finance in the context of the medium-term expenditure frame work, for the world income (assuming that the US real output growth remains
constant at annual rate of 3%), projections of various other sources, such as the IMF World Economic Outlook or the OECD Economic Outlook, have been used.

We look at the impact of three sets of fiscal and monetary policy shocks, i.e. (i) 10 percent increase in the government expenditure for successive three years; (ii) one percent depreciation of the real exchange rate and (iii) One percentage point increase in the interest rate for the next three years. Simulation effects are computed using the deviations of major economic variables during one-year ahead for three years following the given shocks over the base simulation.

• **Ten Percent Increase in Government Spending (Consumption and Investment)**

The government expenditure shock affects the endogenous variables through following channels. First, due to the crowding in effect of government expenditure, the increase in government spending tends to raise the private investment. Second, the rise in total investment tends to increase the real GDP and the effects of the higher real GDP will transmit into inflation, consumption, money demand, imports of goods and services. In addition, the higher imports of goods and services associated with higher GDP growth worsen the external account. When we increase the real government spending by 10 percent for successive three years i.e. 2010 -2012 this leads to real GDP growth of 1.81, 2.35 and 3.13 percentage points above its baseline growth rate during the time period 2010 – 2012. As a result, the CPI inflation also increases by 7.37 and 12.75 percentage points respectively for the next year and year after. Hence an increase in government expenditure brings about an overall increase in the economic activity.
(ii) One Percentage Point Increase in Discount Rate

An increase in the interest rate affects the endogenous variables as following. First, the increase in discount rate raises the user cost of capital which induces a decrease in private investment. Second, the increase in interest rates makes saving more attractive for households and induces them to postpone consumption. The downward adjustment in aggregate demand will reduce real GDP. Third, the reduction in real GDP and the increase in the interest rate would also tend to shrink the money demand as compared to the baseline level. Fourth, an increase in the interest rate reduces the inflation due to lower aggregate demand. The estimates reveal that a tight monetary policy is effective to control inflation in Pakistan. In addition, a decline in real GDP results into a reduction in the imports of goods and hence an improvement in the trade balances.
One Percentage Point increase in Discount Rate in 2010-2012

Domestic goods and services become more competitive due to the depreciation of real exchange rate while imports become more expensive, thus, resulting a gradual improvement in the current account balance. When we introduce one percent depreciation in the real exchange rate, it leads to an improvement in export growth by 0.4 and 0.7 percentage points during next year and year after over the baseline growth rate. The increase in external demand leads to an upward adjustment in domestic production, the resulting employment generation will increase the household income so as their consumption expenditure. Although imports demand is still rising (due to the exchange rate inelasticity) but the growth rate in import demand becomes slower for the period 2010 till 2012 and ranges between 0.01 and 0.067 percentage points respectively during next year and year after over the baseline growth rate. It becomes 0.13 in 2013 which reveals that depreciation of real effective exchange rate has slightly reduced the growth in the import demand. Hence, the impact on real GDP is positive which is reflected by a positive increase in real GDP by 0.08 and 0.16 percentage points.
respectively during next year and year after over the baseline growth rate. The exchange rate pass through positively affects the domestic prices with a time lag of two years and inflation rises to 0.32 percentage points respectively in the year after over the baseline growth rate.

**Figure 5.11 One Percent Depreciation in Real Effective Exchange Rate**

5.4.2 Simulations with Policy Rules

Fiscal Rule
In this section, we present simulations of the model under alternative fiscal policy rules. The Fiscal Responsibility and Debt Limitation (FRDL) Act 2005 was introduced in Pakistan to inculcate financial discipline and to reduce macroeconomic instability caused mainly by the persistence of large fiscal and current account deficits (7 per cent and 5 per cent of the GDP on an average) with rise in public debt reaching an unsustainable level (almost 100 per cent of the GDP). The requirements of the law include: (i) eliminating revenue deficits by June 2008; (ii) lowering total public debt to 60 percent of GDP by 2013; (iii) reducing public debt by at least 2.5 percent of GDP each year; and (iv) limiting the issuance of new government guarantees to 2 percent of GDP in any given year.

To construct these simulations we introduce following debt equation to the model;

\[\text{Debt} = \text{Debt}_{(-1)}(1+nr/100) + (\text{GOV} - \text{TAX}) \]  

(5.20)

\[\text{GOV} = \text{GOV}_{(-1)}(1+\text{GROWTH}/100) - 0.1*(\text{DEBT}/\text{GDP} - 0.6) \]  

(5.20)\`

Where Debt is the nominal total public debt, \( nr \) is the nominal interest rate, \( \text{GOV} \) is the nominal total government expenditure \( \text{TAX} \) is the nominal total revenue receipts, \( \text{GROWTH} \) is the change in real GDP, and the GDP is the nominal Gross Domestic Product. In addition, we make following assumptions about the exogenous variables in the model; the first assumption is that consumer price index is increasing at 10\%, the second assumption is related to government expenditure and we assume that it is rising annually by 5\%, the third assumption is about the trend in real GDP and we are assuming it at 5\%, the fourth assumption is about foreign income and we assume that US real output growth remains constant at annual rate of 3\%. Finally, we assume other exogenous variables like interest rate, capital account, real effective exchange rate and transfer payments are constant at their last period value. To evaluate the impact of fiscal discipline on major macroeconomic variables we develop two scenarios.
• In the first scenario, there is no fiscal discipline and we simulate the model with the given assumptions. In this scenario, there is no limit on the total public debt.

• In the second scenario, we simulate the model with the adoption of a fiscal rule and this fiscal rule is defined as limiting the total public debt to 60% of the GDP (the Fiscal Responsibility and Debt Limitation (FRDL) Act 2005)\(^{25}\).

Figure (5.12) compares the simulated values of the major economic variables with the given two scenarios. With no fiscal rule, inflation increases to 12% in 2025 while with a limit to debt accumulation, inflation reduces to 4% in 2025. In case of the fiscal rule, there is a decline in government expenditure which in turn reduces the aggregate demand and hence GDP growth rate decreases from 6.1% to 5.39%. The effects of lower GDP will transmit into lower inflation, consumption, money demand, imports of goods and services. In addition, the lower imports of goods and services, associated with the lower GDP growth improve the external account and trade deficit to GDP reduces from 10.75% to 8.8%.

**Figure 5.12 Fiscal Rule and some key Endogenous Variables**

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\(^{25}\) See equations (5.20) and (5.20)’
Monetary Policy Rule

There is large literature on monetary policy that has emphasised the role and importance of the systematic component of monetary policy and supports the argument that rules-based policy causes the improved performance. Taylor (1999) and Woodford (1999) extensively examine the performance of simple policy rules in small macroeconomic models and suggest that, by committing to conduct monetary policy in a systematic way, the central bank can stabilise inflation and the output gap more efficiently as policy rules provide predictability and reduce uncertainty.

Since Taylor (1999) presents a very simple rule to formulate monetary policy in terms of interest rates to achieve stable price level while avoiding large fluctuations in output and employment (Mankiw, 2000). Taylor proposed a simple interest rule in which the short term interest rate reacts to two variables: the deviation of inflation from a target rate of inflation, and the percentage deviation for real GDP from potential GDP. In this
section, we investigate that how a simple monetary policy rule (Taylor rule) can improve macroeconomic performance given the constraints in a developing country. For this purpose we introduce the following Taylor rule equation to simulate the model (now interest rate is endogenous in the model);

\[ i_t = r^* + \pi_t + \alpha_1 y_t + \alpha_2 (\pi_t - \pi^*) \]  

(5.21)

where \( r^* \) is the long run equilibrium real interest rate, \( i \) is the short term interest rate, \( \pi_t \) is the current inflation rate (Taylor takes this as last four quarters average including the current quarter), \( \pi^* \) is the target inflation rate and \( y_t \) is the deviation of output in period \( t \) from its long run trend. Taylor assumes the values of these four parameters, \( r^*, \pi^*, \alpha_1 \) and \( \alpha_2 \) in the above equation as, respectively, 2 %, 2 %, 0.5 and 0.5.

Although, developing countries face the structural problems like; weak institutions, small information set, low capacity of professionals and monetary policy having multiple objectives without clear prioritisation. In this situation a simple monetary policy rule might be more attractive for these countries due to the constraint of human capital for optimal decisions from time to time. Wrong judgement by the policy makers at a particular time may lead to undesirable consequences. However, as the developing economies are also characterised with complex economic structure, they are more prone to external shocks and monetary policy has objectives other than output and inflation stabilisation like exchange rate management and fulfilment of the fiscal needs etc, therefore a simple rule may not be a good policy choice. Nevertheless, following a monetary policy rule provides the evidence of a central bank’s commitment as well as it provides the information about the transmission mechanism of monetary policy in a complex structure of a developing economy.

Since we are estimating short term interest rate with actual data on output and inflation and assume Taylor rule as monetary policy strategy, then the equation (5.21) can be written as

\[ nr = 2.0 + \text{INF1} + 0.5 \times (\text{INF1} - 10) + 0.5 \times \text{gap} \]  

(5.22)
where $nr$ is the short term interest rate, $INFI$ is the average inflation rate, the target inflation rate is 10% and $gap$ is the deviation of output in period $t$ from its long run trend.

Figure 5.13 presents the response of the key endogenous variables to the simulations under the Taylor Rule. The efficiency of the Taylor Rule is assessed on the basis that either it is capable to achieve the objectives of a stabilisation policy i.e. maintaining low or stable inflation and keeping output at its potential. A policy rule is said to be efficient if the variability of either inflation or the output gap is minimised given the variability of the other. Figure 5.13 shows that the Taylor rule yields not only the lower output variability, as would be expected, but also substantially lower inflation variability during the sample period 2010 – 2025. As in our model, inflation is determined by the aggregate demand(embodied in the output gap), the central bank of Pakistan can stabilise inflation more if it responds not just to the deviation of inflation from target but also to the state of demand.

**Figure 5.13 Taylor Rule and some key Endogenous Variables**
Stochastic Simulations

At first, we simulate the model through deterministic scenarios analysis which assumes no uncertainty about the forecasted macroeconomic variables. The advantage of this approach is that the results are easy to understand and provide an insight to elaborate the transmission channels of key policy variables. However, uncertainty is inherent to hypothetical scenarios, even more if they have a multi-year horizon but the deterministic analyses only generates one future path of outcomes without allowing for uncertainty in the projections. We therefore perform stochastic scenario analysis as well, to generate probability distributions of the impact on key endogenous variables. These stochastic simulations involve the following sequence of events. At the beginning of each year, the monetary and fiscal authorities in the model set their policy instruments. Stochastic shocks then arrive and displace all endogenous variables. The monetary and fiscal authorities revise their policy setting in the following year, taking into account the unanticipated developments resulting from the stochastic shocks. The simulations continue over a fifteen-year time horizon and the fifteen year stochastic simulation runs are repeated 10,000 times, resulting in 150,000 annual simulation values for each endogenous variable. This enables us to generate probability distributions with
fairly good precision. The model and shocks are symmetric and hence, probability distributions for all simulated variables are centered on their respective mean (steady-state) values.

We use stochastic simulations in order to depict the inflation and output volatility under three alternatives; baseline model, fiscal policy rule and a monetary policy rule (Taylor rule). The baseline simulation serves as a standard of comparison for the simulation of selected policy rules. In general, GDP and inflation are used as the summary variables to compare the variability under different policy rules. The results indicate that largest inflation variability arises from the strict adherence to a fiscal policy rule through cuts in government expenditure and putting limits to public debt accumulation (Figure 5.14). Adoption of fiscal rule leads to an average growth rate of 4.3% with the expected inflation rate of 11.34% in 2025, while without a fiscal rule the growth rate 4.48% with the expected inflation rate of 9.78% in 2025.

**Figure 5.14 Stochastic Simulations comparison between Baseline and Fiscal Rule**
However, the Taylor Rule yields the most promising forecasting results out of these stochastic simulations (Figure 5.15). The probability of standard deviation of output and inflation, with Taylor rule as the monetary policy strategy, is quite low which reflects low variability in both the variables. Following a monetary policy rule enables the economy to achieve price and output stability during the forecast sample period. The Taylor Rule policy simulations achieve an average growth rate of 4.8 with the average inflation rate of 7.38% in 2025 (Table 5.1). Hence adoption of Taylor rule minimises the social loss.

**Figure 5.15 Stochastic Simulations under Taylor Rule**

![Figure 5.15 Stochastic Simulations under Taylor Rule](image)

<table>
<thead>
<tr>
<th>obs</th>
<th>INF1(baseline)</th>
<th>INF1(combined)</th>
<th>INF1 (fiscal rule)</th>
<th>INF1 (taylor rule)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>3.045</td>
<td>3.055</td>
<td>2.960</td>
<td>3.071</td>
</tr>
<tr>
<td>2015</td>
<td>6.923</td>
<td>3.821</td>
<td>6.990</td>
<td>3.913</td>
</tr>
<tr>
<td>2025</td>
<td>35.874</td>
<td>4.023</td>
<td>36.324</td>
<td>3.901</td>
</tr>
</tbody>
</table>

Table (5.1) compares the alternative policy regimes to achieve price stability in Pakistan. These policy regimes include a monetary policy rule, a fiscal policy rule and a combination of both monetary and fiscal policy rules. Stabilising properties of simple fiscal policy rules combined with monetary policy rules have been studied eg in Leeper
Woodford (2001) suggests that maintaining price stability requires not only commitment to an appropriate monetary policy rule, but also to an appropriate fiscal policy rule. We therefore explore macroeconomic policy within the context of joint plans for monetary and fiscal policy. When we simulate the model with the combination of a fiscal policy rule and a monetary policy rule then results reveal a higher growth rate with lower inflation rate. This stabilization policy also results in lower variability in both the variables of inflation and output growth. Although inflation variability is bit larger than Taylor rule stochastic simulations but the major advantage with this macroeconomic policy is that it also gives least variability in output growth (Figure 5.16).

Figure 5.16 Inflation and Output under combined Policy Rule

![Inflation and Output under combined Policy Rule](image)

5.4.3 Policy Rules in the P-Star Model

In this section, we are introducing a policy feedback system to analyse the possible effects of the fiscal changes on money supply which in turns affect the inflation in the economy. We will examine that how disequilibrium in the money market feeds through the macroeconomic system of the country. The role of the monetary authority to control the money supply and the linkages between the money supply and national income, both indicate the policy significance of a monetary disequilibrium in the economy (Friedman, 1968, 1970). The central bank’s capability to affect monetary variable is constrained by the institutional structure of the financial system which includes the public’s desire to hold cash and the bank’s reserves ratio. However the most critical factor comes from the fiscal side that either the changes in fiscal deficit and debt accumulation lead to a monetary expansion in the country. On the other hand the quantity of money loses its usefulness
for policy makers if the demand for money absorbs any change in money supply which may arise from the existence of absolute liquidity preference (Keynes (1936)) and if it is not predictable by a small set of variables (Judd and Scadding (1982)).

Monetary authority can use multiple ways to affect the inflation and output in the economy. Modigliani and Papademos (1990) suggest that the authorities can control nominal income without assigning any important role to the money supply and interest rates and exchange rates can be used as policy instruments.

However, in the high inflation countries, most often the quantity of money remains an important variable in the stabilization program because of the higher budget deficits and the excessive credit expansion by the banking system. These two factors can constrain the role of monetary policy to control monetary expansion.

Monetary disequilibrium models are helpful to analyse the interactions in an economy where the major source of disturbances is the disequilibrium in the money market. These models help to identify and track the effects of the monetary expansion on the economy. Blejer (1977) and to Blejer and Leiderman (1981) explain the monetary disequilibrium stemming from the changes in the balance of payments and identify only two adjustment channels, price and balance of payments adjustment, to restore equilibrium in the money market at the end of each period. In their models, fiscal policy which is considered to be the major source of monetary expansion has an implicit role. However, Khan and Knight (1981) introduce an explicit role to the link between fiscal policy and money supply and recognize the output effect of monetary disequilibrium.

The studies following Khan and Knight (1981) extend the pegged exchange rate assumption and the specification of the behavioural equations of the model. For example in Lipschitz (1984) the equations for the balance of payments adjustment are extended by an explicit exports and imports functions and the resulted model is applied to the Korean economy. Sundararajan (1986) and Millack (2004) also estimate a
similar model for the Indian economy which takes into account the endogenous determinants of the balance of payments equation by incorporating import and export functions into the model. However, the set up of their models does not include any output adjustment equation to monetary disequilibrium as in Blejer and Leiderman(1981).

Following Khan and Knight (1981)'s framework, in this section, we will develop and estimate a monetary disequilibrium model for Pakistan to examine the interaction between the main economic variables. After estimating the model we will simulate the model with some policy variables while focusing on fiscal channel to affect inflation and output in the economy.

**The Model**

**Money demand:** The cornerstone of the following analysis of monetary indicators of price developments is the assumption that a stable long-term money demand function exists which is homogenous in terms of prices:

\[ M_{dt} = p + \beta y - \gamma i \]  \hspace{1cm} (5.23)

Where \( M^{d} \) is the money demand, \( p \) is the price level and \( y \) is the real output. The opportunity cost of cash holdings (\( i \)) is a long-term interest rate. The signs are stated explicitly; \( \beta \) is the income elasticity and \( \gamma \) is the semi-interest-rate elasticity of money demand. The equilibrium in the money market holds when

\[ M_{dt} = M_{s,t} \]

However, owing to information and adjustment costs, the money stock (\( M_{s,t} \)) available at any given time may differ from the demand for money.

\[ M_{s,t} = M_{dt} + \nu \]  \hspace{1cm} (5.24)
The relative difference between the money stock and money demand is described as disequilibrium in the money market ($u$). It expresses the differences between the existing money holdings and the demand for money holdings resulting from the current economic situation (measured by $y$ and $i$).

**Disequilibrium in the Money Market and Price Gap**

The equilibrium money stock ($m^*$) is defined as the money stock demanded when both the goods and the money markets are in equilibrium at the current general price level;

$$m^* = p + \beta y^* - \gamma i^*$$  \hspace{1cm} (5.25)

Where $y^*$ is potential output and $i^*$ the equilibrium interest rate. The money gap is described as the relative difference between the current money stock and the equilibrium money stock;

$$m - m^* = \beta(y - y^*) - \gamma(i - i^*) + u$$  \hspace{1cm} (5.26)

However, we can also measure the disequilibrium in the money market in terms of the (logarithmic) price level instead of the (logarithmic) money stock. The equilibrium price level ($P^*$) is defined as the price level that would appear given the current holdings of money if both the goods market and the money market are in equilibrium.

$$p^* = m - \beta y^* + \gamma i^*$$  \hspace{1cm} (5.27)

The equilibrium price level reflects the long term prices of goods and services provided that there is no change in existing money stock and the disequilibria ($y - y^*$, $i - i^*$, $u$) disappear. As it can easily be shown that the price gap and the money gap are identical:
\[ p^* - p = \beta(y - y^*) - \gamma(i - i^*) + u = m - m^* \] (5.28)

This shows that inflation, in the long term, is a monetary phenomenon and it may result from the combination of three factors: the utilisation of production capacity is high (capacity pressure), the interest-rate level is lower than in equilibrium (interest-rate pressure) or monetary overhang exists (money supply pressure). Hallman et al (1989, 1991) originally derived the price gap from the quantity equation \((p + y = m + v)\) and defined the equilibrium velocity of circulation of money as; \(v^* = p^* + y^* - m\). This results in a breakdown of the price gap into the output gap and the liquidity gap:

\[ p^* - p = (y - y^*) + (v^* - v) \] (5.29)

The liquidity gap indicates inflationary pressure when cash holdings are higher which in turn reflect a lower velocity of circulation of money. It may be demonstrated that the liquidity gap consists of three components:

\[ v^* - v = (\beta - 1)(y - y^*) - \gamma(i - i^*) + u \] (5.30)

The first component is a spill-over effect from the goods market which emerges if the income elasticity of the money demand deviates from one. The two other components are interest-rate pressure and money supply pressure. In terms of their informative value for the development of inflation, there is a systematic relationship between the monetary indicators. The monetary overhang measures inflation potential resulting from disequilibrium on the money market. Whereas, the price gap (money gap) captures the inflation potential resulting from disequilibria on the money and goods markets.

The P-star approach links disequilibria on the goods and money markets to form a consistent and comprehensive indicator of inflationary pressure. The price gap is thus a
potentially important variable for explaining and forecasting inflation. The aggregate inflation rate is solely a function of macroeconomic determinants, inflation expectations and the price gap.

\[ \Delta p = \Delta p^e + \eta (p^* - p) + v \]  \hspace{1cm} (5.31)

In this setting, the price adjustment processes take place until an equilibrium is achieved on the goods and money markets. The money stock has an influence on the emergence and propagation of inflationary processes. The price gap ensures that the uncoordinated sales plans of the enterprises adjust in the longer term to demand in the economy as a whole. This has important implications for the transmission of monetary policy impulses. In traditional Phillips relationships, monetary impulses have an impact on the inflationary process only through the real demand for goods. In the extended Phillips relationship (above equation) monetary impulses can also have an effect on price developments by means of their liquidity effects. Cost or productivity shocks, which affect all enterprises, have a lasting impact on the general price level only if they are accommodated monetarily. Conversely, an abundant provision of liquidity may have inflationary effects before it is reflected in real demand. Furthermore, recent macroeconomics explain price developments not in terms of costs or demand, but - by analogy with the valuation of assets - by the ratio of government debt to the expected discounted value of future budgetary surpluses (fiscal theory of price level).

The Price Gap in the Monetary Transmission Process

Most often the equilibrium in money market is affected by the budgetary requirements of the government which alternatively affects the inflation and output in the economy. The policy feedback transmits through the following linkages between the money supply growth and the fiscal deficit;

\[ \Delta MB = \theta [GOV-TAX] \hspace{1cm} \text{and} \hspace{1cm} \theta > 0 \]  \hspace{1cm} (5.32)

\[ \Delta MS = m^* \Delta MB \hspace{0.5cm} \text{and} \hspace{0.5cm} m > 0 \]  \hspace{1cm} (5.33)
where $\theta$ indicates the linkages between the fiscal deficit ($\text{GOV} - \text{TAX}$) and monetary base ($\text{MB}$) is the coefficient of fiscal deficit, $m$ is money multiplier which relates the change in monetary base ($\text{MB}$) to the change in money supply ($\text{MS}$). We take the nominal values of $\text{GOV}, \text{TAX}, \text{MS}$ and $\text{MB}$. An increase in the fiscal deficit leads to a higher demand for money which in turns leads to printing of new money and hence money supply growth in the economy. The coefficient $\theta$ indicates the growth in money demand with the changes in fiscal deficit and $m$ reveals the value of money multiplier. While the adjustments in equilibrium price are based on the p-star model which hinges on the long-term quantity theory of money and puts together the long-term determinants of the price level and the short-term changes in current inflation.

Therefore P star model can be used to directly predict movements of the rate of inflation. It implies that if actual inflation $\pi$ exceeds the predicted inflation by this model $\pi^*$, then P-star model predicts that the inflation will fall in future until it reaches the equilibrium rate ($\pi^*$) and vice versa. Hence we can write the P star model as follows;

\[
\Delta \ln P_t = \delta_1(\ln P_{t-1} - \ln P^*_{t-1}) + \delta_2 \Delta \ln P_{t-1} + u_t \tag{5.34a}
\]

where inflation expectations are being formed at the end of the period $t-1$ for the period $t$ and $P^*$ is determined by the money demand function; we can estimate $P^*_t$ as

\[
\Delta \ln P^*_t = \gamma_0 + \gamma_1 \ln M_t + \gamma_2 \Delta \ln Y_t + u_t \tag{5.34b}
\]

The central idea of the P-Star model is that the price level converges to an equilibrium which is largely determined by the domestic liquidity. A consequence of this outcome is that the price gap- is supportive in forecasting future inflation. However the crucial conclusion is that the changes in money stock can influence the CPI and, thereby, the long run price level.
Model Estimation

Table 5.2 presents estimates of our model. The behavioural relationships of the model are estimated using OLS with annual data over the period 1977-2009. The first equation explains the influence of fiscal deficit on monetary base; the estimated coefficients of the monetary base equation suggest a positive and statistically significant relationship between monetary base and budget deficit which indicates the monetization of fiscal deficit. In the second equation, we estimate the money multiplier \( m_1 \) which equals to \((cdr+1)/(cdr+rdr)\) where \( cdr \) is the currency deposit ratio and \( rdr \) is the reserve deposit ratio. In developing countries both \( cdr \) and \( rdr \) are relatively high which lead to a smaller money multiplier value. This equation shows that changes in money supply can be attributed to changes in monetary base and/or changes in the different components of money multiplier. The estimation results suggest a money multiplier value of 2.54 which is statistically significant and consistent with the earlier literature available on money multiplier for Pakistani data.

Table 5.2 Estimation Results for P Star Model

### Changes in Monetary Base

\[
\Delta MB = \theta_0 + \theta_1 [GOV-TAX]
\]

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>t values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.84</td>
<td>0.22</td>
</tr>
<tr>
<td>(0.1631)</td>
<td>(5.8546)</td>
</tr>
</tbody>
</table>

Diagnostics

- \( R^2 = 0.53 \)
- \( DW = 2.35 \)
- \( LM \text{ test : } 0.73[0.49] \) \( \text{ARCH= } 2.23[0.14] \)
- \( \text{Chow }_{1985} = 0.016[0.98] \) \( \text{Chow }_{1995} = 0.505[0.60] \) \( \text{Chow }_{2005} = 6.7[0.042] \)

### Money Multiplier Equation

\[
\Delta MS = m_0 + m_1 \Delta MB
\]

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>t values</th>
</tr>
</thead>
<tbody>
<tr>
<td>38.83</td>
<td>2.54</td>
</tr>
<tr>
<td>(1.21)</td>
<td>(6.36)</td>
</tr>
</tbody>
</table>

Diagnostics

- \( R^2 = 0.57 \)
- \( DW = 2.14 \)
- \( LM \text{ test : } 0.58[0.56] \) \( \text{ARCH= } 2.44[0.12] \)
- \( \text{Chow }_{1985} = 0.41[0.61] \) \( \text{Chow }_{1995} = 2.77[0.77] \) \( \text{Chow }_{2005} = 17.65[0.001] \)

### P-Star Model

\[
\Delta \ln P_t = \delta_0 + \delta_1 (\ln P_{t-1} - \ln P^*_t) + \delta_2 \Delta \ln P_t
\]

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>t values</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.034</td>
<td>0.156</td>
</tr>
<tr>
<td>(4.02)</td>
<td>(3.12)</td>
</tr>
</tbody>
</table>
Equilibrium Price

\[ \ln P^* = \gamma_0 + \gamma_1 \ln M_t + \gamma_2 \Delta \ln Y_t + u_t \]

Coefficients:
- \( \gamma_0 = -1.29 \)
- \( \gamma_1 = 0.49 \)
- \( \gamma_2 = 0.194 \)

\( t \) values:
- \( (-0.78) \)
- \( (5.27) \)
- \( (0.71) \)

Diagnostics
- \( R^2 = 0.99 \)
- \( DW = 0.34 \)
- \( LM \) test: 0.21 [0.89]
- \( ARCH = 1.21 \) [0.61]

Then we estimate the adjustment equations for inflation which act to restore equilibrium in the money market following a shock. The first adjustment equation is the P star model which assumes that actual price level (P) has a tendency to move toward the equilibrium price level (P*) and the difference between the actual and the equilibrium price level acts as a good predictor of inflation. The third equation can be used to predict the movements of the rate of inflation.

For instance, if actual inflation (\( \pi \)) exceeds (\( p - p^* \)) which may be taken as the equilibrium inflation rate (\( \pi^* \)), then \( \pi \) should fall until it reaches \( \pi^* \). The movements would be reversed in case \( \pi < \pi^* \). Therefore, the difference between \( p \) and \( p^* \) provides a leading indicator for future acceleration or deceleration of inflation.

The estimated coefficient of the price gap is positive and statistically significant reflecting the suitability of P star model for Pakistani data. In the next equation we try to explore that how changes in money supply and output can affect the equilibrium price level and the estimated coefficients reveal a positive and statistically significant relationship among the variables.

The estimated price gap (\( p-p^* \)) and actual CPI are plotted and presented in the Figure 5.17. It shows that the gap between the actual prices and the P-star model predicted equilibrium prices (\( P^* \)) remains positive during the early eighties and early years of 2000. It also reveals that actual prices are less than the model predicted prices for the last four years. This implies that in future actual prices would move upward towards the equilibrium prices, which is further augmented when we performed out of sample forecast for the period 2010 - 2025, as shown in the Figure 5.18. These plots reflect that during the forecast period, the output growth remains between 2-3% whereas inflation remain around 8%, and the gap between actual and p star inflation surrounds to zero.
Figure 5.17 - The Gap between CPI and P Star

Figure 5.18 Key Variables under P Star Model Simulations- Sample 1979 – 2009

Figure 5.19 and Figure 5.20 show the forecast trends in the price gap and growth (through the deterministic simulations) for the time period 2010 till 2025. The gap between the actual prices and the P-star model predicted equilibrium prices ($P^*$) is positive for the first five years and then it is gradually reducing which is theoretically
consistent. The stochastic simulations reveal the same trend. The output growth remains at an average of 4% with an inflation rate of 8%. The results seem to be plausible with the historical performance of the economy.

Figure 5.19   Deterministic Simulations with P Star Model --- Sample 2010 – 2025

![Deterministic Simulations](image)

Figure 5.20. Stochastic Simulations with P Star Model --- Sample 2010 – 2025

![Stochastic Simulations](image)

Monetary Policy Rules in the P-Star Model

There are studies which use small macroeconomic models to analyse inflation targeting while assuming no role for monetary aggregates. These include the models used by
Svensson (1997, 1998, 1999a), Blinder (1998) and Bernanke et al (1999). However, both theoretical and empirical literature provides the basis for inflation, in the long run, being a monetary phenomenon and also suggest that the price gap is a relevant variable for explaining the dynamics of inflation. Whereas price adjustment in the Taylor model is determined by the degree of capacity utilisation, in the P-star approach it depends on the difference between effective money holding and that desired in the long term. We are using here small macro models to demonstrate the transmission mechanism of monetary policy shocks when we include price gap in the Phillips relationship.

**Taylor Model**

Following Taylor (1999), a small stylised Neo-Keynesian macro-model is described by the following three equations;

\[
y_t = y^* - \alpha(i_t - \pi_t - r) + \epsilon_t \tag{5.35}
\]

\[
\pi_t = \pi_{t-1} + \eta(y_t - y^*) + \nu_t \tag{5.36}
\]

\[
i_t = r + \pi^* + \gamma(\pi_{t-1} - \pi^*) \tag{5.37}
\]

\[\alpha, \eta, \gamma \geq 0\]

where equation (5.35) is an aggregate demand function, (5.36) is a simple Phillips relationship for inflation dynamics and (5.37) is a monetary policy reaction function. The nominal interest rate \(i\) is simultaneously the monetary policy instrument variable. Furthermore, \(\pi\) is the inflation rate, \(r\) the real interest rate, and \(\pi^*\) is the central bank's inflation target. Real demand depends on the real interest rate, the inflation rate on the output gap, and the central bank's interest rate policy reacts to observed deviations from the inflation target. In the long-run equilibrium (if it exists) \(y = y^*, \pi = \pi^*\) and \(i = r + \pi^*.\) The money stock does not play an active role in this model and monetary policy impulses are transmitted solely via the interest rate and the output gap to the inflation rate.

**P-Star Model**
The P-star model incorporates the money market into the analysis and assigns an active role to the money stock. Prices react to changes in the output gap and the liquidity gap, i.e. to disequilibria on the goods and money markets. In other words, the P-star model is obtained if we replace the output gap by the price gap in equation (5.36) of the Taylor model.

\[ y_t = y^* - \alpha (i_t - \pi_t - r) + \epsilon_t \]  
\[ \pi_t = \pi_{t-1} + \eta (\pi^* - \pi_t) + \nu_t \]  
\[ i_t = r + \pi^* + \gamma (\pi_{t-1} - \pi^*) \]  
\[ \alpha, \eta, \gamma \geq 0 \]

In contrast to the Taylor model, monetary policy acts through two channels. The first transmission channel runs from interest rates via the real demand for goods and the output gap to the inflation rate (equation 5.35). In the second transmission channel, interest rates have an impact on inflation dynamics via money demand and the liquidity gap (equation 5.37). In our model we assume \( \alpha = 0 \) to use interest rate policy for stabilising and controlling the inflation and set the following Taylor rule equation as a monetary policy strategy:

\[ nr = 2.0 + INF1 + 0.5 \times (INF1 - 10) + 0.5 \times gap \]

where \( nr \) is the short term interest rate, \( INF1 \) is the average inflation rate, the target inflation rate is 10% and \( gap \) is the deviation of output in period \( t \) from its long run trend. Figure 5.21 depicts the stable trend in the price gap under Taylor Rule which supports the hypothesis that when we include an interest rate rule in a P star model, the deviation between equilibrium price and actual price is minimum.
Figure 5.21  Price Gap Comparisons with Baseline and Taylor Rule (P Star)

![Price Gap Comparison Graph](image)

Figure 5.22 shows the deterministic shocks to price gap and some other variables in a P star model which includes Taylor Rule for the sample 1979 – 2009. This exercise is to evaluate the plausibility of the p star model within the sample period, in case of divergence, the p star model does not fit for the out of sample forecast. It is revealed that the price gap movements are predictable in the sense that these show both upward and downward trends which implies that if actual inflation is above the equilibrium, then in future it is expected to go down. Trends in output growth are also coinciding with the movements in the price gap.

![Taylor Rule (P Star) Simulations--Deterministic----1979 -2009](image)

Figure 5.23 shows the results of stochastic simulations of Taylor rule in a P star model for the time period 2010 – 2025. The results reveal less variability in price gap, output growth and other indicators of inflation. This variability is calculated by ± 2 standard deviations in the related series which do not explode so rapidly till 2025.
5.5 Conclusions

This empirical chapter describes a small-sized Keynesian macroeconometric model for Pakistani economy which incorporates the essential features of the economy while making extensive use of economic theory. The model is useful for policy simulations, economic planning and debt sustainability. The model identifies the activities of the real sector, the external sector, the fiscal sector, the monetary and the price sector. Behavioural equations are specified according to economic theory and estimated within the Keynesian framework using recent econometric techniques. The linkages of these five sectors are identified and to incorporate these linkages, the model is solved.
simultaneously by using annual data from FY77 - FY09. Stochastic equations for all of the endogenous variables in the model have been set up inspired by the list of potential economic explanatory variables.

Generally, the single-equation analysis of the model shows that the behavioural equations are well specified and the forecasting performance is good. Different paths for the exogenous variable have been assumed to proceed to the out-of-sample forecast of the model. The major findings of the model suggest; a statistically significant relationship between consumption and real interest rate (lagged by one year), private investment is mainly affected by the changes in national income and the foreign capital, an appreciation of Pakistani Rupee decreases the exports volume significantly. The private real disposable income is more influential in determining the level of imports with an elasticity of 0.80 in short run, money demand is significantly affected by the changes in nominal interest rate, and GDP affects the tax revenues mainly. In Addition, the estimated coefficients of inflation equation indicate that in Pakistan, a positive output gap results into higher inflation as the relationship between inflation and the real GDP gap is positive and statistically significant.

The diagnostic tests (Mean Absolute Percent Error (MAPE) and the Theil inequality U-value) confirm the dynamic stability of the model and suggest that the model is reasonably accurate in prediction. The static and dynamic ex post simulations over the period 1979-2009 along with the actual values of 11 macroeconomic variables show that both types of simulations track the actual time paths of the variables reasonably well.

At the next step, we conduct policy simulations experiments to quantify the impact of three sets of fiscal and monetary policy shocks. The result shows that a ten percent increase in government expenditure raise the private investment due to the crowding in effect, which in turns leads to higher GDP and the effects of the higher real GDP will transmit into inflation, consumption, money demand, imports of goods and services. An increase in the interest rate induces a decrease in private investment and motivates more
savings. The downward adjustment in the aggregate demand will reduce the real GDP. The estimates reveal that a tight monetary policy is effective to control inflation in Pakistan. In addition, a decline in real GDP results into a reduction in the imports of goods and hence an improvement in the trade balances. In addition, the model assumes exchange rate as an exogenous variable and we introduce one percent depreciation in the real exchange rate and it shows an improvement in the exports growth which in turns increases the domestic production. The improvement in employment generation increases the household income so as their consumption expenditure.

We also simulate the model with monetary and fiscal policy rules. We define our fiscal rule on the basis of The Fiscal Responsibility and Debt Limitation (FRDL) Act 2005 which limits the debt accumulation to 60 percent of GDP by 2013. The introduction of fiscal rule reduces the government expenditure which in turn reduces the aggregate demand and the GDP growth rate. The simulation results reveal that the adoption of fiscal rule enables the authorities to reduce inflation to a single digit number whereas there is a slight reduction in GDP growth rate from 6 % to 5.39%. Furthermore, we simulate the model with the Taylor Rule as a monetary policy strategy, it induces the less variability in the key endogenous variables during the sample period 2010 – 2025, and the results suggest that, following a Taylor rule as a monetary policy strategy helps to stabilize the macroeconomic performance of the country.

In addition, we perform stochastic simulations to assess the stability of the model and to generate the probability distributions of the impact on key endogenous variables. We use stochastic simulations in order to depict the inflation and output volatility under three alternatives; baseline model, fiscal policy rule and a monetary policy rule (Taylor rule). The results indicate that largest inflation variability arises from the strict adherence to a fiscal policy rule through cuts in government expenditure and putting limits to public debt accumulation. However, Taylor Rule yields the most promising forecasting results out of these stochastic simulations. Then we explore the macroeconomic policy within the context of joint plans for monetary and fiscal policy and the results reveal a higher growth rate with lower inflation rate.
Finally, we introduce a policy feedback system to analyse the possible effects of the fiscal changes on money supply which in turns affect the inflation in the economy. We use a P star model which links disequilibria on the goods and money markets to form a consistent and comprehensive indicator of inflationary pressure. In this case, the price gap is a potentially important variable for explaining and forecasting inflation. The estimates of the related equations suggest: a positive and statistically significant relationship between the monetary base and the budget deficit which indicates the monetization of fiscal deficit and a money multiplier value of 2.54 which is consistent with the earlier literature available on money multiplier for Pakistani data. The price gap reveals inflationary phases during the early eighties and early years of 2000 in Pakistan. Then we combined the P star model with the Taylor Rule, replacing the output gap with the price gap and the resultant price gap movements are predictable and trends in output growth are also coinciding with the movements in the price gap. We also perform stochastic simulations of Taylor rule in a P star model for the time period 2010 – 2025. The results reveal less variability in price gap, output growth and other indicators of inflation which provide an insight to use P star model to identify the leading indicator of inflation because it provides information about the future rate of inflation which can further help the policymakers to assess the future movements of inflation in Pakistan.
Chapter Six

Concluding Remarks

6.1 Conclusions

Chapter 2 provides the historical overview of Pakistan’s economic environment. It shows that till the end of 1980’s, economy of Pakistan performed quite well. Although during this time, there were major changes in the economic structure of the country; a movement from a private sector led economy in the sixties to a nationalized economy in the 1970s and again in the decade of 1980’s there was a shift towards denationalization, liberalisation and deregulation in the country. However, during the decade of nineties Pakistan witnessed the lowest GDP growth rate in the region. During the early years of nineties, government of Pakistan introduced structural adjustments and stabilization reforms in the country which brought some improvement in the macroeconomic indicators in the later years of nineties. But this improvement could not sustain for longer period and again Pakistan economy is facing challenges of low GDP growth rate with high inflation. In addition, Pakistan fiscal structure is categorised with high current expenditure and an inelastic, non-progressive tax structure with narrow tax base which always resulted in high budget deficit. The fiscal authorities always resorted to finance fiscal deficit by domestic borrowing and external
finance which resulted into ever rising public debt and high expenses on debt servicing.

After describing the macroeconomic environment of Pakistan and figuring out some key economic challenges, in Chapter 3, we try to explore the role of monetary policy to combat the challenges of high inflation and low economic growth. In this respect, we measure the monetary policy stance and relate it to the effectiveness of monetary policy to achieve its objectives. We employ two approaches to determine the monetary policy stance - the monetary conditions index (MCI) and the Bernanke and Mihov (1998) Approach using monthly data for the sample period 1981M12 – 2008M6. Following Duguay (1994), MCI weights are derived from a reduced form IS equation. These weights are determined though the estimated coefficients of interest rate and the exchange rate variables in the IS equation. The estimation of backward looking IS curve shows that the estimated parameters are statistically significant with expected signs. The sum of coefficients for the interest rates measure stays at -0.00015, whereas the sum of coefficients for the exchange rate measure is -0.00029 and the value of real MCI is 0.512280702 (alternatively 1:1.95) which reflect a major role of exchange rate channel. The smaller value of MCI is in line with other empirical literature on MCI for developing economies. We construct two MCIs, using a fixed base of 100 for December 1981 and December 1991. Both indices have shown co-movement. The subsequent analysis of MCI with base December 1981, suggest different periods with tight and soft monetary policy. To answer this question that either it is the interest rate channel or exchange rate channel which is the key determinant of aggregate demand in the economy, the results show that swings in the MCI are mostly caused by the changes in the interest rate because the exchange rate movements are mostly unidirectional. Therefore a decrease in the interest rate was translated into a soft monetary policy and a rise in interest rates tightened the policy. After September 2001, the fall in interest rates led to the softening of monetary conditions till December 2003 which was slightly offset by the appreciation of Rupee/Dollar parity. Since January 2005, in response to inflationary pressures (11.3%) , SBP remains in monetary tightening phase which is also reflected by the upward movements in MCI.

Due to the limitations and caveats with the MCI as an operational tool, then we use the Bernanke and Mihov (1998) methodology to analyse the stance measure of monetary
policy. This approach considers three channels of monetary transmission: the interest rate channel, the exchange rate channel, and the money channel. We use three non-policy variables which include real GDP (yr), CPI (LCPI), and world commodity price (LCPIF) and four policy variables i.e. real interest rate (RI), real exchange rate (LREER), term-spread (spr), and monetary aggregate (m2). We employ an SVAR specification to determine the relative weights for the policy variables to calculate an overall measure of monetary policy stance. Then the estimated stance measure is normalized at each date by subtracting from it a 6-month moving average of its own past values. We compare the changes in monetary policy stance with the changes in inflation and real GDP and we find that the relationship between the stance and inflation generally holds for most of the sample period. During the phases of expansionary monetary policy, inflation rises above its past trend (1992-97 and 2002-2008). Apart from the expansionary monetary policy, various other supply side shocks contributed to the rising inflationary trends in the time period 2002-2008.

Chapter 4 evaluates the role of fiscal policy in Pakistan using different analytical approaches and empirically examine the relative effectiveness of the fiscal authorities to enhance economic growth in the economy using quarterly data for the sample period 1977:01–2009:04. At first, it traces out the source of inflation through the determination of type of fiscal regime in Pakistan, and employs two approaches i.e. a backward looking and a forward looking approach. It finds that in Pakistan, there exists a fiscal dominant regime and fiscal authority does not consider the changes in liabilities, the monetary authority follows the fiscal requirements of the government to satisfy its intertemporal budget constraint. In the forward looking approach, we use a two variables (primary deficit and the operational deficit) VAR specification with different orders of the variables and the resultant estimates of Granger Causality tests, the impulse response functions and the variance decomposition also confirm the presence of fiscal dominant regime in Pakistan. To check the robustness of the results, we also specify VAR models with a real sector variable (real GDP) and in second case with a discount factor (real interest rate). Since in a fiscal dominant regime, fiscal shocks create fluctuations in aggregate demand which in turn affect the level of real economic activity, real interest rate, as
well as the inflation rate. The estimates in both the specification further confirm the active fiscal policy in Pakistan. These results are consistent with some of the earlier studies on Pakistan i.e. Chaudhary and Ahmad (1995) and Agha and Khan (2006).

After establishing the type of regime in Pakistan, in the second section we examine the long term relationship between inflation, the exchange rate, GDP, the money supply and the fiscal deficit in Pakistan covering the time period 1977q1-2009q4. After establishing the existence of cointegration, we estimate error correction specifications to model the dynamic relationship. We examine three different empirical specifications of the VECM models. The results in the first model indicate that the exchange rate and money growth are major determinants of inflation in Pakistan. However analysis of IRF and VDCs reveal that the budget deficit exogenously determines money growth, which is consistent with the Sargent and Wallace (1981) argument that inflation is a fiscal-driven monetary phenomenon. After controlling for the correlation between prices and exchange rate, the second model indicates a statistically significant relationship between prices and budget deficits and the estimates from third model show that the relationships are consistent even after the inclusion of a real sector variable (GDP). Moreover there exist a statistical significant relationship between fiscal deficit and seigniorage indicating the monetization of fiscal deficit and hence an indirect evidence of a fiscal dominant regime.

In the third section, we evaluates the macroeconomic effects of fiscal policy in Pakistan using two approaches; the recursive approach introduced by Sims (1988) and, the Blanchard and Perotti (2002) approach to identify the SVAR model. The estimations through recursive approach suggest a statistically insignificant role of government expenditure shocks in explaining the variation in output and inflation. Whereas, the estimates from Blanchard and Perotti (2002) approach indicate a significant role of government expenditure and taxes in explaining the changes in output and inflation in Pakistan.
As the fiscal policy stance is based on the objective to achieve higher and sustainable growth whereas monetary policy target is to achieve price stability so there is a potential for a conflict between these two macroeconomic policies. Therefore coordination between these two aforementioned policies as well as better management of fiscal sector can improve the macroeconomic performance of Pakistan economy. Therefore in fifth chapter we develop a small-sized Keynesian macroeconometric model for Pakistan which incorporates the essential features of the economy while making extensive use of economic theory. The model identifies the activities of the real sector, the external sector, the fiscal sector, the monetary and the price sector. The model is solved simultaneously by using annual data from FY77 - FY09 while incorporating the linkages between the given five sectors of the economy. Generally, the single-equation analysis of the model shows that the behavioural equations are well specified and the forecasting performance is good.

The diagnostic tests (Mean Absolute Percent Error (MAPE) and the Theil inequality \( U \)-value) confirm the dynamic stability of the model and suggest that the model is reasonably accurate in prediction. The static and dynamic \textit{ex post} simulations over the period 1979-2009 along with the actual values of 11 macroeconomic variables show that both types of simulations track the actual time paths of the variables reasonably well.

At the next step, we conduct some policy simulations experiments to quantify the impact of three sets of policy shocks, i.e. (i) 10 percent increase in the government expenditure for successive three years; (ii) one percent depreciation of the real exchange rate and (iii) One percentage point increase in the short term interest rate for the next three years. The results show that impact of these shocks is consistent with economic theory. We also simulate the model with monetary and fiscal policy rules for the out of sample period 2010-2025 using both deterministic and stochastic strategies. We define our fiscal rule on the basis of The Fiscal Responsibility and Debt Limitation (FRDL) Act 2005 which limits the debt accumulation to 60 percent of GDP by 2013. With no fiscal rule, inflation increases to 12% in 2025 while with a limit to debt accumulation, inflation reduces to 4% in 2025. Hence, adoption of fiscal rule enables
the authorities to reduce inflation to a single digit number whereas there is a slight reduction in GDP growth rate from 6% to 5.39%. We also simulate the model with Taylor Rule as monetary policy strategy and it induces the less variability in the key endogenous variables, especially the trends in inflation rate movement show a stable pattern. Henceforth, we can conclude that following a Taylor rule as a monetary policy strategy helps to stabilize the macroeconomic performance of the country. In case of stochastic simulations, we develop three alternatives; baseline model, fiscal policy rule and a monetary policy rule (Taylor rule). The results indicate that largest inflation variability arises from the strict adherence to a fiscal policy rule whereas Taylor Rule yields the most promising forecasting results out of these stochastic simulations with low variability in both the variables of inflation and output. We also examine the joint effect of monetary and fiscal policy rules and the results reveal a higher growth rate with lower inflation rate and variability is low for both variables.

Finally, we use a P star model to analyse the policy feedback system to analyse that how changes in fiscal deficit lead to the higher inflation. In this case, the price gap is a potentially important variable for explaining and forecasting inflation. We find a statistically significant relationship between monetary base and budget deficit indicating the monetization of fiscal deficit. In addition the estimated coefficient of price gap is positive and statistically significant reflecting the suitability of P start model for Pakistan; the estimates also reveal a positive and significant role of money supply and output to affect equilibrium price level.

The trends in the price gap (actual prices and the P-star model) show inflationary phases during the early eighties and early years of 2000. Furthermore, the price gap movements are predictable when we use P star model with Taylor rule replacing output gap with price gap in Phillips relationship. We also perform stochastic simulations of Taylor rule in a P star model for the time period 2010 – 2025. The results reveal less variability in price gap, output growth and other indicators of inflation. Therefore P star model can be used to identify the leading indicator of inflation since it provides information about the future rate of inflation.
To sum up the findings of this thesis, it is clear that Pakistan is a fiscal dominant regime, where monetary policy is constrained to achieve its objectives, especially the objective of low and stable price level. Government expenditure policy is effective to bring crowding in effect in the economy but at cost of higher inflation. So coordination between fiscal and monetary authorities is required and in this context strict adherence to fiscal rule along with monetary policy rule can bring sustainable growth with low and stable price level.
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Appendix

Chow Lin Procedure to generate Quarterly Estimates of GDP

The Chow-Lin procedure, which they presented to convert quarterly observations to monthly interpolations, can easily be adapted to convert annual aggregates to quarterly values. Assume that GDP figures are available annually over n years. Let y be a (4n x 1) vector of quarterly GDP figures to be estimated. Let C be a (n x 4n) matrix that converts 4n quarterly observations into n annual observations. This matrix is defined as:

\[
C = \begin{bmatrix}
1 & 1 & 1 & 1 & 0 & 0 & 0 & - & - & - & - & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 & - & - & - & -
\end{bmatrix}
\]

(1)

Now suppose that quarterly y can be predicted using a multiple linear regression:

\[y = X\beta + u\]  

(2)

where X is a (4n x k) matrix of k predictor variables which are observed quarterly and u is a (4n x 1) random vector with zero mean and covariance matrix V (4n x 4n). Using subscript “a” to denote annual figures, equation (2) can be converted to a regression of annual aggregates:

\[y_a = Cy = CX\beta + Cu = X_a + u_a\]

(3)
To implement the Chow-Lin procedure first apply GLS method to Equation (3) to obtain

\[ \hat{\beta} = \left( X'_a V^{-1}_a X_a \right)^{-1} X'_a V^{-1}_a y_a \]

where \( V_a = \text{CVC} \) and obtain \( \hat{u} = y_a - X_a \hat{\beta} \).

Finally the Chow-Lin best linear unbiased predictor (disaggregate) of \( y \) is derived from:

\[ \hat{y} = X \hat{\beta} + V C' (C V C')^{-1} \hat{u}_a \]  \hspace{1cm} (4)

The first term on the RHS of equation (4) gives the predicted quarterly \( y \) based on observed quarterly \( X \) and estimated \( \beta \) from annual totals. The second term allocates the annual residuals \( \hat{u} \) to the four quarters of the year such that the annual sum of the interpolated values equal the observed value \( y_a \). In addition, Chow and Lin (1971) assume that (a) \( v = \sigma_v^2 I \) and (b) \( u_t = \rho u_{t-1} + \epsilon_t \) where \( \epsilon_t \) is white noise and \( |\rho| < 1 \). Under assumption (a) \( \hat{\beta} \) reduces to the OLS estimator \( \left( X'_a X_a \right)^{-1} X'_a y_a \) and the second term on the RHS of equation (4) amounts to allocating one quarter of the annual residual to each quarter of the year. Under assumption (b) the subscript \( t \) is used to pick out the individual quarters. We can derive the following sequence of autocovariances for the process:

\[ \text{var}(u_a) = \frac{\sigma^2}{1 - \rho^2} \left( 4 + 6\rho + 4\rho^2 + 2\rho^3 \right) \]

\[ \text{cov}(u_a u_{a-1}) = \frac{\sigma^2}{16(1 - \rho^2)} \left( \rho + 2\rho + 3\rho^2 + 4\rho^3 + 2\rho + 3\rho^5 + 2\rho^6 + \rho^7 \right) \]  \hspace{1cm} (5)

\[ \text{cov}(u_a u_{a-k}) = \rho^k \text{cov}(u_a u_{a-k}) \quad k \geq 2 \]  \hspace{1cm} (6)

Using the above mentioned Chow-Lin Procedure, we construct quarterly estimates of Gross Domestic Product (GDP) covering the time period 1977Q1 to 2009Q4. While the
annual GDP series is available from IFS, to generate quarterly data we employ industrial production as a related series such as industrial production which is available at a quarterly or even higher frequency in IFS.